Punnets Reference Manual

1.0a

Generated by Doxygen 1.2.18

Mon Jun 16 15:42:24 2003

Contents

Chapter 1

Punnets Main Page

Punnets is a C++ library for Pulsed Neural Network Simulator. Based on its event-discrete (event-driven) manner of simulation, Punnets provides highly accurate and efficient simulation environment for rather complex neuron models. Please take a look at the sample programs, **dtest.cpp** and **dlanguage.cpp**, to see how to use the library.

Punnets provides two user-accessible namespaces, punnets and **punnets_nodebug** (p. 29). A user program may import one of the two namespaces to use the library. Although the **punnets_nodebug** (p. 29) version is more efficient in simulation, punnets version can provide debugging facility, which can be turned on for neuron-by-neuron basis. Stuffs in **punnets_common** (p. 23) namespace can be accessed via either namespace, punnets or **punnets_nodebug** (p. 29).

You can obtain the reference manual of this library by using doxygen, a document generation tool. If you have installed doxygen, it will be automatically generated and installed via a standard install process. You can also see the reference manual via the Punnets home page: `http://www.snowelm.com/~t/research/software/punnets/`

Chapter 2

Punnets Module Index

2.1 Punnets Modules

Here is a list of all modules:

Chapter 3

Punnets Namespace Index

3.1 Punnets Namespace List

Here is a list of all documented namespaces with brief descriptions:

Chapter 4

Punnets Hierarchical Index

4.1 Punnets Class Hierarchy

This inheritance list is sorted roughly, but not completely, alphabetically:

Chapter 5

Punnets Compound Index

5.1 Punnets Compound List

Here are the classes, structs, unions and interfaces with brief descriptions:

Chapter 6

Punnets File Index

6.1 Punnets File List

Here is a list of all documented files with brief descriptions:

Chapter 7

Punnets Page Index

7.1 Punnets Related Pages

Here is a list of all related documentation pages:

Chapter 8

Punnets Module Documentation

8.1 Logging (drawing a graph of neuron potentials)

Compounds

- class **tlogger**

8.2 Variables for Statistics

Variables

- u_int64_t **totalfire** = 0

  This variable counts the total number of firing of the neurons.

- u_int64_t **totalpulse** = 0

  This variable counts the total pulse arrivals to any of the neurons.

- u_int64_t **totalpartition** = 0

  This variable counts the total number of partitions.

- u_int64_t **totalpartition_nonewton** [4] = {0,0,0,0}
- u_int64_t **totalpartition_newton** [4] = {0,0,0,0}
- u_int64_t **totalpeaksearch** [3] = {0,0,0}
- u_int64_t **totalpeakenclosing** = 0

  This variable counts the total number of peak enclosings. One peak search contains several enclosings.

- u_int64_t **totalrescheduled** = {0}

  This variable counts the total number of re-scheduling.

- u_int64_t **totalfiltered_maxgrad** = 0

  This variable counts the total filtering caused by maximum gradient check.

- u_int64_t **totalfiltered_incontinuity** = 0

  This variable counts the total filtering caused by nearby incontinuity.

- u_int64_t **totalfiltered_nextpulse** = 0

  This variable counts the total filtering caused by nearby next pulse.

8.2.1 Variable Documentation

8.2.1.1 u_int64_t punnets_common::totalpartition_newton = {0,0,0,0}

This variable counts the number of partitions with Newton-Raphson search. Each element contains the number of 0th, 1st, 2nd. and delta partitions, respectively.

Definition at line 42 of file dneuron.cpp.

Referenced by punnets_private::tneuron_ext< debug >::scheduleFire().

8.2.1.2 u_int64_t punnets_common::totalpartition_nonewton = {0,0,0,0}

This variable counts the number of partitions without Newton-Raphson search. Each element contains the number of 0th, 1st, 2nd. and delta partitions, respectively.

Definition at line 41 of file dneuron.cpp.

Referenced by punnets_private::tneuron_ext< debug >::scheduleFire().

8.2.1.3 u_int64_t punnets_common::totalpeaksearch = {0,0,0}

This variable counts the number of peak searches. Each element contains the number of searches with peak below threshold (no crossing), peak above threshold (crossing), no peak (not convex), respectively.

Definition at line 43 of file dneuron.cpp.

Referenced by punnets_private::tneuron_ext< debug >::scheduleFire().

8.3 Neurons

Compounds

- class **tneuron**
- class **tneuron_base**
- class **tneuron_ext**
- class **tneuron_ext_const**

8.4 Synapses

Compounds

- class **tsynapse**
- class **tsynapse_addfunc**

  Synapse class that adds a new function to the destination (postsynaptic) **tneuron_ext** (p. 81).

- class **tsynapse_base**
- class **tsynapse_fatigue**
- class **tsynapse_message**
- class **tsynapse_messfunc**

8.5 Scheduling

Compounds

- struct **greater_tevent**
- class **taction**
- class **tevent**
- class **tsched_double**

Chapter 9

Punnets Namespace Documentation

9.1 punnets Namespace Reference

Typedefs

- typedef punnets_private::tsynapse< true > **tsynapse**

  a typedef referring **punnets_private::tsynapse** (p. 90) *class.*

- typedef punnets_private::tsynapse_message< true > **tsynapse_message**

  a typedef referring **punnets_private::tsynapse_message** (p. 98) *class.*

- typedef punnets_private::tsynapse_fatigue< true > **tsynapse_fatigue**

  a typedef referring **punnets_private::tsynapse_fatigue** (p. 96) *class.*

- typedef punnets_private::tsynapse_addfunc< true > **tsynapse_addfunc**

  a typedef referring **punnets_private::tsynapse_addfunc** (p. 92) *class.*

- typedef punnets_private::tsynapse_messfunc< true > **tsynapse_messfunc**

  a typedef referring **punnets_private::tsynapse_messfunc** (p. 100) *class.*

- typedef punnets_private::tneuron< true > **tneuron**

  a typedef referring **punnets_private::tneuron** (p. 76) *class.*

- typedef punnets_private::tneuron_ext_const< true > **tneuron_ext_const**

  a typedef referring **punnets_private::tneuron_ext_const** (p. 84) *class.*

- typedef punnets_private::tneuron_ext< true > **tneuron_ext**

  a typedef referring **punnets_private::tneuron_ext** (p. 81) *class.*

9.1.1 Detailed Description

This namespace provides Punnets library. Importing this namespace, a user can access the classes of Punnets library. Alternatively, if you need efficiency, you may import **punnets_nodebug** (p. 29) namespace. For most of the available classes, refer to the **punnets_common** (p. 23) namespace.

This namespace imports **punnets_common** (p. 23) so that every definitions in the **punnets_common** (p. 23) namespace can be transparently used in this namespace.

9.2 punnets_common Namespace Reference

This namespace provides commonly available classes. Users should use classes and functions in this namespace via either punnets or **punnets_nodebug** (p. 29) namespace.

Compounds

- class **debugflag< false >**
- class **debugflag< true >**

  This instantiation of the class is used for punnets namespace.

- class **func_base**
- class **func_const**

  </classdef>

- class **func_const_int**
- class **func_delta_int**

  </classdef>

- class **func_deriveq_base**
- class **func_exp**
- class **func_exp_diff**
- class **func_exp_int**
- class **func_response**
- class **func_sine**
- class **func_sine_int**
- class **func_sineshot**
- class **func_sineshot_int**
- class **func_step**

  </classdef>

- struct **greater_tevent**
- class **message_add_pulse**

  A message that adds a new pulse.

- class **message_add_event_time**
- class **message_base**
- class **message_set_lambda**

  A message that changes lambda (leak value).

- class **message_set_zero_point**

  A message that changes zero point.

- class **message_set_t0**

  A message that changes t0.

- struct **less_sched_entry**

  This class is used to construct a global priority queue on STL.

- class **taction**

- class **tevent**
- struct **neuentry**

  A class to keep a list of logging neurons.

- class **tlogger**
- class **tmessage**
- class **tneuron_base**
- class **tpulse**
- class **tsched_double**
- class **tsentinel**
- class **tsynapse_base**

Typedefs

- typedef double **real**
- typedef double **ntime_t**

Functions

- **taction** & **makePulse** (**tneuron_base** &idest, **real** ilevel)

  Generate a pulse to the specified destination.

- **taction** & **makePulse** (**tneuron_base** &idest, **message_base** *mess)

  Generate a pulse to the specified destination.

- template<bool b> **taction** & **setExtInput** (**punnets_private::tneuron_ext_const**< b > &idest, **real** ilevel)

  Set an external input to a specified level.

Variables

- u_int64_t **totalfire** = 0

  This variable counts the total number of firing of the neurons.

- u_int64_t **totalpulse** = 0

  This variable counts the total pulse arrivals to any of the neurons.

- u_int64_t **totalpartition** = 0

  This variable counts the total number of partitions.

- u_int64_t **totalpartition_nonewton** [4] = {0,0,0,0}
- u_int64_t **totalpartition_newton** [4] = {0,0,0,0}
- u_int64_t **totalpeaksearch** [3] = {0,0,0}
- u_int64_t **totalpeakenclosing** = 0

  This variable counts the total number of peak enclosings. One peak search contains several enclosings.

- u_int64_t **totalrescheduled** = {0}

This variable counts the total number of re-scheduling.

- u_int64_t **totalfiltered_maxgrad** = 0

  This variable counts the total filtering caused by maximum gradient check.

- u_int64_t **totalfiltered_incontinuity** = 0

  This variable counts the total filtering caused by nearby incontinuity.

- u_int64_t **totalfiltered_nextpulse** = 0

  This variable counts the total filtering caused by nearby next pulse.

- const **real epsilon** = 1e-10

  This variable specifies the minimum error value.

9.2.1 Detailed Description

This namespace provides commonly available classes. Users should use classes and functions in this namespace via either punnets or **punnets_nodebug** (p. 29) namespace.

9.2.2 Typedef Documentation

9.2.2.1 typedef double punnets_common::ntime_t

Time representation type.

The type that represents a simulation time.

Definition at line 34 of file punnets_base.h.

Referenced by punnets_common::tsentinel::activate(), punnets_private::tsynapse_messfunc< debug >::activate(), punnets_private::tsynapse_addfunc< debug >::activate(), punnets_private::tneuron_ext< debug >::activate(), punnets_private::tneuron< debug >::activate(), punnets_private::tsynapse_fatigue< debug >::activate(), punnets_private::tsynapse_message< debug >::activate(), punnets_private::tsynapse< debug >::activate(), punnets_common::tlogger::activate(), punnets_common::tlogger::add(), punnets_private::tsynapse_fatigue< debug >::addDelay(), punnets_private::tsynapse< debug >::addDelay(), punnets_private::tneuron_ext< debug >::broadcastMessage(), punnets_private::tneuron_ext< debug >::calcSignal(), punnets_private::tneuron_ext< debug >::fire(), punnets_common::func_delta_int::func_delta_int(), punnets_common::func_exp_diff::get1stDeriv(), punnets_common::func_exp_int::get1stDeriv(), punnets_common::func_exp::get1stDeriv(), punnets_common::func_sineshot_int::get1stDeriv(), punnets_common::func_sine_int::get1stDeriv(), punnets_common::func_sineshot::get1stDeriv(), punnets_common::func_sine::get1stDeriv(), punnets_common::func_response::get1stDeriv(), punnets_common::func_delta_int::get1stDeriv(), punnets_common::func_step::get1stDeriv(), punnets_common::func_const_int::get1stDeriv(), punnets_common::func_const::get1stDeriv(), punnets_common::func_exp_int::get1stDerivDomain(), punnets_common::func_exp::get1stDerivDomain(), punnets_common::func_sine_int::get1stDerivDomain(), punnets_common::func_step::get1stDerivDomain(), punnets_common::func_const::get1stDerivDomain(), punnets_common::func_exp_diff::get1stDerivDomain(), punnets_common::func_sineshot_int::get1stDerivDomain(), punnets_common::func_sineshot::get1stDerivDomain(), punnets_common::func_sine::get1stDerivDomain(), punnets_common::func_response::get1stDerivDomain(), punnets_common::func_delta_int::get1stDerivDomain(), punnets_common::func_const_int::get1stDerivDomain(), punnets_common::func_exp_diff::get2nd-

Deriv(), punnets_common::func_exp_int::get2ndDeriv(), punnets_common::func_exp::get2ndDeriv(), punnets_common::func_sineshot_int::get2ndDeriv(), punnets_common::func_sine_int::get2ndDeriv(), punnets_common::func_sineshot::get2ndDeriv(), punnets_common::func_sine::get2ndDeriv(), punnets_common::func_response::get2ndDeriv(), punnets_common::func_delta_int::get2ndDeriv(), punnets_common::func_step::get2ndDeriv(), punnets_common::func_const_int::get2ndDeriv(), punnets_common::func_const::get2ndDeriv(), punnets_common::func_exp_int::get2ndDerivDomain(), punnets_common::func_exp::get2ndDerivDomain(), punnets_common::func_sine_int::get2ndDerivDomain(), punnets_common::func_step::get2ndDerivDomain(), punnets_common::func_const::get2ndDerivDomain(), punnets_common::func_exp_diff::get2ndDerivDomain(), punnets_common::func_sineshot_int::get2ndDerivDomain(), punnets_common::func_sineshot::get2ndDerivDomain(), punnets_common::func_sine::get2ndDerivDomain(), punnets_common::func_response::get2ndDerivDomain(), punnets_common::func_delta_int::get2ndDerivDomain(), punnets_common::func_const_int::get2ndDerivDomain(), punnets_private::tneuron_ext_const< debug >::getCurrentExtInput(), punnets_common::tneuron_base::getCurrentExtInput(), punnets_private::tneuron_ext< debug >::getCurrentSigLevel(), punnets_private::tneuron_ext_const< debug >::getCurrentSigLevel(), punnets_private::tneuron< debug >::getCurrentSigLevel(), punnets_common::tneuron_base::getCurrentSigLevel(), punnets_private::tneuron_ext< debug >::getCurrentThrLevel(), punnets_private::tneuron< debug >::getCurrentThrLevel(), punnets_common::tneuron_base::getCurrentThrLevel(), punnets_common::tsynapse_base::getDelay(), punnets_private::tneuron_ext< debug >::getLastFire(), punnets_private::tneuron< debug >::getLastFire(), punnets_common::tneuron_base::getLastFire(), punnets_private::tneuron_ext< debug >::getLastSimulate(), punnets_private::tneuron< debug >::getLastSimulate(), punnets_common::tneuron_base::getLastSimulate(), punnets_common::func_exp_diff::getMaxGradient(), punnets_common::func_exp_int::getMaxGradient(), punnets_common::func_exp::getMaxGradient(), punnets_common::func_sineshot_int::getMaxGradient(), punnets_common::func_sine_int::getMaxGradient(), punnets_common::func_sineshot::getMaxGradient(), punnets_common::func_sine::getMaxGradient(), punnets_common::func_response::getMaxGradient(), punnets_common::func_delta_int::getMaxGradient(), punnets_common::func_step::getMaxGradient(), punnets_common::func_const_int::getMaxGradient(), punnets_common::func_const::getMaxGradient(), punnets_common::func_exp_diff::getNextIncontinuity(), punnets_common::func_exp_int::getNextIncontinuity(), punnets_common::func_exp::getNextIncontinuity(), punnets_common::func_sineshot::getNextIncontinuity(), punnets_common::func_sine::getNextIncontinuity(), punnets_common::func_response::getNextIncontinuity(), punnets_common::func_delta_int::getNextIncontinuity(), punnets_common::func_step::getNextIncontinuity(), punnets_common::func_base::getNextIncontinuity(), punnets_common::tevent::getTime(), punnets_common::func_exp_diff::getValue(), punnets_common::func_exp_int::getValue(), punnets_common::func_exp::getValue(), punnets_common::func_sineshot_int::getValue(), punnets_common::func_sine_int::getValue(), punnets_common::func_sineshot::getValue(), punnets_common::func_sine::getValue(), punnets_common::func_response::getValue(), punnets_common::func_delta_int::getValue(), punnets_common::func_step::getValue(), punnets_common::func_const_int::getValue(), punnets_common::func_const::getValue(), punnets_common::func_exp_int::getValueDomain(), punnets_common::func_exp::getValueDomain(), punnets_common::func_sine_int::getValueDomain(), punnets_common::func_step::getValueDomain(), punnets_common::func_const::getValueDomain(), punnets_common::func_exp_diff::getValueDomain(), punnets_common::func_sineshot_int::getValueDomain(), punnets_common::func_sineshot::getValueDomain(), punnets_common::func_sine::getValueDomain(), punnets_common::func_response::getValueDomain(), punnets_common::func_delta_int::getValueDomain(), punnets_common::func_const_int::getValueDomain(), punnets_common::func_sineshot::processMessage(), punnets_common::func_delta_int::processMessage(), punnets_common::func_deriveq_base::processMessage(), punnets_common::func_base::processMessage(), punnets_common::func_exp_diff::processMessage(), tobserver::pulseArrive(), punnets_private::tneuron< debug >::pulseArrive(), punnets_private::tneuron_ext< debug >::pulseArrive(), punnets_common::tsched_double::run(), punnets_common::tsched_double::scheduleEvent(), punnets_private::tneuron_ext< debug >::scheduleFire(), pun-

nets_private::tneuron_ext_const< debug >::scheduleFire(), punnets_private::tneuron< debug >::scheduleFire(), punnets_private::tneuron_ext< debug >::sendMessage(), punnets_private::tneuron_ext_const< debug >::setConvergeLevel(), punnets_private::tneuron_ext_const< debug >::setExtInput(), punnets_private::tneuron_ext< debug >::setLoopBack(), punnets_common::func_sineshot::shouldDelete(), punnets_common::func_base::shouldDelete(), punnets_private::tneuron_ext_const< debug >::simulateElapse(), punnets_private::tneuron< debug >::simulateElapse(), punnets_common::tevent::tevent(), punnets_common::tlogger::tlogger(), punnets_private::tneuron< debug >::tneuron(), punnets_private::tneuron_ext_const< debug >::tneuron_ext_const(), punnets_private::tsynapse< debug >::tsynapse(), and punnets_common::tsynapse_base::tsynapse_base().

