qpp

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Chapter 1

Namespace Index

1.1 Namespace List

Here is a list of all namespaces with brief descriptions:

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Chapter 2

Hierarchical Index

2.1 Class Hierarchy

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

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Chapter 3

Class Index

3.1 Class List

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

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Chapter 5

Namespace Documentation

5.1 qpp Namespace Reference

Namespaces

- ct
- internal
- types

Classes

- class Exception
- class Gates
- class Qudit
- class RandomDevices
- class NormalDistribution
- class UniformRealDistribution
- class DiscreteDistribution
- class DiscreteDistributionAbsSquare
- class Timer

Functions

- types::cmat channel (const types::cmat &rho, const std::vector< types::cmat > &Ks)
- types::cmat super (const std::vector< types::cmat > &Ks)
- types::cmat choi (const std::vector< types::cmat > &Ks)
- std::vector< types::cmat > choi2kraus (const types::cmat &A)
- template<typename Derived >
  double shannon (const Eigen::MatrixBase< Derived > &A)
- template<typename Derived >
  double renyi (const double alpha, const Eigen::MatrixBase< Derived > &A)
- template<typename Derived >
  double renyi_inf (const Eigen::MatrixBase< Derived > &A)
- template<typename Derived >
  types::DynMat< typename
  Derived::Scalar > transpose (const Eigen::MatrixBase< Derived > &A)
- template<typename Derived >
  types::DynMat< typename
  Derived::Scalar > conjugate (const Eigen::MatrixBase< Derived > &A)

- template<typename Derived >
  types::DynMat< typename
  Derived::Scalar > adjoint (const Eigen::MatrixBase< Derived > &A)
- template<typename Derived >
  Derived::Scalar trace (const Eigen::MatrixBase< Derived > &A)
- template<typename Derived >
  Derived::Scalar det (const Eigen::MatrixBase< Derived > &A)
- template<typename Derived >
  Derived::Scalar sum (const Eigen::MatrixBase< Derived > &A)
- template<typename Derived >
  double norm (const Eigen::MatrixBase< Derived > &A)
- template<typename Derived >
  types::cmat evals (const Eigen::MatrixBase< Derived > &A)
- template<typename Derived >
  types::cmat evects (const Eigen::MatrixBase< Derived > &A)
- template<typename Derived >
  types::cmat hevals (const Eigen::MatrixBase< Derived > &A)
- template<typename Derived >
  types::cmat hevects (const Eigen::MatrixBase< Derived > &A)
- template<typename Derived >
  types::cmat