9.2.2.2 typedef double punnets_common::real

Real number type.

The type that represents a real number.

Definition at line 28 of file punnets_base.h.

Referenced by punnets_private::tsynapse_fatigue< debug >::activate(), punnets_common::tlogger::add(), punnets_private::tsynapse_fatigue< debug >::addWeight(), punnets_private::tsynapse< debug >::addWeight(), punnets_private::tneuron_ext< debug >::calcSignal(), punnets_common::func_const::func_const(), punnets_common::func_const_int::func_const_int(), punnets_common::func_delta_int::func_delta_int(), punnets_common::func_exp::func_exp(), punnets_common::func_exp_diff::func_exp_diff(), punnets_common::func_exp_int::func_exp_int(), punnets_common::func_sine::func_sine(), punnets_common::func_sine_int::func_sine_int(), punnets_common::func_sineshot::func_sineshot(), punnets_common::func_sineshot_int::func_sineshot_int(), punnets_common::func_exp_diff::get1stDeriv(), punnets_common::func_exp_int::get1stDeriv(), punnets_common::func_exp::get1stDeriv(), punnets_common::func_sineshot_int::get1stDeriv(), punnets_common::func_sine_int::get1stDeriv(), punnets_common::func_sineshot::get1stDeriv(), punnets_common::func_sine::get1stDeriv(), punnets_common::func_response::get1stDeriv(), punnets_common::func_delta_int::get1stDeriv(), punnets_common::func_step::get1stDeriv(), punnets_common::func_const_int::get1stDeriv(), punnets_common::func_const::get1stDeriv(), punnets_common::func_exp_int::get1stDerivDomain(), punnets_common::func_exp::get1stDerivDomain(), punnets_common::func_sine_int::get1stDerivDomain(), punnets_common::func_step::get1stDerivDomain(), punnets_common::func_const::get1stDerivDomain(), punnets_common::func_exp_diff::get1stDerivDomain(), punnets_common::func_sineshot_int::get1stDerivDomain(), punnets_common::func_sineshot::get1stDerivDomain(), punnets_common::func_sine::get1stDerivDomain(), punnets_common::func_response::get1stDerivDomain(), punnets_common::func_delta_int::get1stDerivDomain(), punnets_common::func_const_int::get1stDerivDomain(), punnets_common::func_exp_diff::get2ndDeriv(), punnets_common::func_exp_int::get2ndDeriv(), punnets_common::func_exp::get2ndDeriv(), punnets_common::func_sineshot_int::get2ndDeriv(), punnets_common::func_sine_int::get2ndDeriv(), punnets_common::func_sineshot::get2ndDeriv(), punnets_common::func_sine::get2ndDeriv(), punnets_common::func_response::get2ndDeriv(), punnets_common::func_delta_int::get2ndDeriv(), punnets_common::func_step::get2ndDeriv(), punnets_common::func_const_int::get2ndDeriv(), punnets_common::func_const::get2ndDeriv(), punnets_common::func_exp_int::get2ndDerivDomain(), punnets_common::func_exp::get2ndDerivDomain(), punnets_common::func_sine_int::get2ndDerivDomain(), punnets_common::func_step::get2ndDerivDomain(), punnets_common::func_const::get2ndDerivDomain(), punnets_common::func_exp_diff::get2ndDerivDomain(), punnets_common::func_sineshot_int::get2ndDerivDomain(), punnets_common::func_sineshot::get2ndDerivDomain(), punnets_common::func_sine::get2ndDerivDomain(), punnets_common::func_response::get2ndDerivDomain(), punnets_common::func_delta_int::get2ndDerivDomain(), punnets_common::func_const_int::get2ndDerivDomain(), punnets_private::tneuron_ext_const< debug >::getConvergeLevel(), punnets_private::tneuron_ext_const<

debug >::getCurrentExtInput(), punnets_common::tneuron_base::getCurrentExtInput(), punnets_private::tneuron_ext< debug >::getCurrentSigLevel(), punnets_private::tneuron_ext_const< debug >::getCurrentSigLevel(), punnets_private::tneuron< debug >::getCurrentSigLevel(), punnets_common::tneuron_base::getCurrentSigLevel(), punnets_private::tneuron_ext< debug >::getCurrentThrLevel(), punnets_private::tneuron< debug >::getCurrentThrLevel(), punnets_common::tneuron_base::getCurrentThrLevel(), punnets_private::tneuron_ext_const< debug >::getExtInput(), punnets_common::func_exp_diff::getMaxGradient(), punnets_common::func_exp_int::getMaxGradient(), punnets_common::func_exp::getMaxGradient(), punnets_common::func_sineshot_int::getMaxGradient(), punnets_common::func_sine_int::getMaxGradient(), punnets_common::func_sineshot::getMaxGradient(), punnets_common::func_sine::getMaxGradient(), punnets_common::func_response::getMaxGradient(), punnets_common::func_delta_int::getMaxGradient(), punnets_common::func_step::getMaxGradient(), punnets_common::func_const_int::getMaxGradient(), punnets_common::func_const::getMaxGradient(), punnets_common::func_exp_diff::getValue(), punnets_common::func_exp_int::getValue(), punnets_common::func_exp::getValue(), punnets_common::func_sineshot_int::getValue(), punnets_common::func_sine_int::getValue(), punnets_common::func_sineshot::getValue(), punnets_common::func_sine::getValue(), punnets_common::func_response::getValue(), punnets_common::func_delta_int::getValue(), punnets_common::func_step::getValue(), punnets_common::func_const_int::getValue(), punnets_common::func_const::getValue(), punnets_common::func_exp_int::getValueDomain(), punnets_common::func_exp::getValueDomain(), punnets_common::func_sine_int::getValueDomain(), punnets_common::func_step::getValueDomain(), punnets_common::func_const::getValueDomain(), punnets_common::func_exp_diff::getValueDomain(), punnets_common::func_sineshot_int::getValueDomain(), punnets_common::func_sineshot::getValueDomain(), punnets_common::func_sine::getValueDomain(), punnets_common::func_response::getValueDomain(), punnets_common::func_delta_int::getValueDomain(), punnets_common::func_const_int::getValueDomain(), punnets_private::tsynapse_fatigue< debug >::getWeight(), punnets_private::tsynapse< debug >::getWeight(), punnets_common::tsynapse_base::getWeight(), makePulse(), tobserver::pulseArrive(), punnets_private::tneuron< debug >::pulseArrive(), punnets_private::tneuron_ext< debug >::pulseArrive(), punnets_private::tneuron_ext< debug >::scheduleFire(), punnets_private::tneuron_ext_const< debug >::scheduleFire(), punnets_private::tneuron< debug >::scheduleFire(), punnets_private::tneuron_ext_const< debug >::setConvergeLevel(), punnets_private::tneuron_ext_const< debug >::setExtInput(), punnets_common::func_deriveq_base::setLambda(), punnets_common::func_base::setLambda(), punnets_common::func_response::setZeroPoint(), punnets_common::func_deriveq_base::setZeroPoint(), punnets_common::func_base::setZeroPoint(), punnets_private::tneuron< debug >::tneuron(), punnets_private::tneuron_ext< debug >::tneuron_ext(), punnets_private::tneuron_ext_const< debug >::tneuron_ext_const(), punnets_private::tsynapse< debug >::tsynapse(), punnets_private::tsynapse_addfunc< debug >::tsynapse_addfunc(), punnets_private::tsynapse_fatigue< debug >::tsynapse_fatigue(), punnets_private::tsynapse_message< debug >::tsynapse_message(), and punnets_private::tsynapse_messfunc< debug >::tsynapse_messfunc().

9.3 punnets_nodebug Namespace Reference

Typedefs

- typedef punnets_private::tsynapse< false > **tsynapse**
  tsynapse class.
- typedef punnets_private::tsynapse_message< false > **tsynapse_message**
  tsynapse_message class.
- typedef punnets_private::tsynapse_fatigue< false > **tsynapse_fatigue**
  tsynapse_fatigue class.
- typedef punnets_private::tsynapse_addfunc< false > **tsynapse_addfunc**
  tsynapse_addfunc class.
- typedef punnets_private::tsynapse_messfunc< false > **tsynapse_messfunc**
  tsynapse_messfunc class.
- typedef punnets_private::tneuron< false > **tneuron**
  tneuron class.
- typedef punnets_private::tneuron_ext_const< false > **tneuron_ext_const**
  tneuron_ext_const class.
- typedef punnets_private::tneuron_ext< false > **tneuron_ext**
  tneuron_ext class.

9.3.1 Detailed Description

This namespace provides Punnets library without debugging facility. Importing this namespace, a user can access an efficient variant of the Punnets library. It is recommended for a user to use **punnets** (p. 21) namespace, at least in the period of development. For most of the available classes, refer to the **punnets_common** (p. 23) namespace.

This namespace imports **punnets_common** (p. 23) so that every definitions in the **punnets_common** (p. 23) namespace can be transparently used in this namespace.

9.4 punnets_private Namespace Reference

This namespace provides some private classes used for punnets library. Users should not use classes and functions in this namespace directly.

Compounds

- class **tneuron**
- class **tneuron_ext**
- class **tneuron_ext_const**
- class **tsynapse**
- class **tsynapse_addfunc**

  Synapse class that adds a new function to the destination (postsynaptic) **tneuron_ext** (p. 81).

- class **tsynapse_fatigue**
- class **tsynapse_message**
- class **tsynapse_messfunc**
- struct **valdomain**

9.4.1 Detailed Description

This namespace provides some private classes used for punnets library. Users should not use classes and functions in this namespace directly.

Chapter 10

Punnets Class Documentation

10.1 punnets_common::debugflag< false > Class Template Reference

`#include <dneuron.h>`

Public Methods

- bool **getDeb** () const

  Get debugging condition, which is always false.

- void **setDeb** (bool)

  Set debugging condition, which always fails.

10.1.1 Detailed Description

template<> class punnets_common::debugflag< false >

This instantiation of the class is used for **punnets_nodebug** (p. 29) namespace. it provides always false value to the **getDeb()** (p. 31), so that the debugging code is optimized out.

Definition at line 114 of file dneuron.h.

The documentation for this class was generated from the following file:

- **dneuron.h**

10.2 punnets_common::debugflag< true > Class Template Reference

This instantiation of the class is used for punnets namespace.

`#include <dneuron.h>`

Public Methods

- **debugflag** ()

  Constructor initialized the debugging condition to false.

- bool **getDeb** () const

  Get debugging condition.

- void **setDeb** (bool b)

  Set debugging condition.

Protected Attributes

- bool **debug**

  The debugging condition.

10.2.1 Detailed Description

template<> class punnets_common::debugflag< true >

This instantiation of the class is used for punnets namespace.

Definition at line 125 of file dneuron.h.

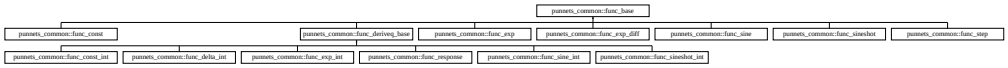
The documentation for this class was generated from the following file:

- **dneuron.h**

10.3 punnets_common::func_base Class Reference

`#include <func.h>`

Inheritance diagram for punnets_common::func_base::



Public Methods

- virtual bool **shouldDelete** (**ntime_t**)

  Return true if the function will return only zeros after the specified time.

- virtual bool **processMessage** (**ntime_t**, const **message_base** &)
- virtual void **setLambda** (**real**)

  Change leak value on a leaky integrate function. Redefined in **func_deriveq_base** (p. 43).

- virtual void **setZeroPoint** (**real**)

  Change zero point on a leaky integrate function. Redefined in **func_deriveq_base** (p. 43).

- virtual **real getMaxGradient** (**ntime_t** t) const=0

  A pure virtual function that returns the max gradient of the function after the time t.

- virtual **ntime_t getNextIncontinuity** (**ntime_t**) const
- virtual **real getValue** (**ntime_t** t) const=0

  A pure virtual function that returns f(t).

- virtual **real get1stDeriv** (**ntime_t** t) const=0

  A pure virtual function that returns df(t)/dt.

- virtual **real get2ndDeriv** (**ntime_t** t) const=0

  A pure virtual function that returns $d^2f(t)/dt^2$.

- virtual void **getValueDomain** (**ntime_t** t, **real** &upslope, **real** &ceil, **real** &downslope, **real** &floor) const=0

  Obtains a zeroth-order linear envelope of the function. floor < f(t+α) < ceil, f(t)+αdownslope < f(t+α) < f(t)+αupslope.

- virtual void **get1stDerivDomain** (**ntime_t** t, **real** &upslope, **real** &ceil, **real** &downslope, **real** &floor) const=0

  Obtains a first–order linear envelope of the function. floor < f(t+α) < ceil, f(t)+αdownslope < f(t+α) < f(t)+αupslope.

- virtual void **get2ndDerivDomain** (**ntime_t** t, **real** &upslope, **real** &ceil, **real** &downslope, **real** &floor) const=0

  Obtains a second-order linear envelope of the function. floor < f(t+α) < ceil, f(t)+αdownslope < f(t+α) < f(t)+αupslope.

- virtual func_base * **clone** ()=0

Allocates and returns another instance of this function.

- virtual std::string **getDescription** ()=0

  Obtains a human-readable description string of this function.

Protected Methods

- virtual void **valueChange** ()

10.3.1 Detailed Description

Abstract base class of a function.

A base class that represents a numerical function. Some functions needs a reference point to be calculated based on differential equation. Such a function is derived from **func_deriveq_base** (p. 43), but **func_base** (p. 33) contains interface for such a function.

Definition at line 69 of file func.h.

10.3.2 Member Function Documentation

10.3.2.1 virtual ntime_t punnets_common::func_base::getNextIncontinuity (ntime_t) const [inline, virtual]

A virtual function that returns the next incontinuity point after the time t. In **func_base** (p. 33), the function always returns infinity.

Reimplemented in **punnets_common::func_step** (p. 66), **punnets_common::func_delta_int** (p. 41), **punnets_common::func_response** (p. 54), **punnets_common::func_sine** (p. 56), **punnets_common::func_sineshot** (p. 60), **punnets_common::func_exp** (p. 47), **punnets_common::func_exp_int** (p. 52), and **punnets_common::func_exp_diff** (p. 49).

Definition at line 96 of file func.h.

References punnets_common::ntime_t.

```
96 { return mak::Infinity; };
```

10.3.2.2 virtual bool punnets_common::func_base::processMessage (ntime_t, const message_base &) [inline, virtual]

Process the specified message at the specified time. Return true if the message is processed. In **func_base** (p. 33), this function always returns false (processes no message).

Reimplemented in **punnets_common::func_deriveq_base** (p. 43), **punnets_common::func_delta_int** (p. 40), **punnets_common::func_sineshot** (p. 61), and **punnets_common::func_exp_diff** (p. 49).

Definition at line 85 of file func.h.

References punnets_common::ntime_t.

```
85 { return false; }
```

10.3.2.3 virtual void punnets_common::func_base::valueChange () [inline, protected, virtual]

An entrance to recalculate coefficient at the value change caused by some external factor. In **func_base** (p. 33) this function do nothing. This function will be defined in the derived classes with the requirement of the recalculation.

Definition at line 75 of file func.h.

Referenced by punnets_common::func_const_int::func_const_int(), punnets_common::func_delta_int::func_delta_int(), punnets_common::func_exp_diff::func_exp_diff(), punnets_common::func_exp_int::func_exp_int(), punnets_common::func_sine::func_sine(), punnets_common::func_sine_int::func_sine_int(), punnets_common::func_sineshot::func_sineshot(), punnets_common::func_sineshot_int::func_sineshot_int(), punnets_common::func_exp_diff::processMessage(), and punnets_common::func_deriveq_base::setLambda().

```
75 { }
```

The documentation for this class was generated from the following file:

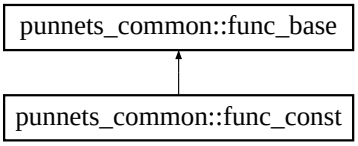
- **func.h**

10.4 punnets_common::func_const Class Reference

</classdef>

`#include <func.h>`

Inheritance diagram for punnets_common::func_const::



Public Methods

- **func_const** (**real** ic)

  constructs a **func_const** (p. 36) *with the constant c.*

- virtual **real getMaxGradient** (**ntime_t**) const

  A pure virtual function that returns the max gradient of the function after the time t.

- virtual **real getValue** (**ntime_t**) const

  A pure virtual function that returns f(t).

- virtual **real get1stDeriv** (**ntime_t**) const

  A pure virtual function that returns df(t)/dt.

- virtual **real get2ndDeriv** (**ntime_t**) const

  A pure virtual function that returns $d^2f(t)/dt^2$.

- virtual void **getValueDomain** (**ntime_t**, **real** &upslope, **real** &ceil, **real** &downslope, **real** &floor) const

  Obtains a zeroth-order linear envelope of the function. floor < f(t+α) < ceil, f(t)+αdownslope < f(t+α) < f(t)+αupslope.

- virtual void **get1stDerivDomain** (**ntime_t**, **real** &upslope, **real** &ceil, **real** &downslope, **real** &floor) const

  Obtains a first–order linear envelope of the function. floor < f(t+α) < ceil, f(t)+αdownslope < f(t+α) < f(t)+αupslope.

- virtual void **get2ndDerivDomain** (**ntime_t**, **real** &upslope, **real** &ceil, **real** &downslope, **real** &floor) const

  Obtains a second-order linear envelope of the function. floor < f(t+α) < ceil, f(t)+αdownslope < f(t+α) < f(t)+αupslope.

- virtual func_const * **clone** ()

  Allocates and returns another instance of this function.

- virtual std::string **getDescription** ()

  Obtains a human-readable description string of this function.

10.4.1 Detailed Description

</classdef>

A constant function.

This class represents a constant function f(t) = c.

Definition at line 201 of file func.h.

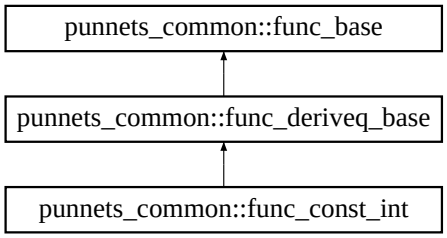
The documentation for this class was generated from the following file:

- **func.h**

10.5 punnets_common::func_const_int Class Reference

`#include <func.h>`

Inheritance diagram for punnets_common::func_const_int::



Public Methods

- **func_const_int** (**real** ic)

  Constructs a **func_const_int** (p. 38) *with the constant c.*

- virtual **real getMaxGradient** (**ntime_t**) const

  A pure virtual function that returns the max gradient of the function after the time t.

- virtual **real getValue** (**ntime_t** t) const

  A pure virtual function that returns f(t).

- virtual **real get1stDeriv** (**ntime_t** t) const

  A pure virtual function that returns df(t)/dt.

- virtual **real get2ndDeriv** (**ntime_t** t) const

  A pure virtual function that returns $d^2f(t)/dt^2$.

- virtual void **getValueDomain** (**ntime_t** t, **real** &upslope, **real** &ceil, **real** &downslope, **real** &floor) const

  Obtains a zeroth-order linear envelope of the function. floor < f(t+α) < ceil, f(t)+αdownslope < f(t+α) < f(t)+αupslope.

- virtual void **get1stDerivDomain** (**ntime_t** t, **real** &upslope, **real** &ceil, **real** &downslope, **real** &floor) const

  Obtains a first–order linear envelope of the function. floor < f(t+α) < ceil, f(t)+αdownslope < f(t+α) < f(t)+αupslope.

- virtual void **get2ndDerivDomain** (**ntime_t** t, **real** &upslope, **real** &ceil, **real** &downslope, **real** &floor) const

  Obtains a second-order linear envelope of the function. floor < f(t+α) < ceil, f(t)+αdownslope < f(t+α) < f(t)+αupslope.

- virtual func_const_int * **clone** ()

  Allocates and returns another instance of this function.

- virtual std::string **getDescription** ()

Obtains a human-readable description string of this function.

10.5.1 Detailed Description

An integration of a constant function.

The result of solving dx/dt = c - λ x. That is, x = c/λ + C e^-λ t, where C is an integration constant.

Definition at line 238 of file func.h.

The documentation for this class was generated from the following files:

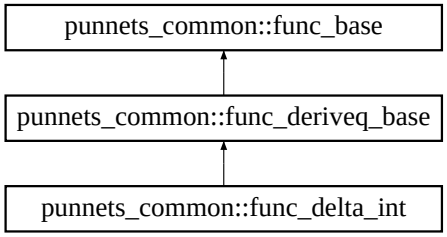
- **func.h**
- **func.cpp**

10.6 punnets_common::func_delta_int Class Reference

</classdef>

`#include <func.h>`

Inheritance diagram for punnets_common::func_delta_int::



Public Methods

- **func_delta_int** (**real** ir, **ntime_t** it0)

  Constructs **func_delta_int** (p. 40) *with pulse amplitude r, and pulse arrival time t0.*

- virtual **real getMaxGradient** (**ntime_t**) const

  A pure virtual function that returns the max gradient of the function after the time t.

- virtual **real getValue** (**ntime_t** t) const
- virtual **real get1stDeriv** (**ntime_t** t) const

  A pure virtual function that returns df(t)/dt.

- virtual **real get2ndDeriv** (**ntime_t** t) const

  A pure virtual function that returns $d^2f(t)/dt^2$.

- virtual **ntime_t getNextIncontinuity** (**ntime_t** from) const
- virtual void **getValueDomain** (**ntime_t** t, **real** &upslope, **real** &ceil, **real** &downslope, **real** &floor) const

  Obtains a zeroth-order linear envelope of the function. floor < f(t+α) < ceil, f(t)+αdownslope < f(t+α) < f(t)+αupslope.

- virtual void **get1stDerivDomain** (**ntime_t** t, **real** &upslope, **real** &ceil, **real** &downslope, **real** &floor) const

  Obtains a first–order linear envelope of the function. floor < f(t+α) < ceil, f(t)+αdownslope < f(t+α) < f(t)+αupslope.

- virtual void **get2ndDerivDomain** (**ntime_t** t, **real** &upslope, **real** &ceil, **real** &downslope, **real** &floor) const

  Obtains a second-order linear envelope of the function. floor < f(t+α) < ceil, f(t)+αdownslope < f(t+α) < f(t)+αupslope.

- virtual std::string **getDescription** ()

  Obtains a human-readable description string of this function.

- virtual bool **processMessage** (**ntime_t** t, const **message_base** &m)

Processes message_set_lambda and message_set_zero_point messages.

- virtual func_delta_int * **clone** ()

  Allocates and returns another instance of this function.

10.6.1 Detailed Description

</classdef>

An integrated delta function with leak.

A leaky integration of a delta function. $df/dt = r \delta(t - t0) - \lambda f$.

Definition at line 316 of file func.h.

10.6.2 Member Function Documentation

10.6.2.1 virtual ntime_t punnets_common::func_delta_int::getNextIncontinuity (ntime_t *from*) const [inline, virtual]

A virtual function that returns the next incontinuity point after the time t. In **func_base** (p. 33), the function always returns infinity.

Reimplemented from **punnets_common::func_base** (p. 34).

Definition at line 345 of file func.h.

References punnets_common::ntime_t.

```
345 { return from < t0 ? t0 : mak::Infinity; };
```

10.6.2.2 virtual real punnets_common::func_delta_int::getValue (ntime_t *t*) const [inline, virtual]

A function that returns a leaky integrated value between the last pulse arrival time *t0* and *t*. $x = 1/e^{λt} (∫_{from}^{to} e^{λt} f(t) + C)$

Implements **punnets_common::func_base** (p. 33).

Definition at line 331 of file func.h.

References punnets_common::ntime_t, and punnets_common::real.

Referenced by processMessage().

```
334                 {
335 //                  std::cout << "zerop=" << zerop << ", t0=" << t0 << ",t=" << t << std::endl;
336                     return (zerop < t0 && t0 <= t) ? r * exp( - lambda * (t - t0) ) : 0.0; }
```

The documentation for this class was generated from the following files:

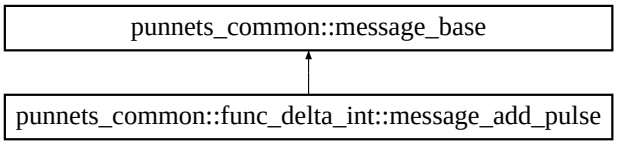
- **func.h**
- **func.cpp**

10.7 punnets_common::func_delta_int::message_add_pulse Class Reference

A message that adds a new pulse.

`#include <func.h>`

Inheritance diagram for punnets_common::func_delta_int::message_add_pulse::



Public Methods

- virtual const char * **getMessageId** () const

10.7.1 Detailed Description

A message that adds a new pulse.

Definition at line 354 of file func.h.

10.7.2 Member Function Documentation

10.7.2.1 virtual const char* punnets_common::func_delta_int::message_add_pulse::getMessageId () [inline, virtual]

Returns the pointer of a string that represents the class. The pointer must be same for any instance of a given class. A function can check the type of the message by comparing the pointer.

Implements **punnets_common::message_base** (p. 68).

Definition at line 360 of file func.h.

```
360 { return messageId; }
```

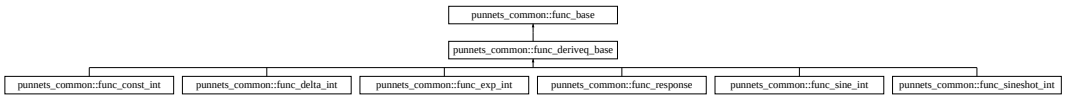
The documentation for this class was generated from the following files:

- **func.h**
- **func.cpp**

10.8 punnets_common::func_deriveq_base Class Reference

`#include <func.h>`

Inheritance diagram for punnets_common::func_deriveq_base::



Public Methods

- virtual void **setLambda** (**real** new_lambda)
  Change leak value on a leaky integrate function.
- virtual void **setZeroPoint** (**real** new_zeropoint)
  Change zero point on a leaky integrate function.
- virtual bool **processMessage** (**ntime_t** t, const **message_base** &m)
  Processes **message_set_lambda** (p. 44) *and* **message_set_zero_point** (p. 45) *messages.*

Protected Methods

- virtual void **zeropChange** ()

10.8.1 Detailed Description

Abstract base class of a leaky integration function.

The function has a form of the following differential equation. <nobr>dx/dt = f(t)-λx</nobr> The integration constant C is determined as f(zerop)=0 stands.

Definition at line 125 of file func.h.

10.8.2 Member Function Documentation

10.8.2.1 virtual void punnets_common::func_deriveq_base::zeropChange () [inline, protected, virtual]

An entrance to recalculate coefficient at the zero-pointer change. In **func_base** (p. 33) this function do nothing. This function will be defined in the derived classes with the requirement of the recalculation.

Definition at line 134 of file func.h.

Referenced by punnets_common::func_response::setZeroPoint(), and setZeroPoint().

```
134 { }
```

The documentation for this class was generated from the following file:

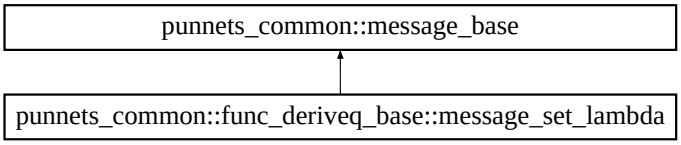
- **func.h**

10.9 punnets_common::func_deriveq_base::message_set_lambda Class Reference

A message that changes lambda (leak value).

`#include <func.h>`

Inheritance diagram for punnets_common::func_deriveq_base::message_set_lambda::



Public Methods

- virtual const char * **getMessageId** () const

10.9.1 Detailed Description

A message that changes lambda (leak value).

Definition at line 146 of file func.h.

10.9.2 Member Function Documentation

10.9.2.1 virtual const char* punnets_common::func_deriveq_base::message_set_lambda::getMessageId () [inline, virtual]

Returns the pointer of a string that represents the class. The pointer must be same for any instance of a given class. A function can check the type of the message by comparing the pointer.

Implements **punnets_common::message_base** (p. 68).

Definition at line 152 of file func.h.

```
152 { return messageId; }
```

The documentation for this class was generated from the following files:

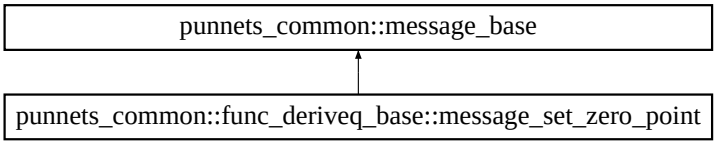
- **func.h**
- **func.cpp**

10.10 punnets_common::func_deriveq_base::message_set_zero_point Class Reference

A message that changes zero point.

`#include <func.h>`

Inheritance diagram for punnets_common::func_deriveq_base::message_set_zero_point::



Public Methods

- virtual const char * **getMessageId** () const

10.10.1 Detailed Description

A message that changes zero point.

Definition at line 156 of file func.h.

10.10.2 Member Function Documentation

10.10.2.1 virtual const char* punnets_common::func_deriveq_base::message_set_zero_point::getMessageId () [inline, virtual]

Returns the pointer of a string that represents the class. The pointer must be same for any instance of a given class. A function can check the type of the message by comparing the pointer.

Implements **punnets_common::message_base** (p. 68).

Definition at line 162 of file func.h.

```
162 { return messageId; }
```

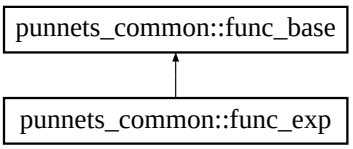
The documentation for this class was generated from the following files:

- **func.h**
- **func.cpp**

10.11 punnets_common::func_exp Class Reference

`#include <func.h>`

Inheritance diagram for punnets_common::func_exp::



Public Methods

- **func_exp** (**real** ir, **real** ipsi, **real** it0)

  Constructs a **func_exp** (p. 46) *with initial value r at time t0, and decay constant psi.*

- virtual **real getMaxGradient** (**ntime_t** t) const

  A pure virtual function that returns the max gradient of the function after the time t.

- virtual **real getValue** (**ntime_t** t) const

  A pure virtual function that returns f(t).

- virtual **real get1stDeriv** (**ntime_t** t) const

  A pure virtual function that returns df(t)/dt.

- virtual **real get2ndDeriv** (**ntime_t** t) const

  A pure virtual function that returns $d^2f(t)/dt^2$.

- virtual **ntime_t getNextIncontinuity** (**ntime_t**) const
- virtual void **getValueDomain** (**ntime_t** t, **real** &upslope, **real** &ceil, **real** &downslope, **real** &floor) const

  Obtains a zeroth-order linear envelope of the function. floor < f(t+α) < ceil, f(t)+αdownslope < f(t+α) < f(t)+αupslope.

- virtual void **get1stDerivDomain** (**ntime_t** t, **real** &upslope, **real** &ceil, **real** &downslope, **real** &floor) const

  Obtains a first–order linear envelope of the function. floor < f(t+α) < ceil, f(t)+αdownslope < f(t+α) < f(t)+αupslope.

- virtual void **get2ndDerivDomain** (**ntime_t** t, **real** &upslope, **real** &ceil, **real** &downslope, **real** &floor) const

  Obtains a second-order linear envelope of the function. floor < f(t+α) < ceil, f(t)+αdownslope < f(t+α) < f(t)+αupslope.

- virtual func_exp * **clone** ()

  Allocates and returns another instance of this function.

- virtual std::string **getDescription** ()

  Obtains a human-readable description string of this function.

10.11.1 Detailed Description

Exponential function

Exponentially decaying function f(t) = r exp(- ψ (t - t_0)).

Definition at line 655 of file func.h.

10.11.2 Member Function Documentation

10.11.2.1 virtual ntime_t punnets_common::func_exp::getNextIncontinuity (ntime_t) const [inline, virtual]

A virtual function that returns the next incontinuity point after the time t. In **func_base** (p. 33), the function always returns infinity.

Reimplemented from **punnets_common::func_base** (p. 34).

Definition at line 679 of file func.h.

References punnets_common::ntime_t.

```
679 { return mak::Infinity; };
```

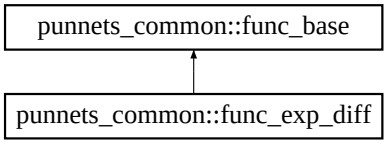
The documentation for this class was generated from the following file:

- **func.h**

10.12 punnets_common::func_exp_diff Class Reference

`#include <func.h>`

Inheritance diagram for punnets_common::func_exp_diff::



Public Methods

- **func_exp_diff** (**real** ir1, **real** ipsi1, **real** ir2, **real** ipsi2, **real** it0)
  constructs **func_exp_diff** (p. 48).
- virtual **real getMaxGradient** (**ntime_t** t) const
  A pure virtual function that returns the max gradient of the function after the time t.
- virtual **real getValue** (**ntime_t** t) const
  A pure virtual function that returns f(t).
- virtual **real get1stDeriv** (**ntime_t** t) const
  A pure virtual function that returns df(t)/dt.
- virtual **real get2ndDeriv** (**ntime_t** t) const
  A pure virtual function that returns $d^2f(t)/dt^2$.
- virtual **ntime_t getNextIncontinuity** (**ntime_t**) const
- virtual void **getValueDomain** (**ntime_t** t, **real** &upslope, **real** &ceil, **real** &downslope, **real** &floor) const
  Obtains a zeroth-order linear envelope of the function. floor < f(t+α) < ceil, f(t)+αdownslope < f(t+α) < f(t)+αupslope.
- virtual void **get1stDerivDomain** (**ntime_t** t, **real** &upslope, **real** &ceil, **real** &downslope, **real** &floor) const
  Obtains a first–order linear envelope of the function. floor < f(t+α) < ceil, f(t)+αdownslope < f(t+α) < f(t)+αupslope.
- virtual void **get2ndDerivDomain** (**ntime_t** t, **real** &upslope, **real** &ceil, **real** &downslope, **real** &floor) const
  Obtains a second-order linear envelope of the function. floor < f(t+α) < ceil, f(t)+αdownslope < f(t+α) < f(t)+αupslope.
- virtual func_exp_diff * **clone** ()
  Allocates and returns another instance of this function.
- virtual std::string **getDescription** ()
  Obtains a human-readable description string of this function.
- virtual bool **processMessage** (**ntime_t** t, const **message_base** &m)

10.12.1 Detailed Description

Difference of two exponential functions

External input of a form f(t) = r1 exp(- ψ1 (t - t_0)) - r2 exp(- ψ2 (t - t_0)). Here r1129Ar2 > 0 and 0 < psi1 < psi2.

Definition at line 801 of file func.h.

10.12.2 Member Function Documentation

10.12.2.1 virtual ntime_t punnets_common::func_exp_diff::getNextIncontinuity (ntime_t) const [inline, virtual]

A virtual function that returns the next incontinuity point after the time t. In **func_base** (p. 33), the function always returns infinity.

Reimplemented from **punnets_common::func_base** (p. 34).

Definition at line 834 of file func.h.

References punnets_common::ntime_t.

```
834 { return mak::Infinity; }
```

10.12.2.2 bool punnets_common::func_exp_diff::processMessage (ntime_t *t*, const message_base & *m*) [virtual]

Process the specified message at the specified time. Return true if the message is processed. In **func_base** (p. 33), this function always returns false (processes no message).

Reimplemented from **punnets_common::func_base** (p. 34).

Definition at line 529 of file func.cpp.

References punnets_common::message_base::getMessageId(), punnets_common::ntime_t, and punnets_common::func_base::valueChange().

```
530 {
531 #ifdef USE_DYNAMIC
532     if( dynamic_cast<const message_add_event_time *>(&m) != NULL )
533 #else
534     if( m.getMessageId() == message_add_event_time::messageId )
535 #endif
536     {
537         ir1 = r1orig + ir1 * exp( - psi1 * (t-it0) );
538         ir2 = r2orig + ir2 * exp( - psi2 * (t-it0) );
539         it0 = t;
540         valueChange();
541         return true;
542     }
543     return func_base::processMessage(t, m);
544 }
```

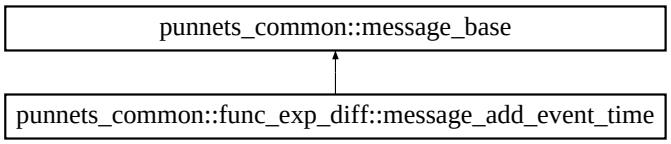
The documentation for this class was generated from the following files:

- **func.h**
- **func.cpp**

10.13 punnets_common::func_exp_diff::message_add_event_time Class Reference

`#include <func.h>`

Inheritance diagram for punnets_common::func_exp_diff::message_add_event_time::



Public Methods

- virtual const char * **getMessageId** () const

10.13.1 Detailed Description

Message to add an event. ????

Definition at line 846 of file func.h.

10.13.2 Member Function Documentation

10.13.2.1 virtual const char* punnets_common::func_exp_diff::message_add_event_time::getMessageId () [inline, virtual]

Returns the pointer of a string that represents the class. The pointer must be same for any instance of a given class. A function can check the type of the message by comparing the pointer.

Implements **punnets_common::message_base** (p. 68).

Definition at line 851 of file func.h.

```
851 { return messageId; }
```

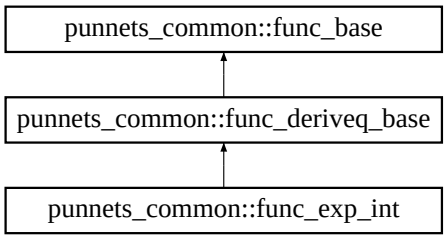
The documentation for this class was generated from the following files:

- **func.h**
- **func.cpp**

10.14 punnets_common::func_exp_int Class Reference

`#include <func.h>`

Inheritance diagram for punnets_common::func_exp_int::



Public Methods

- **func_exp_int** (**real** ir, **real** ipsi, **real** it0)

  Constructs a **func_exp** (p. 46) *with initial value r at time t0, and decay constant psi.*

- virtual **real getMaxGradient** (**ntime_t**) const

  A pure virtual function that returns the max gradient of the function after the time t.

- virtual **real getValue** (**ntime_t** t) const

  A pure virtual function that returns f(t).

- virtual **real get1stDeriv** (**ntime_t** t) const

  A pure virtual function that returns df(t)/dt.

- virtual **real get2ndDeriv** (**ntime_t** t) const

  A pure virtual function that returns $d^2f(t)/dt^2$.

- virtual **ntime_t getNextIncontinuity** (**ntime_t**) const
- virtual void **getValueDomain** (**ntime_t** t, **real** &upslope, **real** &ceil, **real** &downslope, **real** &floor) const

  Obtains a zeroth-order linear envelope of the function. floor < f(t+α) < ceil, f(t)+αdownslope < f(t+α) < f(t)+αupslope.

- virtual void **get1stDerivDomain** (**ntime_t**, **real** &, **real** &, **real** &, **real** &) const

  Obtains a first–order linear envelope of the function. floor < f(t+α) < ceil, f(t)+αdownslope < f(t+α) < f(t)+αupslope.

- virtual void **get2ndDerivDomain** (**ntime_t**, **real** &, **real** &, **real** &, **real** &) const

  Obtains a second-order linear envelope of the function. floor < f(t+α) < ceil, f(t)+αdownslope < f(t+α) < f(t)+αupslope.

- virtual func_exp_int * **clone** ()

  Allocates and returns another instance of this function.

- virtual std::string **getDescription** ()

  Obtains a human-readable description string of this function.

10.14.1 Detailed Description

Integration of an exponential function

leaky integration of external, exponential input f(t) = r exp(- ψ (t - t_0)).

Todo:
implement get1stDerivDomain etc. for this function

Definition at line 705 of file func.h.

10.14.2 Member Function Documentation

10.14.2.1 virtual ntime_t punnets_common::func_exp_int::getNextIncontinuity (ntime_t) const [inline, virtual]

A virtual function that returns the next incontinuity point after the time t. In **func_base** (p. 33), the function always returns infinity.

Reimplemented from **punnets_common::func_base** (p. 34).

Definition at line 744 of file func.h.

References punnets_common::ntime_t.

```
744 { return mak::Infinity; };
```

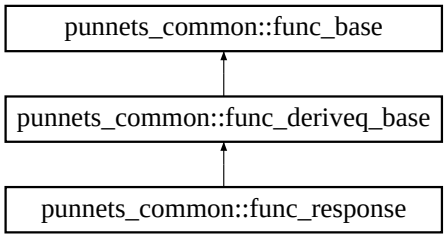
The documentation for this class was generated from the following file:

- **func.h**

10.15 punnets_common::func_response Class Reference

`#include <func.h>`

Inheritance diagram for punnets_common::func_response::



Public Methods

- virtual **real getMaxGradient** (**ntime_t**) const

  A pure virtual function that returns the max gradient of the function after the time t.

- virtual **real getValue** (**ntime_t** t) const

  A pure virtual function that returns f(t).

- virtual **real get1stDeriv** (**ntime_t** t) const

  A pure virtual function that returns df(t)/dt.

- virtual **real get2ndDeriv** (**ntime_t** t) const

  A pure virtual function that returns $d^2f(t)/dt^2$.

- virtual **ntime_t getNextIncontinuity** (**ntime_t**) const
- virtual void **getValueDomain** (**ntime_t** t, **real** &upslope, **real** &ceil, **real** &downslope, **real** &floor) const

  Obtains a zeroth-order linear envelope of the function. floor < f(t+α) < ceil, f(t)+αdownslope < f(t+α) < f(t)+αupslope.

- virtual void **get1stDerivDomain** (**ntime_t** t, **real** &upslope, **real** &ceil, **real** &downslope, **real** &floor) const

  Obtains a first–order linear envelope of the function. floor < f(t+α) < ceil, f(t)+αdownslope < f(t+α) < f(t)+αupslope.

- virtual void **get2ndDerivDomain** (**ntime_t** t, **real** &upslope, **real** &ceil, **real** &downslope, **real** &floor) const

  Obtains a second-order linear envelope of the function. floor < f(t+α) < ceil, f(t)+αdownslope < f(t+α) < f(t)+αupslope.

- virtual std::string **getDescription** ()

  Obtains a human-readable description string of this function.

- virtual func_response * **clone** ()

  Allocates and returns another instance of this function.

- virtual void **setZeroPoint** (**real** new_zeropoint)

  Change zero point on a leaky integrate function.

10.15.1 Detailed Description

A response function.

Todo:
document this function

Definition at line 387 of file func.h.

10.15.2 Member Function Documentation

10.15.2.1 virtual ntime_t punnets_common::func_response::getNextIncontinuity (ntime_t) const [inline, virtual]

A virtual function that returns the next incontinuity point after the time t. In **func_base** (p. 33), the function always returns infinity.

Reimplemented from **punnets_common::func_base** (p. 34).

Definition at line 409 of file func.h.

References punnets_common::ntime_t.

```
409 { return mak::Infinity; };
```

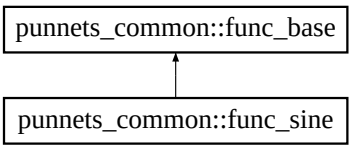
The documentation for this class was generated from the following files:

- **func.h**
- **func.cpp**

10.16 punnets_common::func_sine Class Reference

`#include <func.h>`

Inheritance diagram for punnets_common::func_sine::



Public Methods

- **func_sine** (**real** ir, **real** iomega, **real** itheta)

  Constructs a **func_sine** (p. 55) *with amplitude r, angle velocity omega, and phase theta.*

- virtual **real getMaxGradient** (**ntime_t**) const

  A pure virtual function that returns the max gradient of the function after the time t.

- virtual **real getValue** (**ntime_t** t) const

  A pure virtual function that returns f(t).

- virtual **real get1stDeriv** (**ntime_t** t) const

  A pure virtual function that returns df(t)/dt.

- virtual **real get2ndDeriv** (**ntime_t** t) const

  A pure virtual function that returns $d^2f(t)/dt^2$.

- virtual **ntime_t getNextIncontinuity** (**ntime_t**) const
- virtual void **getValueDomain** (**ntime_t** t, **real** &upslope, **real** &ceil, **real** &downslope, **real** &floor) const

  Obtains a zeroth-order linear envelope of the function. floor < f(t+α) < ceil, f(t)+αdownslope < f(t+α) < f(t)+αupslope.

- virtual void **get1stDerivDomain** (**ntime_t** t, **real** &upslope, **real** &ceil, **real** &downslope, **real** &floor) const

  Obtains a first–order linear envelope of the function. floor < f(t+α) < ceil, f(t)+αdownslope < f(t+α) < f(t)+αupslope.

- virtual void **get2ndDerivDomain** (**ntime_t** t, **real** &upslope, **real** &ceil, **real** &downslope, **real** &floor) const

  Obtains a second-order linear envelope of the function. floor < f(t+α) < ceil, f(t)+αdownslope < f(t+α) < f(t)+αupslope.

- virtual func_sine * **clone** ()

  Allocates and returns another instance of this function.

- virtual std::string **getDescription** ()

  Obtains a human-readable description string of this function.

10.16.1 Detailed Description

Sinusoidal function

This function represents a sinusoidal function f(t) = r sin(ω t + θ).

Definition at line 431 of file func.h.

10.16.2 Member Function Documentation

10.16.2.1 virtual ntime_t punnets_common::func_sine::getNextIncontinuity (ntime_t) const [inline, virtual]

A virtual function that returns the next incontinuity point after the time t. In **func_base** (p. 33), the function always returns infinity.

Reimplemented from **punnets_common::func_base** (p. 34).

Definition at line 460 of file func.h.

References punnets_common::ntime_t.

```
460 { return mak::Infinity; };
```

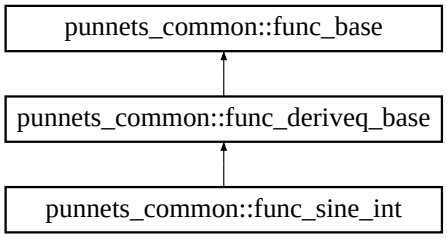
The documentation for this class was generated from the following files:

- **func.h**
- **func.cpp**

10.17 punnets_common::func_sine_int Class Reference

`#include <func.h>`

Inheritance diagram for punnets_common::func_sine_int::



Public Methods

- **func_sine_int** (**real** ir, **real** iomega, **real** itheta)

  Constructs a **func_sine_int** (p. 57) *with amplitude r, angle velocity omega, and phase theta.*

- virtual **real getMaxGradient** (**ntime_t**) const

  A pure virtual function that returns the max gradient of the function after the time t.

- virtual **real getValue** (**ntime_t** t) const

  A pure virtual function that returns f(t).

- virtual **real get1stDeriv** (**ntime_t** t) const

  A pure virtual function that returns df(t)/dt.

- virtual **real get2ndDeriv** (**ntime_t** t) const

  A pure virtual function that returns $d^2f(t)/dt^2$.

- virtual void **getValueDomain** (**ntime_t** t, **real** &upslope, **real** &ceil, **real** &downslope, **real** &floor) const

  Obtains a zeroth-order linear envelope of the function. floor < f(t+α) < ceil, f(t)+αdownslope < f(t+α) < f(t)+αupslope.

- virtual void **get1stDerivDomain** (**ntime_t** t, **real** &upslope, **real** &ceil, **real** &downslope, **real** &floor) const

  Obtains a first–order linear envelope of the function. floor < f(t+α) < ceil, f(t)+αdownslope < f(t+α) < f(t)+αupslope.

- virtual void **get2ndDerivDomain** (**ntime_t** t, **real** &upslope, **real** &ceil, **real** &downslope, **real** &floor) const

  Obtains a second-order linear envelope of the function. floor < f(t+α) < ceil, f(t)+αdownslope < f(t+α) < f(t)+αupslope.

- virtual func_sine_int * **clone** ()

  Allocates and returns another instance of this function.

- virtual std::string **getDescription** ()

Obtains a human-readable description string of this function.

10.17.1 Detailed Description

Integrated function of **func_sine** (p. 55)

This function represents an integration of a sinusoidal function.

Definition at line 548 of file func.h.

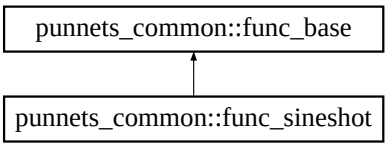
The documentation for this class was generated from the following file:

- **func.h**

10.18 punnets_common::func_sineshot Class Reference

`#include <func.h>`

Inheritance diagram for punnets_common::func_sineshot::



Public Methods

- **func_sineshot** (**real** ir, **real** iomega, **real** it0)

  Constructs a **func_sineshot** (p. 59) *with amplitude r, angle velocity omega, and origin t0.*

- virtual **real getMaxGradient** (**ntime_t**) const

  A pure virtual function that returns the max gradient of the function after the time t.

- virtual bool **shouldDelete** (**ntime_t** current)

  Return true if the function will return only zeros after the specified time.

- virtual **real getValue** (**ntime_t** t) const

  A pure virtual function that returns f(t).

- virtual **real get1stDeriv** (**ntime_t** t) const

  A pure virtual function that returns df(t)/dt.

- virtual **real get2ndDeriv** (**ntime_t** t) const

  A pure virtual function that returns $d^2f(t)/dt^2$.

- virtual **ntime_t getNextIncontinuity** (**ntime_t** from) const
- virtual void **getValueDomain** (**ntime_t** t, **real** &upslope, **real** &ceil, **real** &downslope, **real** &floor) const
- virtual void **get1stDerivDomain** (**ntime_t** t, **real** &upslope, **real** &ceil, **real** &downslope, **real** &floor) const

  Obtains a first–order linear envelope of the function. floor < f(t+α) < ceil, f(t)+αdownslope < f(t+α) < f(t)+αupslope.

- virtual void **get2ndDerivDomain** (**ntime_t** t, **real** &upslope, **real** &ceil, **real** &downslope, **real** &floor) const

  Obtains a second-order linear envelope of the function. floor < f(t+α) < ceil, f(t)+αdownslope < f(t+α) < f(t)+αupslope.

- virtual func_sineshot * **clone** ()

  Allocates and returns another instance of this function.

- virtual std::string **getDescription** ()

  Obtains a human-readable description string of this function.

- virtual bool **processMessage** (**ntime_t** t, const **message_base** &m)

10.18.1 Detailed Description

A single shot of sinusoidal function

This function represents a single shot (one cycle) of a sinusoidal function f(t) = r sin^2(ω (t - t0)) (t0 <= t <= t0+π/ω).

Definition at line 477 of file func.h.

10.18.2 Member Function Documentation

10.18.2.1 virtual ntime_t punnets_common::func_sineshot::getNextIncontinuity (ntime_t *from*) const [inline, virtual]

A virtual function that returns the next incontinuity point after the time t. In **func_base** (p. 33), the function always returns infinity.

Reimplemented from **punnets_common::func_base** (p. 34).

Definition at line 509 of file func.h.

References punnets_common::ntime_t.

```
509 { return from < t0 ? t0 : mak::Infinity; };
```

10.18.2.2 void punnets_common::func_sineshot::getValueDomain (ntime_t *t*, real & *upslope*, real & *ceil*, real & *downslope*, real & *floor*) const [virtual]

A virtual function that returns the next incontinuity point after the time t. Although this function has no incontinuity, it returns t0 because the linear envelope is divided at the point.

Implements **punnets_common::func_base** (p. 33).

Definition at line 175 of file func.cpp.

References punnets_common::ntime_t, and punnets_common::real.

```
176 {
177     upslope = ceil = downslope = floor = 0.0;
178     if( t < t0 || t >= t0 + duration )
179         return;
180     else
181     {
182         real phase = omega_2 * (t - t0);
183         real phi = phase + M_PI;
184         if( phi >= 2*M_PI ) phi -= 2*M_PI;
185         ( r > 0 ? ceil : floor ) = r;
186         if( phase < 0.5 * M_PI )
187         {
188             ( r > 0 ? upslope : downslope ) = omega_2 * r_div_2 * cos( alpha * cos( beta * phi ) + 0.5*M_PI - alpha);
189             ( r > 0 ? downslope : upslope ) = - omega_2 * r_div_2 * cos( alpha * cos( beta * (phi-M_PI) ) + 0.5*M_PI - a
190         }
191         else if( phase < M_PI )
192         {
193             ( r > 0 ? upslope : downslope ) = r_div_2 * omega_2 * sin(phase );
```

```
194             ( r > 0 ? downslope : upslope ) = - omega_2 * r_div_2 * cos( alpha * cos( beta * (phi-M_PI) ) + 0.5*M_PI - a
195         }
196         else if( phase < 1.5*M_PI )
197         {
198             ( r > 0 ? downslope : upslope ) = - omega_2 * r_div_2 * cos( alpha * cos( beta * (phi+M_PI) ) + 0.5*M_PI - a
199         }
200         else
201         {
202             ( r > 0 ? downslope : upslope ) = r_div_2 * omega_2 * sin(phase);
203         }
204     }
205 }
```

10.18.2.3 virtual bool punnets_common::func_sineshot::processMessage (ntime_t *t*, const message_base & *m*) [inline, virtual]

Process the specified message at the specified time. Return true if the message is processed. In **func_base** (p. 33), this function always returns false (processes no message).

Reimplemented from **punnets_common::func_base** (p. 34).

Definition at line 528 of file func.h.

References punnets_common::message_base::getMessageId(), and punnets_common::ntime_t.

```
528                                                                 {
529 #ifdef USE_DYNAMIC
530         if( dynamic_cast<const message_set_t0 *>(&m) != NULL )
531 #else
532         if( m.getMessageId() == message_set_t0::messageId )
533 #endif
534         {
535             t0 = t;
536             return true;
537         }
538         return func_base::processMessage(t, m);
539     }
```

The documentation for this class was generated from the following files:

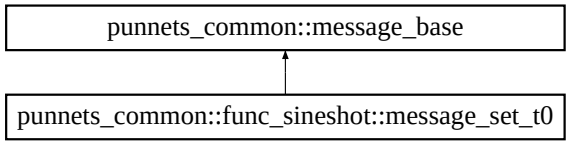
- **func.h**
- **func.cpp**

10.19 punnets_common::func_sineshot::message_set_t0 Class Reference

A message that changes t0.

`#include <func.h>`

Inheritance diagram for punnets_common::func_sineshot::message_set_t0::



Public Methods

- virtual const char * **getMessageId** () const

10.19.1 Detailed Description

A message that changes t0.

Definition at line 520 of file func.h.

10.19.2 Member Function Documentation

10.19.2.1 virtual const char* punnets_common::func_sineshot::message_set_t0::getMessageId () [inline, virtual]

Returns the pointer of a string that represents the class. The pointer must be same for any instance of a given class. A function can check the type of the message by comparing the pointer.

Implements **punnets_common::message_base** (p. 68).

Definition at line 525 of file func.h.

```
525 { return messageId; }
```

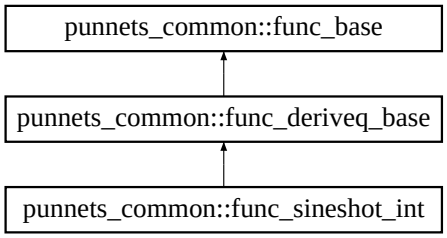
The documentation for this class was generated from the following files:

- **func.h**
- **func.cpp**

10.20 punnets_common::func_sineshot_int Class Reference

`#include <func.h>`

Inheritance diagram for punnets_common::func_sineshot_int::



Public Methods

- **func_sineshot_int** (**real** ir, **real** iomega)

  Constructs a **func_sineshot_int** (p. 63) *with amplitude r and angle velocity omega.*

- virtual **real getMaxGradient** (**ntime_t**) const

  A pure virtual function that returns the max gradient of the function after the time t.

- virtual **real getValue** (**ntime_t** t) const

  A pure virtual function that returns f(t).

- virtual **real get1stDeriv** (**ntime_t** t) const

  A pure virtual function that returns df(t)/dt.

- virtual **real get2ndDeriv** (**ntime_t** t) const

  A pure virtual function that returns $d^2f(t)/dt^2$.

- virtual void **getValueDomain** (**ntime_t** t, **real** &upslope, **real** &ceil, **real** &downslope, **real** &floor) const

  Obtains a zeroth-order linear envelope of the function. floor < f(t+α) < ceil, f(t)+αdownslope < f(t+α) < f(t)+αupslope.

- virtual void **get1stDerivDomain** (**ntime_t** t, **real** &upslope, **real** &ceil, **real** &downslope, **real** &floor) const

  Obtains a first–order linear envelope of the function. floor < f(t+α) < ceil, f(t)+αdownslope < f(t+α) < f(t)+αupslope.

- virtual void **get2ndDerivDomain** (**ntime_t** t, **real** &upslope, **real** &ceil, **real** &downslope, **real** &floor) const

  Obtains a second-order linear envelope of the function. floor < f(t+α) < ceil, f(t)+αdownslope < f(t+α) < f(t)+αupslope.

- virtual func_sineshot_int * **clone** ()

  Allocates and returns another instance of this function.

- virtual std::string **getDescription** ()

Obtains a human-readable description string of this function.

10.20.1 Detailed Description

Integrated function of **func_sineshot** (p. 59)

This function represents an integration of **func_sineshot** (p. 59). t0 is always equal to zerop.

Definition at line 612 of file func.h.

The documentation for this class was generated from the following files:

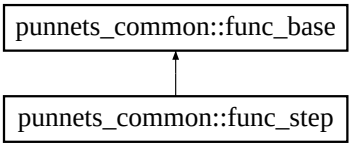
- **func.h**
- **func.cpp**

10.21 punnets_common::func_step Class Reference

</classdef>

`#include <func.h>`

Inheritance diagram for punnets_common::func_step::



Public Methods

- virtual **real getMaxGradient** (**ntime_t**) const

  A pure virtual function that returns the max gradient of the function after the time t.

- virtual **real getValue** (**ntime_t** t) const

  A pure virtual function that returns f(t).

- virtual **real get1stDeriv** (**ntime_t**) const

  A pure virtual function that returns df(t)/dt.

- virtual **real get2ndDeriv** (**ntime_t**) const

  A pure virtual function that returns $d^2f(t)/dt^2$.

- virtual **ntime_t getNextIncontinuity** (**ntime_t** from) const
- virtual void **getValueDomain** (**ntime_t** t, **real** &upslope, **real** &ceil, **real** &downslope, **real** &floor) const

  Obtains a zeroth-order linear envelope of the function. floor < f(t+α) < ceil, f(t)+αdownslope < f(t+α) < f(t)+αupslope.

- virtual void **get1stDerivDomain** (**ntime_t**, **real** &upslope, **real** &ceil, **real** &downslope, **real** &floor) const

  Obtains a first–order linear envelope of the function. floor < f(t+α) < ceil, f(t)+αdownslope < f(t+α) < f(t)+αupslope.

- virtual void **get2ndDerivDomain** (**ntime_t**, **real** &upslope, **real** &ceil, **real** &downslope, **real** &floor) const

  Obtains a second-order linear envelope of the function. floor < f(t+α) < ceil, f(t)+αdownslope < f(t+α) < f(t)+αupslope.

- virtual func_step * **clone** ()

  Allocates and returns another instance of this function.

- virtual std::string **getDescription** ()

  Obtains a human-readable description string of this function.

10.21.1 Detailed Description

</classdef>

A step function.

This class represents a step function, f(t) = r s(t - t_0).

Definition at line 277 of file func.h.

10.21.2 Member Function Documentation

10.21.2.1 virtual ntime_t punnets_common::func_step::getNextIncontinuity (ntime_t *from*) const [inline, virtual]

A virtual function that returns the next incontinuity point after the time t. In **func_base** (p. 33), the function always returns infinity.

Reimplemented from **punnets_common::func_base** (p. 34).

Definition at line 294 of file func.h.

References punnets_common::ntime_t.

```
294 { return from < t0 ? t0 : mak::Infinity; };
```

The documentation for this class was generated from the following file:

- **func.h**

10.22 punnets_common::greater_tevent Struct Reference

`#include <dsched.h>`

10.22.1 Detailed Description

Function class to compare event times

This class is used to construct a local priority queue on STL. In a queue, events are sorted in an ascending order of event time. This class is privately used internally in the punnets library.

Definition at line 102 of file dsched.h.

The documentation for this struct was generated from the following file:

- **dsched.h**

10.23 punnets_common::message_base Class Reference

`#include <func.h>`

Inheritance diagram for punnets_common::message_base::

Public Methods

- virtual const char * **getMessageId** () const=0

10.23.1 Detailed Description

Base class of a message to a function

A message is used to deliver a change to a function. Usually an event is delivered to a neuron, but a neuron has several functions. Moreover, we don't make neuron to handle correspondence of a specific event to a specific function. For this purpose a message is used, as every function knows which message has correspondence to itself.

Definition at line 49 of file func.h.

10.23.2 Member Function Documentation

10.23.2.1 virtual const char* punnets_common::message_base::getMessageId () [pure virtual]

Returns the pointer of a string that represents the class. The pointer must be same for any instance of a given class. A function can check the type of the message by comparing the pointer.

Implemented in **punnets_common::func_deriveq_base::message_set_lambda** (p. 44), **punnets_common::func_deriveq_base::message_set_zero_point** (p. 45), **punnets_common::func_delta_int::message_add_pulse** (p. 42), **punnets_common::func_sineshot::message_set_t0** (p. 62), and **punnets_common::func_exp_diff::message_add_event_time** (p. 50).

Referenced by punnets_common::func_sineshot::processMessage(), punnets_common::func_delta_int::processMessage(), punnets_common::func_deriveq_base::processMessage(), and punnets_common::func_exp_diff::processMessage().

The documentation for this class was generated from the following file:

- **func.h**

10.24 punnets_common::taction Class Reference

`#include <dsched.h>`

Inheritance diagram for punnets_common::taction::

Public Methods

- virtual void **activate** (tscheduler &scheduler, **ntime_t** current_time)=0
- virtual tqueue * **queue** () const=0

  Obtain a local event queue of this action.

- virtual const char * **getClassName** () const=0

  Get the class name of this action. Primarily for debugging.

10.24.1 Detailed Description

Action (some affection to an entity)

Class taction is a abstract base class of "changing something", such as pulse arrival etc. Event is an instance of an action, represented by a pair of time and action. When simulation time reaches the event time, the scheduler triggers the event; the corresponding action is "activated" to perform the change. E.g. when a pulse arrival is activated, the potential of the destination neuron is changed.

Punnets adopts a distributed queue model, in which every action has a corresponding "local queue".

Todo:
write more

Definition at line 52 of file dsched.h.

10.24.2 Member Function Documentation

10.24.2.1 virtual void punnets_common::taction::activate (tscheduler & *scheduler*, ntime_t *current_time*) [pure virtual]

Activates the action at the specified time. When the correspinding new events are generated by the action, it is scheduled to the scheduler.

Implemented in **punnets_common::tsentinel** (p. 89), **punnets_common::tlogger** (p. 72), **punnets_common::tsynapse_base** (p. 95), **punnets_private::tsynapse< debug >** (p. 90), **punnets_private::tsynapse_message< debug >** (p. 98), **punnets_private::tsynapse_fatigue< debug >** (p. 97), **punnets_private::tneuron< debug >** (p. 76), **punnets_private::tneuron_ext< debug >** (p. 82), **punnets_private::tsynapse_addfunc< debug >** (p. 92), and **punnets_private::tsynapse_messfunc< debug >** (p. 101).

Referenced by punnets_common::tevent::activate().

The documentation for this class was generated from the following file:

- **dsched.h**

10.25 punnets_common::tevent Class Reference

`#include <dsched.h>`

Public Methods

- **tevent** (**ntime_t** itime, **taction** &iact)

  construct an event with the specified time and action.

- **ntime_t getTime** () const

  Obtain the time component of the event.

- **taction** & **getAction** () const

  Obtain the action component of the event.

- void **activate** (tscheduler &scheduler) const

  When the event time reaches, scheduler calls this member to trigger the event.

10.25.1 Detailed Description

Event (scheduled action)

Class tevent represents a scheduled event, which is a pair of a scheduled time and an action. When simulation time reaches the event time, the scheduler triggers the event; the corresponding action is "activated" to perform the change.

Definition at line 74 of file dsched.h.

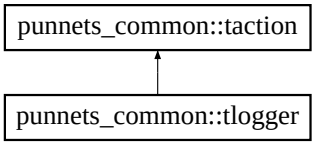
The documentation for this class was generated from the following file:

- **dsched.h**

10.26 punnets_common::tlogger Class Reference

`#include <dlogger.h>`

Inheritance diagram for punnets_common::tlogger::



Public Types

- enum **logoption** { **shownone** = 0, **showthr** = 1, **showext** = 2, **showpart** = 4 }

Public Methods

- **tlogger** (std::ostream &iout, **ntime_t** istep, **ntime_t** ifrom=0, **ntime_t** iuntil=mak::Infinity)

  Constructs a logger with output stream iout, time step istep, and logging range between ifrom and iuntil.

- virtual const char * **getClassName** () const

  Get the class name of this action. Primarily for debugging.

- virtual tqueue * **queue** () const

  Obtain a local event queue of this action.

- void **add** (**tneuron_base** &p, **ntime_t** delay, bool ishowthr, bool ishowext=false, **real** offset=0.0)

  Add a neuron to be logged. Two boolean specifies logging options of thresholds and externals.

- void **add** (**tneuron_base** &p, **ntime_t** delay=0.0, **logoption** logopt=showthr, **real** offset=0.0)

  Add a neuron to be logged. logoption specifies logging options.

- void **add** (**tsynapse_base** &p, **ntime_t** delay=0.0)

  Add a synapse to be logged.

- virtual void **activate** (tscheduler &scheduler, **ntime_t** current_time)

  When activated by scheduler, the logger logs the current status to the log file.

- void **schedule** (tscheduler &scheduler)

  Schedule the logger itself to the specified scheduler.

- void **gnuplot_def** (std::ostream &os, std::string file)

10.26.1 Detailed Description

Activation logging class.

This class periodically probes the state (potential value) of neurons, and produces a log file of the state changes. To use logging, you need to do the followings:

- Register the neurons to be logged by calling add method of the logger. If you want to plot several neurons separately, specify offsets to displace the graph vertically. Or you may specify the horizontal displacement by delay. This is useful for analyzing events with temporal delays.
- Schedule the logger to the scheduler by calling schedule method of the logger.
- Create gnuplot definition file by calling gnuplot_def method of the logger.

Definition at line 51 of file dlogger.h.

10.26.2 Member Enumeration Documentation

10.26.2.1 enum punnets_common::tlogger::logoption

The option of the logging. You may log threshold, external inputs, and partitions. Multiple of them can be specified by logical or.

Enumeration values:

shownone Nothing.

showthr Threshold.

showext External inputs.

showpart Partitions.

Definition at line 58 of file dlogger.h.

Referenced by add().

```
59     {
60         shownone = 0,
61         showthr = 1,
62         showext = 2,
63         showpart = 4
64     };
```

10.26.3 Member Function Documentation

10.26.3.1 void punnets_common::tlogger::gnuplot_def (std::ostream & *os*, std::string *file*)

Generate a GNUPLOT definition file to the specified stream. file is a file name of the log file.

Definition at line 90 of file dlogger.cpp.

References showext, showpart, and showthr.

```
91 {
92 //  cerr << "min/max: " << delaymin << "/" << delaymax << endl;
93 //  os << "set term X11" << endl;
```

```
94      os << "set y2tics" << endl;
95      os << "plot [" << from << ":" << until << "]";
96
97      string delim = "";
98      int column = 1;
99      for( vector< neuentry >::iterator i = neus.begin(); i != neus.end(); i++ )
100      {
101          int xcol = (i->delay == 0.0 ? 1 : ++column);
102          os << delim << " \\" << endl << "\t'" << logfile << "' " <<
103              "using " << xcol << ":" << (++column) << " axes x1y1 " <<
104              "title \"" << i->neuron->getClassName() << " '" << i->neuron->getName() << "'";
105          if( i->delay != 0.0 )
106              os << "(delay " << i->delay << ")";
107          if( i->offset != 0.0 )
108              os << "(offset " << i->offset << ")";
109          os << " signal\" with lines";
110          delim = ",";
111
112          if( i->logopt & showthr )
113          {
114              os << delim << " \\" << endl << "\t'" << logfile << "' " <<
115                  "using " << xcol << ":" << (++column) << " axes x1y1 " <<
116                  "title \"" << i->neuron->getClassName() << " '" << i->neuron->getName() << "'";
117              if( i->delay != 0.0 )
118                  os << "(delay " << i->delay << ")";
119              if( i->offset != 0.0 )
120                  os << "(offset " << i->offset << ")";
121              os << " threshold\" with dots";
122              delim = ",";
123          }
124          if( i->logopt & showext )
125          {
126              os << delim << " \\" << endl << "\t'" << logfile << "' " <<
127                  "using " << xcol << ":" << (++column) << " axes x1y1 " <<
128                  "title \"" << i->neuron->getClassName() << " '" << i->neuron->getName() << "'";
129              if( i->delay != 0.0 )
130                  os << "(delay " << i->delay << ")";
131              if( i->offset != 0.0 )
132                  os << "(offset " << i->offset << ")";
133              os << " external\" with dots";
134              delim = ",";
135          }
136          if( i->logopt & showpart )
137          {
138              os << delim << " \\" << endl << "\t'" << logfile << "' " <<
139                  "using " << xcol << ":" << (++column) << " axes x1y1 " <<
140                  "title \"" << i->neuron->getClassName() << " '" << i->neuron->getName() << "'";
141              if( i->delay != 0.0 )
142                  os << "(delay " << i->delay << ")";
143              if( i->offset != 0.0 )
144                  os << "(offset " << i->offset << ")";
145              os << " partition 0\" with impulses";
146              delim = ",";
147
148              os << delim << " \\" << endl << "\t'" << logfile << "' " <<
149                  "using " << xcol << ":" << (++column) << " axes x1y1 " <<
150                  "title \"" << i->neuron->getClassName() << " '" << i->neuron->getName() << "'";
151              if( i->delay != 0.0 )
152                  os << "(delay " << i->delay << ")";
153              if( i->offset != 0.0 )
154                  os << "(offset " << i->offset << ")";
155              os << " partition 1\" with impulses";
156
157              os << delim << " \\" << endl << "\t'" << logfile << "' " <<
158                  "using " << xcol << ":" << (++column) << " axes x1y1 " <<
159                  "title \"" << i->neuron->getClassName() << " '" << i->neuron->getName() << "'";
160              if( i->delay != 0.0 )
```

```
161                 os << "(delay " << i->delay << ")";
162             if( i->offset != 0.0 )
163                 os << "(offset " << i->offset << ")";
164             os << " partition 2\" with impulses";
165 
166             os << delim << " \\" << endl << "\t'" << logfile << "' " <<
167                 "using " << xcol << ":" << (++column) << " axes x1y1 " <<
168                 "title \"" << i->neuron->getClassName() << " '" << i->neuron->getName() << "'";
169             if( i->delay != 0.0 )
170                 os << "(delay " << i->delay << ")";
171             if( i->offset != 0.0 )
172                 os << "(offset " << i->offset << ")";
173             os << " partition delta_t\" with impulses";
174         }
175     }
176     for( vector<pair<tsynapse_base *, ntime_t> >::iterator i = syns.begin(); i != syns.end(); i++ )
177     {
178         int xcol = (i->second == 0.0 ? 1 : ++column);
179         os << delim << " \\" << endl << "\t'" << logfile << "' " <<
180             "using " << xcol << ":" << (++column) << " axes x1y2 " <<
181             "title \"" << i->first->getClassName() << " '" << i->first->getSrc().getName() << "' -> '" << i->first->getD
182         if( i->second != 0.0 )
183             os << "(delay " << i->second << ")";
184         os << "\" with lines";
185         delim = ",";
186     }
187 
188     os << endl;
189     os << "pause -1" << endl;
190 }
```

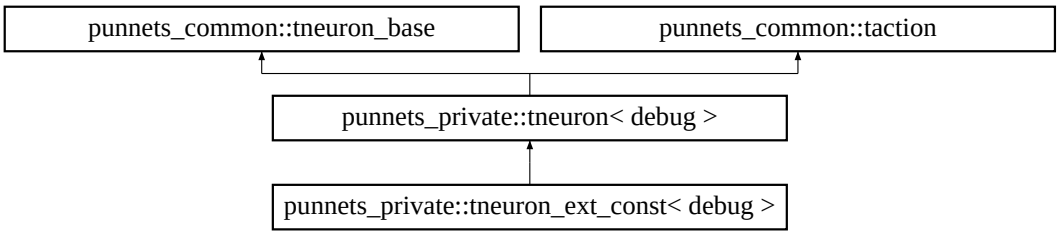
The documentation for this class was generated from the following files:

- **dlogger.h**
- **dlogger.cpp**

10.27 punnets_private::tneuron< debug > Class Template Reference

`#include <dneuron.h>`

Inheritance diagram for punnets_private::tneuron< debug >::



Public Methods

- **tneuron** (std::string iname="", ntime_t isig_hv_period=def_sig_hv_period, ntime_t ithr_hv_period=def_thr_hv_period, real imin_threshold=def_min_threshold, real imax_threshold=def_max_threshold)
- virtual real **getCurrentSigLevel** (ntime_t current_time)

  Calculates the current signal level.

- virtual real **getCurrentThrLevel** (ntime_t current_time)

  Calculates the current threshold level.

- virtual void **pulseArrive** (tscheduler &scheduler, ntime_t current_time, real pulse_level)

  Processes the pulse arrival.

- virtual void **addSynapse** (tsynapse_base *s)

  Add an synapse whose destination (post-synapse) is this neuron.

- virtual void **eraseSynapse** (tsynapse_base *s)

  Remove an synapse from this neuron.

- virtual ntime_t **getLastFire** () const

  Get the time of the last firing.

- virtual ntime_t **getLastSimulate** () const

  Get the time of the last simulation.

- virtual void **activate** (tscheduler &scheduler, ntime_t current_time)

  When activated as an event, it re-calculates its state and check firing.

- virtual const char * **getClassName** () const

  Get the class name.

- virtual tqueue * **queue** () const

  Get the pointer to the queue object.

- const std::vector< tsynapse_base * > & **getSynapses** ()
  Get the vector of synapses.

Protected Methods

- void **simulateElapse** (ntime_t current_time)
  This function simulates time elapse up to the specified time.
- virtual void **scheduleFire** (tscheduler &scheduler, ntime_t current_time, bool resched=true)
  Schedule the next firing.

Protected Attributes

- ntime_t **sig_hv_period**
  Signal half-value period.
- ntime_t **thr_hv_period**
  Threshold half-value period.
- real **min_threshold**
  Minimum threshold level.
- real **max_threshold**
  Maximum threshold level just after one firing.
- real **coeff_sigdecay**
  Signal decaying coefficient is calculated from the signal half-value period.
- real **coeff_thrdecay**
  Threshold decaying coefficient is calculated from the threshold half-value period.

Static Protected Attributes

- const real **sig_converge_level** = 0.0
  The converge level (resting potential) of this neuron.

10.27.1 Detailed Description

template<bool debug> class punnets_private::tneuron< debug >

The class defines a leaky integrate-and-fire neuron with threshold change, which receives only immediate pulses. A neuron itself behaves as an action of an event. When the next firing is predicted, the action is scheduled at the predicted firing time (called 'loopback'). When activated at a certain simulation time, the neuron re-calculates its state and process firing if necessary.

Definition at line 431 of file dneuron.h.

10.27.2 Constructor & Destructor Documentation

10.27.2.1 template<bool debug> punnets_private::tneuron< debug >::tneuron (std::string *iname* = """, ntime_t *isig_hv_period* = def_sig_hv_period, ntime_t *ithr_hv_period* = def_thr_hv_period, real *imin_threshold* = def_min_threshold, real *imax_threshold* = def_max_threshold)

Construct a neuron with the specified name, signal half-value period, threshold half-value period, minimum threshold and maximum threshold.

Definition at line 122 of file dneuron.cpp.

References punnets_common::ntime_t, and punnets_common::real.

```
127         : tneuron_base(iname),
128           sig_level(0.0), last_simulate(0.0), last_fire(0.0),
129           sig_hv_period(isig_hv_period), thr_hv_period(ithr_hv_period),
130           min_threshold(imin_threshold), max_threshold(imax_threshold),
131           coeff_sigdecay(- M_LN2 / isig_hv_period),
132           coeff_thrdecay( - M_LN2 / ithr_hv_period )
133 { }
```

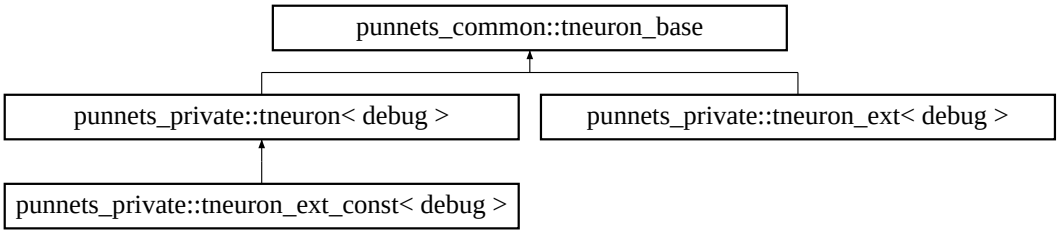
The documentation for this class was generated from the following files:

- **dneuron.h**
- **dneuron.cpp**

10.28 punnets_common::tneuron_base Class Reference

`#include <dneuron.h>`

Inheritance diagram for punnets_common::tneuron_base::



Public Methods

- **tneuron_base** (std::string iname="")

  Construct a neuron with the name iname.

- const std::string & **getName** () const

  Returns the name of this neuron.

- virtual void **pulseArrive** (tscheduler &scheduler, **ntime_t** current_time, **real** pulse_level)=0
- virtual void **addSynapse** (**tsynapse_base** *)

  Add a synapse input (this neuron becomes postsynaptic). A derived class should redefine this method.

- virtual **real getCurrentSigLevel** (**ntime_t**)

  This function probes the current signal level of the neuron. A derived class should redefine this method.

- virtual **real getCurrentThrLevel** (**ntime_t**)

  This function probes the current threshold level of the neuron. A derived class should redefine this method.

- virtual **real getCurrentExtInput** (**ntime_t**)

  This function probes the current external input level of the neuron. A derived class should redefine this method.

- virtual **ntime_t getLastFire** () const

  This function returns the last time that the neuron fired. Used in STDP and such.

- virtual **ntime_t getLastSimulate** () const

  This function returns the last time that the neuron has been simulated.

- virtual int **getLastSimulateType** () const

  This function returns the type of the last simulation (0th/1st/2nd and so on).

- virtual tqueue * **queue** () const

  Obtains the pointer to the queue object of this neuron.

- virtual const char * **getClassName** () const

  Obtains the class name of this neuron.

Protected Attributes

- std::string **name**

  The name of this neuron. Used in debugging and logging.

- tqueue **_queue**

  The event queue of this neuron.

10.28.1 Detailed Description

The base class of a neuron.

This abstract base class provides several interfaces for neuron access.

Definition at line 147 of file dneuron.h.

10.28.2 Member Function Documentation

10.28.2.1 virtual void punnets_common::tneuron_base::pulseArrive (tscheduler & *scheduler*, ntime_t *current_time*, real *pulse_level*) [pure virtual]

These methods handle pulse arrivals of the neuron. The pulse may be a real number (immediate value), message, or a function to be added. The latter two has a default handler that does nothing. A derived class should redefine these methods.

Implemented in **punnets_private::tneuron< debug >** (p. 76), and **punnets_private::tneuron_ext< debug >** (p. 81).

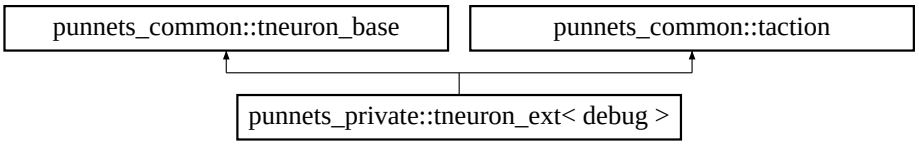
The documentation for this class was generated from the following file:

- **dneuron.h**

10.29 punnets_private::tneuron_ext< debug > Class Template Reference

`#include <dneuron.h>`

Inheritance diagram for punnets_private::tneuron_ext< debug >::



Public Methods

- **tneuron_ext** (std::string iname="", real sig_hv_period=1.0)

  Construct a **tneuron_ext** (p. 81) *class with the specified name and signal half-value period.*

- virtual real **getCurrentSigLevel** (ntime_t current_time)

  Get the current signal level.

- virtual real **getCurrentThrLevel** (ntime_t)

  Get the current threshold level, which is always 0.0.

- virtual void **pulseArrive** (tscheduler &scheduler, ntime_t current_time, real pulse_level)

  Process the pulse arrival to this neuron.

- virtual void **pulseArrive** (tscheduler &scheduler, ntime_t current_time, message_base *mess)

  Process the message arrival to this neuron.

- virtual void **pulseArrive** (tscheduler &scheduler, ntime_t current_time, func_base *func)

  Process the function arrival to this neuron.

- virtual void **addSynapse** (tsynapse_base *s)

  Add an incoming synapse to this neuron.

- virtual void **eraseSynapse** (tsynapse_base *s)

  Erase an incoming synapse from this neuron.

- virtual void **addExt** (func_base *s)

  Add an external function to this neuron.

- virtual ntime_t **getLastFire** () const

  This function returns the last time that the neuron fired. Used in STDP and such.

- virtual ntime_t **getLastSimulate** () const

  This function returns the last time that the neuron has been simulated.

- virtual int **getLastSimulateType** () const

  This function returns the type of the last simulation (0th/1st/2nd and so on).

- virtual void **activate** (tscheduler &scheduler, ntime_t current_time)

  When activated as an event (loopback), it re-calculates its state and check firing.

- virtual const char * **getClassName** () const

  Gets the class name.

- const std::vector< tsynapse_base * > & **getSynapses** ()

  Gets the collection of the synapses.

- virtual tqueue * **queue** () const

  Get the queue object of this neuron.

- void **setLoopBack** (tscheduler &scheduler, ntime_t schedule_time)

Protected Methods

- void **fire** (tscheduler &scheduler, ntime_t current_time)

  Process firing at the specified time.

- real **calcSignal** (ntime_t current_time)

  Calculate the power of signal at the specified time.

- virtual void **scheduleFire** (tscheduler &scheduler, ntime_t current_time, bool resched=true)

  Schedule the next firing.

- bool **sendMessage** (ntime_t t, message_base *mess)

  Send the message to a function.

- bool **broadcastMessage** (ntime_t t, message_base *mess)

  Send the message to all the functions.

Protected Attributes

- std::vector< tsynapse_base * > **synapses**

  A collection of incoming synapses.

- std::vector< func_base * > **exts**

  A collection of functions.

- func_delta_int * **pulses**

  A pulse function to support tsynapse.

- ntime_t **last_simulate**

  Last simulation time, only for simulate-logging.

- ntime_t **last_fire**

  Last firing time.

- ntime_t **loopback**

  Loopback time. It is used to check the loopback time changes,.

- real **lambda**

  The decaying coefficient for the inputs.

- int **last_simulate_type**

  The last simulation type, only for simulate-logging.

10.29.1 Detailed Description

template<bool debug> class punnets_private::tneuron_ext< debug >

The extended neuron class. This class of neurons calculates the potential as a sum of functions. You can specify arbitrary functions, if you can provide the linear envelopes of the function and 1st/2nd derivatives.

Definition at line 604 of file dneuron.h.

10.29.2 Member Function Documentation

10.29.2.1 template<bool debug> void punnets_private::tneuron_ext< debug >::setLoopBack (tscheduler & *scheduler*, ntime_t *schedule_time*) [inline]

Specify the loopback at the time. If the time is infinity, the loopback is cancelled. This method is public because the loopback is explicitly set.

Definition at line 718 of file dneuron.h.

References punnets_common::ntime_t.

Referenced by punnets_private::tneuron_ext< debug >::scheduleFire().

```
719     {
720         loopback = schedule_time;
721         if( schedule_time < mak::Infinity )
722             scheduler.scheduleEvent( schedule_time, *this );
723     }
```

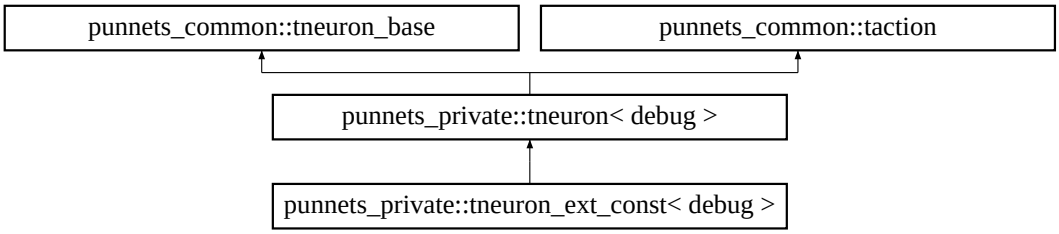
The documentation for this class was generated from the following files:

- **dneuron.h**
- **dneuron.cpp**

10.30 punnets_private::tneuron_ext_const< debug > Class Template Reference

`#include <dneuron.h>`

Inheritance diagram for punnets_private::tneuron_ext_const< debug >::



Public Methods

- **tneuron_ext_const** (std::string iname="", ntime_t isig_hv_period=def_sig_hv_period, ntime_t ithr_hv_period=def_thr_hv_period, real imin_threshold=def_min_threshold, real imax_threshold=def_max_threshold, real iext_input=def_ext_input)
- virtual real **getCurrentSigLevel** (ntime_t current_time)

  Calculates the current signal level.

- real **getExtInput** ()

  Get the weight of the external input.

- virtual real **getCurrentExtInput** (ntime_t)

  Get the weight of the external input for logging.

- void **setExtInput** (tscheduler &scheduler, ntime_t current_time, real val)

  Change the weight of the external input at the specified time.

- real **getConvergeLevel** ()

  Get the converge level (resting potential of this neuron).

- void **setConvergeLevel** (tscheduler &scheduler, ntime_t current_time, real val)
- virtual const char * **getClassName** () const

  Get the class name.

Protected Methods

- void **simulateElapse** (ntime_t current_time)
- virtual void **scheduleFire** (tscheduler &scheduler, ntime_t current_time, bool resched=true)

  Schedule the next firing.

Protected Attributes

- real **sig_converge_level**

  The converge level (resting potential) of this neuron.

10.30.1 Detailed Description

template<bool debug> class punnets_private::tneuron_ext_const< debug >

This class extends the tneuron class with a constant external input.

Definition at line 539 of file dneuron.h.

10.30.2 Constructor & Destructor Documentation

10.30.2.1 template<bool debug> punnets_private::tneuron_ext_const< debug >::tneuron_ext_const (std::string *iname* = """, ntime_t *isig_hv_period* = def_sig_hv_period, ntime_t *ithr_hv_period* = def_thr_hv_period, real *imin_threshold* = def_min_threshold, real *imax_threshold* = def_max_threshold, real *iext_input* = def_ext_input) [inline]

Construct a neuron with the specified name, signal half-value period, threshold half-value period, minimum threshold, maximum threshold, and the weight of the external input.

Definition at line 562 of file dneuron.h.

References punnets_common::ntime_t, and punnets_common::real.

```
568         : tneuron<debug>( iname, isig_hv_period, ithr_hv_period, imin_threshold, imax_threshold ),
569           ext_input(iext_input), sig_converge_level(iext_input / coeff_sigdecay) { }
```

10.30.3 Member Function Documentation

10.30.3.1 template<bool debug> void punnets_private::tneuron_ext_const< debug >::setConvergeLevel (tscheduler & *scheduler*, ntime_t *current_time*, real *val*) [inline]

Change the weight of the external input at the specified time, so that the converge level (resting potential of this neuron) becomes the specified value..

Definition at line 587 of file dneuron.h.

References punnets_common::ntime_t, and punnets_common::real.

```
588         { simulateElapse( current_time ); sig_converge_level = val; ext_input = sig_converge_level * coeff_sigdecay; sch
```

10.30.3.2 template<bool debug> void punnets_private::tneuron_ext_const< debug >::simulateElapse (ntime_t *current_time*) [inline, protected]

This function simulates time elapse up to the specified time. Note that this function is non-virtual to speed-up the simulation.

Reimplemented from **punnets_private::tneuron< debug >** (p. 77).

Definition at line 548 of file dneuron.h.

References punnets_common::ntime_t.

```
549     {
550         sig_level = sig_converge_level +
551                     ( ( sig_level - sig_converge_level )
552                       * exp( (current_time - last_simulate) * coeff_sigdecay ) );
553         last_simulate = current_time;
554     }
```

The documentation for this class was generated from the following files:

- **dneuron.h**
- **dneuron.cpp**

10.31 tobserver Class Reference

Public Methods

- **tobserver** (string iname, bool ishow=false)
  The constructor.
- virtual void **pulseArrive** (tscheduler &, ntime_t current_time, real pulse_level)
  When a pulse is arrived, it counts and reports the pulse arrival.
- int **getNPulses** () const
  Get the number of pulses observed.
- void **clearNPulses** ()
  Clear the pulse counter.

10.31.1 Detailed Description

An observer neuron class.

When this neuron received a pulse, it counts the number of pulses. If constructed with true *show* parameter, it also reports the arrival of a pulse to the console.

Definition at line 51 of file dtest.cpp.

The documentation for this class was generated from the following file:

- **dtest.cpp**

10.32 punnets_common::tsched_double Class Reference

`#include <dsched.h>`

Public Methods

- **tsched_double** ()
  Constructs a scheduler with no events.
- void **scheduleEvent** (const **tevent** &event)
  Schedule an event.
- void **scheduleEvent** (**ntime_t** t, **taction** &act)
  Schedule an action for the specified time.
- bool **isScheduled** () const
  Tests if the scheduler is not empty.
- **ntime_t run** (**ntime_t** until=HUGE_VAL)
  Run the simulation (continue triggering events) until the specified time.

10.32.1 Detailed Description

Event scheduler class.

The scheduler class activates events in an order of time.

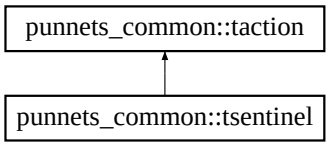
Definition at line 115 of file dsched.h.

The documentation for this class was generated from the following files:

- **dsched.h**
- **dsched.cpp**

10.33 punnets_common::tsentinel Class Reference

Inheritance diagram for punnets_common::tsentinel::



Public Methods

- virtual void **activate** (tscheduler &, **ntime_t**)
- tqueue * **queue** () const

  Obtain a local event queue of this action.

- virtual const char * **getClassName** () const

  Get the class name of this action. Primarily for debugging.

10.33.1 Detailed Description

Sentinel action.

This class is used to mark the end of the simulation range.

Definition at line 37 of file dsched.cpp.

10.33.2 Member Function Documentation

10.33.2.1 virtual void punnets_common::tsentinel::activate (tscheduler &, ntime_t) [inline, virtual]

Activates the action at the specified time. When the correspinding new events are generated by the action, it is scheduled to the scheduler.

Implements **punnets_common::taction** (p. 69).

Definition at line 46 of file dsched.cpp.

References punnets_common::ntime_t.

```
47         {
48             processed = true;
49         }
```

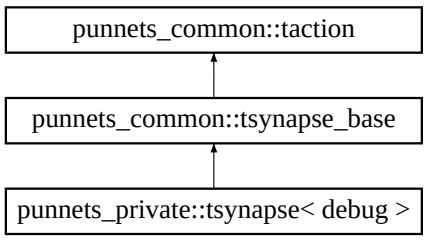
The documentation for this class was generated from the following file:

- **dsched.cpp**

10.34 punnets_private::tsynapse< debug > Class Template Reference

`#include <dneuron.h>`

Inheritance diagram for punnets_private::tsynapse< debug >::



Public Methods

- **tsynapse** (tneuron_base &isrc, tneuron_base &idest, ntime_t idelay, real iweight)

  Construct a synapse with the specified source, destination, delay and weight.

- **tsynapse** (tneuron_base &idest, ntime_t idelay, real iweight)
- virtual void **setSrc** (tneuron_base &isrc)

  Specify the source neuron.

- virtual real **getWeight** () const

  Get the weight value of this synapse.

- virtual tneuron_base & **getSrc** () const

  Get the source neuron (pre-synaptic).

- virtual tneuron_base & **getDest** () const

  Get the destination neuron (post-synaptic).

- void **addWeight** (real delta_w)

  Modify the weight value with the specified step size.

- void **addDelay** (ntime_t delta_d)

  Modify the delay with the specified step size.

- virtual void **activate** (tscheduler &scheduler, ntime_t current_time)

  The event handler delivers a pulse to the destination (post-synaptic) neuron.

- virtual tqueue * **queue** () const

  Obtains the pointer to the queue object of this event.

10.34.1 Detailed Description

template<bool debug> class punnets_private::tsynapse< debug >

The default synapse class. This class of synapses has an effect for the destination (post-synaptic) neuron to update its potential immediately with a constant amount of the weight.

Definition at line 265 of file dneuron.h.

10.34.2 Constructor & Destructor Documentation

10.34.2.1 template<bool debug> punnets_private::tsynapse< debug >::tsynapse (tneuron_base & *idest*, ntime_t *idelay*, real *iweight*) [inline]

Construct a synapse with the specified destination, delay and weight. Source neuron will be specified after the construction via **setSrc()** (p. 90) method.

Definition at line 278 of file dneuron.h.

References punnets_common::ntime_t, and punnets_common::real.

```
279         : tsynapse_base(idelay), src(NULL), dest(&idest), weight(iweight) { }
```

The documentation for this class was generated from the following file:

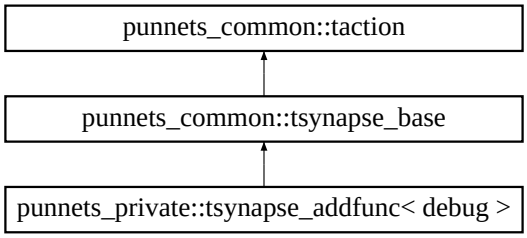
- **dneuron.h**

10.35 punnets_private::tsynapse_addfunc< debug > Class Template Reference

Synapse class that adds a new function to the destination (postsynaptic) **tneuron_ext** (p. 81).

`#include <dneuron.h>`

Inheritance diagram for punnets_private::tsynapse_addfunc< debug >::



Public Methods

- **tsynapse_addfunc** (tneuron_base &isrc, **tneuron_ext**< debug > &idest, real idelay, func_base *ifunc, message_base *imess=NULL, real ilev=0.0)
- **tsynapse_addfunc** (**tneuron_ext**< debug > &idest, real idelay, func_base *ifunc, message_base *imess=NULL, real ilev=0.0)
- virtual void **setSrc** (tneuron_base &isrc)

  Set the source neuron (presynaptic) of this synapse. A derived class should redefine this method.

- virtual tneuron_base & **getSrc** () const

  Get the source neuron (pre-synaptic). A derived class should redefine this method.

- virtual **tneuron_ext**< debug > & **getDest** () const

  Get the destination neuron (post-synaptic). A derived class should redefine this method.

- virtual void **activate** (tscheduler &scheduler, ntime_t current_time)

  When activated, The synapse clones the function and added it to the destination neuron.

- virtual tqueue * **queue** () const

  Obtain a local event queue of this action.

10.35.1 Detailed Description

template<bool debug> class punnets_private::tsynapse_addfunc< debug >

Synapse class that adds a new function to the destination (postsynaptic) **tneuron_ext** (p. 81).

Definition at line 734 of file dneuron.h.

10.35.2 Constructor & Destructor Documentation

10.35.2.1 template<bool debug> punnets_private::tsynapse_addfunc< debug >::tsynapse_addfunc (tneuron_base & *isrc*, tneuron_ext< debug > & *idest*, real *idelay*, func_base * *ifunc*, message_base * *imess* = NULL, real *ilev* = 0.0) [inline]

Constructs add-function synapse with the specified source, destination, delay, a pointer to a function, a pointer to a message that is sent before adding, and immediate pulse level.

Definition at line 746 of file dneuron.h.

References punnets_common::real.

```
747         : tsynapse_base(idelay), src(&isrc), dest(&idest), func(ifunc), mess(imess), lev(ilev) { }
```

10.35.2.2 template<bool debug> punnets_private::tsynapse_addfunc< debug >::tsynapse_addfunc (tneuron_ext< debug > & *idest*, real *idelay*, func_base * *ifunc*, message_base * *imess* = NULL, real *ilev* = 0.0) [inline]

Constructs add-function synapse with the specified destination, delay, a pointer to a function, a pointer to a message that is sent before adding, and immediate pulse level.

Definition at line 750 of file dneuron.h.

References punnets_common::real.

```
751         : tsynapse_base(idelay), src(NULL), dest(&idest), func(ifunc), mess(imess), lev(ilev) { }
```

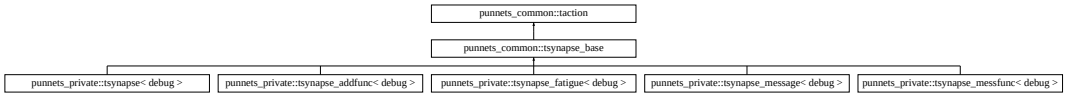
The documentation for this class was generated from the following file:

- **dneuron.h**

10.36 punnets_common::tsynapse_base Class Reference

`#include <dneuron.h>`

Inheritance diagram for punnets_common::tsynapse_base::



Public Methods

- **tsynapse_base** (**ntime_t** idelay)

  Construct a synapse with the specified delay.

- **ntime_t getDelay** () const

  Get the delay length.

- virtual **real getWeight** () const

  Get the weight of the synapse. A derived class should redefine this method.

- virtual void **setSrc** (**tneuron_base** &)

  Set the source neuron (presynaptic) of this synapse. A derived class should redefine this method.

- virtual **tneuron_base** & **getSrc** () const

  Get the source neuron (pre-synaptic). A derived class should redefine this method.

- virtual **tneuron_base** & **getDest** () const

  Get the destination neuron (post-synaptic). A derived class should redefine this method.

- virtual void **activate** (tscheduler &scheduler, **ntime_t** current_time)=0
- virtual const char * **getClassName** () const

  Obtains the class name of this neuron.

Protected Attributes

- **ntime_t ndelay**

  synaptic delay.

10.36.1 Detailed Description

The base class of a synapse.

This abstract base class provides several interfaces for a synapse. A synapse itself behaves as an action of an event; i.e. when activated at a certain simulation time, a synapse updates the destination (post-synaptic) neuron.

Definition at line 217 of file dneuron.h.

10.36.2 Member Function Documentation

10.36.2.1 virtual void punnets_common::tsynapse_base::activate (tscheduler & *scheduler*, ntime_t *current_time*) [pure virtual]

The event handler. When the source (pre-synaptic) neuron fires, this function is called after the synaptic delay. A derived class should redefine this method to update the destination (post-synaptic) neuron.

Implements **punnets_common::taction** (p. 69).

Implemented in **punnets_private::tsynapse< debug >** (p. 90), **punnets_private::tsynapse_message< debug >** (p. 98), **punnets_private::tsynapse_fatigue< debug >** (p. 97), **punnets_private::tsynapse_addfunc< debug >** (p. 92), and **punnets_private::tsynapse_messfunc< debug >** (p. 101).

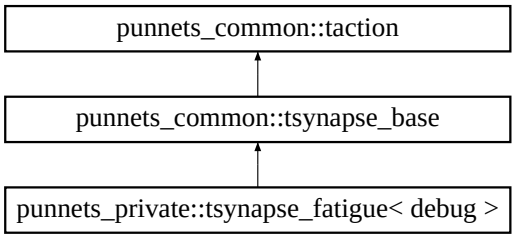
The documentation for this class was generated from the following file:

- **dneuron.h**

10.37 punnets_private::tsynapse_fatigue< debug > Class Template Reference

`#include <dneuron.h>`

Inheritance diagram for punnets_private::tsynapse_fatigue< debug >::



Public Methods

- **tsynapse_fatigue** (tneuron_base &isrc, tneuron_base &idest, real idelay, real iweight)

  Construct a synapse with the specified source, destination, delay and initial weight.

- **tsynapse_fatigue** (tneuron_base &idest, real idelay, real iweight)
- virtual real **getWeight** () const

  Get the weight value of this synapse.

- virtual tneuron_base & **getSrc** () const

  Get the source neuron (pre-synaptic).

- virtual tneuron_base & **getDest** () const

  Get the destination neuron (post-synaptic).

- void **addWeight** (real delta_w)

  Modify the weight value with the specified step size.

- void **addDelay** (ntime_t delta_d)

  Modify the delay with the specified step size.

- virtual void **activate** (tscheduler &scheduler, ntime_t current_time)
- virtual const char * **getClassName** () const

  Obtains the class name of this neuron.

Static Protected Attributes

- const ntime_t **recover_hv_period** = 2000

  The time of half-value period of the synapse weight decrease.

- const real **fire_ratio** = 0.002

  The ratio of the decay of the weight caused by one pulse deliver.

10.37.1 Detailed Description

template<bool debug> class punnets_private::tsynapse_fatigue< debug >

The "fatigue" synapse class. This class of synapses delivers a pulse to the destination (post-synaptic) neuron, whose strength decays on bursting (by lack of energy) and recovers gradually. This is a sample for constructing more complex synapse class.

Definition at line 363 of file dneuron.h.

10.37.2 Constructor & Destructor Documentation

10.37.2.1 template<bool debug> punnets_private::tsynapse_fatigue< debug >::tsynapse_fatigue (tneuron_base & *idest*, real *idelay*, real *iweight*) [inline]

Construct a synapse with the specified destination, delay and initial weight. Source neuron will be specified after the construction via **setSrc()** (p. 94) method.

Definition at line 383 of file dneuron.h.

References punnets_common::real.

```
384         : tsynapse_base(idelay), src(NULL), dest(&idest), weight(iweight / fire_ratio), last_fire( -Infinity ), last_wei
```

10.37.3 Member Function Documentation

10.37.3.1 template<bool debug> virtual void punnets_private::tsynapse_fatigue< debug >::activate (tscheduler & *scheduler*, ntime_t *current_time*) [inline, virtual]

The event handler delivers a pulse to the destination (post-synaptic) neuron. Then the last firing time is recorded to process the fatigueness.

Implements **punnets_common::tsynapse_base** (p. 95).

Definition at line 401 of file dneuron.h.

References punnets_common::ntime_t, and punnets_common::real.

```
402     {
403         real this_weight = weight + (last_weight - weight) * exp( (current_time - last_fire) * (-M_LN2 / recover_hv_peri
404         if( getDeb() )
405             std::cout << std::setw(9) << std::setiosflags(std::ios::fixed) << std::setprecision(debug_precision) << curr
406             " Pulse Arrived from " << src->getName() << "(" << this_weight * fire_ratio << "/" << weight << ")" << std::
407         dest->pulseArrive( scheduler, current_time, this_weight * fire_ratio );
408         last_fire = current_time;
409         last_weight = this_weight * (1.0 - fire_ratio);
410     }
```

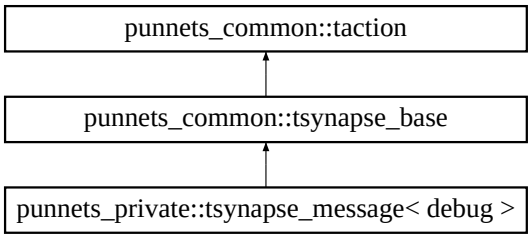
The documentation for this class was generated from the following file:

- **dneuron.h**

10.38 punnets_private::tsynapse_message< debug > Class Template Reference

`#include <dneuron.h>`

Inheritance diagram for punnets_private::tsynapse_message< debug >::



Public Methods

- **tsynapse_message** (tneuron_base &isrc, tneuron_base &idest, real idelay, message_base *imess)
- **tsynapse_message** (tneuron_base &idest, real idelay, message_base *imess)
- virtual ~**tsynapse_message** ()

  Destructor deletes the message.

- virtual void **setSrc** (tneuron_base &isrc)

  Specify the source neuron.

- virtual tneuron_base & **getSrc** () const

  Get the source neuron (pre-synaptic).

- virtual tneuron_base & **getDest** () const

  Get the destination neuron (post-synaptic).

- virtual void **activate** (tscheduler &scheduler, ntime_t current_time)

  The event handler delivers a message to the destination (post-synaptic) neuron.

10.38.1 Detailed Description

template<bool debug> class punnets_private::tsynapse_message< debug >

The message synapse class. This class of synapses has an effect for the destination (post-synaptic) neuron to deliver a message. THe effect of the message can be arbitrarily specified.

Definition at line 317 of file dneuron.h.

10.38.2 Constructor & Destructor Documentation

10.38.2.1 template<bool debug> punnets_private::tsynapse_message< debug >::tsynapse_message (tneuron_base & *isrc*, tneuron_base & *idest*, real *idelay*, message_base * *imess*) [inline]

Construct a synapse with the specified source, destination, delay and a pointer to a message. The pointer to the message will be deleted at the destrucion of this synapse.

Definition at line 327 of file dneuron.h.

References punnets_common::real.

```
328         : tsynapse_base(idelay), src(&isrc), dest(&idest), mess(imess) { }
```

10.38.2.2 template<bool debug> punnets_private::tsynapse_message< debug >::tsynapse_message (tneuron_base & *idest*, real *idelay*, message_base * *imess*) [inline]

Construct a synapse with the specified destination, delay and a pointer to a message. Source neuron will be specified after the construction via **setSrc()** (p. 98) method. The pointer to the message will be deleted at the destrucion of this synapse.

Definition at line 332 of file dneuron.h.

References punnets_common::real.

```
333         : tsynapse_base(idelay), src(NULL), dest(&idest), mess(imess) { }
```

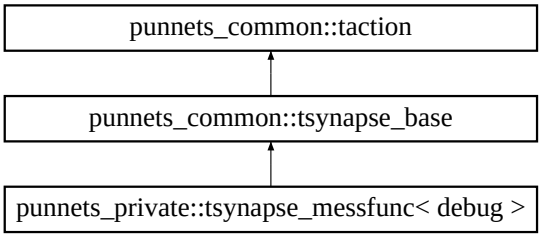
The documentation for this class was generated from the following file:

- **dneuron.h**

10.39 punnets_private::tsynapse_messfunc< debug > Class Template Reference

`#include <dneuron.h>`

Inheritance diagram for punnets_private::tsynapse_messfunc< debug >::



Public Methods

- **tsynapse_messfunc** (tneuron_base &isrc, **tneuron_ext**< debug > &idest, real idelay, func_base *ifunc, message_base *imess, real ilev=0.0)
- **tsynapse_messfunc** (**tneuron_ext**< debug > &idest, real idelay, func_base *ifunc, message_base *imess, real ilev=0.0)
- virtual void **setSrc** (tneuron_base &isrc)

  Set the source neuron (presynaptic) of this synapse. A derived class should redefine this method.

- virtual tneuron_base & **getSrc** () const

  Get the source neuron (pre-synaptic). A derived class should redefine this method.

- virtual **tneuron_ext**< debug > & **getDest** () const

  Get the destination neuron (post-synaptic). A derived class should redefine this method.

- virtual void **activate** (tscheduler &scheduler, ntime_t current_time)
- virtual tqueue * **queue** () const

  Obtain a local event queue of this action.

10.39.1 Detailed Description

template<bool debug> class punnets_private::tsynapse_messfunc< debug >

Synapse class that sends a message to a function in a **tneuron_ext** (p. 81) neuron. It is useful for applying an effect of func_expdiff, on which several firing can be calculated by one function and message_add_event_time message.

Definition at line 779 of file dneuron.h.

10.39.2 Constructor & Destructor Documentation

10.39.2.1 template<bool debug> punnets_private::tsynapse_messfunc< debug >::tsynapse_messfunc (tneuron_base & *isrc*, tneuron_ext< debug > & *idest*, real *idelay*, func_base * *ifunc*, message_base * *imess*, real *ilev* = 0.0) [inline]

Constructs add-function synapse with the specified source, destination, delay, a pointer to a function, a pointer to a message that is sent for the function at every activation, and immediate pulse level. In the constructor the function is added to the destination neuron.

Definition at line 792 of file dneuron.h.

References punnets_private::tneuron_ext< debug >::addExt(), and punnets_common::real.

```
793         : tsynapse_base(idelay), src(&isrc), dest(&idest), func(ifunc), mess(imess), lev(ilev) { dest->addExt(func); }
```

10.39.2.2 template<bool debug> punnets_private::tsynapse_messfunc< debug >::tsynapse_messfunc (tneuron_ext< debug > & *idest*, real *idelay*, func_base * *ifunc*, message_base * *imess*, real *ilev* = 0.0) [inline]

Constructs add-function synapse with the specified destination, delay, a pointer to a function, a pointer to a message that is sent for the function at every activation, and immediate pulse level. In the constructor the function is added to the destination neuron.

Definition at line 797 of file dneuron.h.

References punnets_private::tneuron_ext< debug >::addExt(), and punnets_common::real.

```
798         : tsynapse_base(idelay), src(NULL), dest(&idest), func(ifunc), mess(imess), lev(ilev) { dest->addExt(func); }
```

10.39.3 Member Function Documentation

10.39.3.1 template<bool debug> virtual void punnets_private::tsynapse_messfunc< debug >::activate (tscheduler & *scheduler*, ntime_t *current_time*) [inline, virtual]

When activated, the synapse sends the message to the function and sends the pulse to the destination neuron (to notive the change of the function).

Implements **punnets_common::tsynapse_base** (p. 95).

Definition at line 809 of file dneuron.h.

References punnets_common::tneuron_base::getName(), punnets_common::ntime_t, and punnets_private::tneuron_ext< debug >::pulseArrive().

```
810     {
811         if( getDeb() )
812             std::cout << std::setw(9) << std::setiosflags(std::ios::fixed) << std::setprecision(debug_precision) << curr
813         func->processMessage( current_time, *mess );
814 //      cout << f->getDescription() << endl;
815         dest->pulseArrive( scheduler, current_time, lev );
816     }
```

The documentation for this class was generated from the following file:

- **dneuron.h**

Chapter 11

Punnets File Documentation

11.1 dlanguage.cpp File Reference

Language simulation based on the punnets library.

```
#include <stdlib.h>
#include <sstream>
#include <fstream>
#include <iomanip>
#include <sys/types.h>
#include <sys/wait.h>
#include <unistd.h>
#include <math.h>
#include <string>
#include <mak/hash_string.h>
#include "punnets.h"
```

Namespaces

- namespace **__gnu_cxx**
- namespace **mak**
- namespace **std**

Compounds

- struct **neuinfo**
- struct **word_t**

11.1.1 Detailed Description

Language simulation based on the punnets library.

See the paper "A Pulsed Neural Network for Language Understanding: Discrete-Event Simulation of a Short-Term Memory Mechanism and Sentence Understanding" for details. In short, we assign one representer neuron (*exts*) to represent each word. Once fired, a representer neuron periodically fires to keep short-term memory of the word. Representer neurons are interconnected via two networks, named autoassociative network (sgates) and heteroassociative network (dgates). When the network receives several words in a sequence, the two networks computes the bindings of the words, and as a result, the meaning of the input sentence is represented by the activation patter of the representer neurons (synchronized neurons have been bound). The connection weights of the two networks are obtained from the external files.

Author:
Makino, Takaki <t-makino-punnets01@snowelm.com>

Date:
2003-05-01

Version:

Id:
dlanguage.cpp,v 1.7 2003/05/08 08:23:56 t Exp

Definition in file **dlanguage.cpp**.

11.1.2 Variable Documentation

11.1.2.1 const string posstrs[]

Initial value:

```
{ "pronoun 1st", "pronoun 3rd", "noun", "proper noun",
       "vi", "vt", "vt_subj", "det" }
```

Definition at line 104 of file dlanguage.cpp.

11.2 dlogger.cpp File Reference

Logger.

`#include "dlogger.h"`

`#include <iomanip>`

Namespaces

- namespace **punnets_common**

11.2.1 Detailed Description

Logger.

Author:
Makino, Takaki <t-makino-punnets01@snowelm.com>

Date:
2003-05-01

Version:

Id:
dlogger.cpp,v 1.1 2003/05/01 10:57:43 t Exp

Definition in file **dlogger.cpp**.

11.3 dlogger.h File Reference

Activation logging class.

`#include "dneuron.h"`

`#include <mak/infinity.h>`

Namespaces

- namespace **punnets_common**

11.3.1 Detailed Description

Activation logging class.

Author:
Makino, Takaki <t-makino-punnets01@snowelm.com>

Date:
2003-05-01

Version:

Id:
dlogger.h,v 1.2 2003/05/08 07:24:56 t Exp

Definition in file **dlogger.h**.

11.4 dneuron.cpp File Reference

Neurons.

```
#include "dneuron.h"
```

```
#include <math.h>
```

```
#include <mak/profile.h>
```

Namespaces

- namespace **punnets_common**
- namespace **punnets_private**

11.4.1 Detailed Description

Neurons.

Author:
Makino, Takaki <t-makino-punnets01@snowelm.com>

Date:
2003-05-01

Version:

Id:
dneuron.cpp,v 1.7 2003/05/07 09:32:23 t Exp

Definition in file **dneuron.cpp**.

11.5 dneuron.h File Reference

Neuron/Synapse class in discrete-event NN simulation.

```
#include <vector>
#include <map>
#include <string>
#include <algorithm>
#include <math.h>
#include <queue>
#include <iostream>
#include <iomanip>
#include "dsched.h"
#include "func.h"
```

Namespaces

- namespace **punnets**
- namespace **punnets_common**
- namespace **punnets_nodebug**
- namespace **punnets_private**

11.5.1 Detailed Description

Neuron/Synapse class in discrete-event NN simulation.

Author:
Makino, Takaki <t-makino-punnets01@snowelm.com>

Date:
2003-05-01

Version:

Id:
dneuron.h,v 1.6 2003/05/08 07:24:56 t Exp

Definition in file **dneuron.h**.

11.6 dsched.cpp File Reference

Event, Action, Scheduler.

```
#include "dsched.h"
```

Namespaces

- namespace **punnets_common**

11.6.1 Detailed Description

Event, Action, Scheduler.

Author:
Makino, Takaki <t-makino-punnets01@snowelm.com>

Date:
2003-05-01

Version:

Id:
dsched.cpp,v 1.1 2003/05/01 10:57:43 t Exp

Definition in file **dsched.cpp**.

11.7 dsched.h File Reference

Distributed scheduler.

```
#include <math.h>
#include <functional>
#include <map>
#include <set>
#include <vector>
#include <queue>
#include <string>
#include "punnets_base.h"
```

Namespaces

- namespace **punnets_common**

11.7.1 Detailed Description

Distributed scheduler.

Author:
Makino, Takaki <t-makino-punnets01@snowelm.com>

Date:
2003-05-01

Version:

Id:
dsched.h,v 1.2 2003/05/08 07:24:56 t Exp

Definition in file **dsched.h**.

11.8 dtest.cpp File Reference

Test program of the punnets library.

```
#include <iostream>
#include <fstream>
#include <sstream>
#include "dneuron.h"
#include "dsched.h"
#include "dlogger.h"
#include <mak/cmdopt.h>
```

Compounds

- class **tobserver**

11.8.1 Detailed Description

Test program of the punnets library.

This program tests the performance of delayed firing simulations. Every neuron has an sinusoidal external input and interconnecting synapses, which causes alpha-function-style (difference of two exponential functions) response. Two hundred pulses are injected to produce initial activity. You can change parameters by command-line options; try `dtest -h` to show the list of options.

Author:
Makino, Takaki <t-makino-punnets01@snowelm.com>

Date:
2003-05-01

Version:

Id:
dtest.cpp,v 1.7 2003/05/08 08:23:56 t Exp

Definition in file **dtest.cpp**.

11.9 func.cpp File Reference

Functions.

```
#include "func.h"
```

```
#include <iostream>
```

Namespaces

- namespace **punnets_common**

11.9.1 Detailed Description

Functions.

Author:
Makino, Takaki <t-makino-punnets01@snowelm.com>

Date:
2003-05-01

Version:

Id:
func.cpp,v 1.3 2003/05/02 09:14:21 t Exp

Definition in file **func.cpp**.

11.10 func.h File Reference

Function representation.

```
#include <math.h>
#include <string>
#include <iostream>
#include <sstream>
#include <mak/infinity.h>
#include "punnets_base.h"
```

Namespaces

- namespace **punnets_common**

11.10.1 Detailed Description

Function representation.

Author:
Makino, Takaki <t-makino-punnets01@snowelm.com>

Date:
2003-05-01

Version:

Id:
func.h,v 1.2 2003/05/02 09:13:05 t Exp

Definition in file **func.h**.

11.11 punnets.h File Reference

Punnets header file.

```
#include "config_punnets.h"
#include "func.h"
#include "dsched.h"
#include "dlogger.h"
#include "dneuron.h"
```

11.11.1 Detailed Description

Punnets header file.

Author:
Makino, Takaki <t-makino-punnets01@snowelm.com>

Date:
2003-05-01

Version:

Id:
punnets.h,v 1.4 2003/05/08 08:23:56 t Exp

Definition in file **punnets.h**.

11.12 punnets_base.h File Reference

Base class of Punnets.

```
#include "config_punnets.h"
```

Namespaces

- namespace **punnets**
- namespace **punnets_common**
- namespace **punnets_nodebug**
- namespace **punnets_private**

11.12.1 Detailed Description

Base class of Punnets.

Author:
Makino, Takaki <t-makino-punnets01@snowelm.com>

Date:
2003-05-01

Version:

Id:
punnets_base.h,v 1.2 2003/05/08 07:24:56 t Exp

Definition in file **punnets_base.h**.

Chapter 12

Punnets Page Documentation

12.1 Todo List

Class punnets_common::func_exp_int implement get1stDerivDomain etc. for this function

Class punnets_common::func_response document this function

Class punnets_common::taction write more

Index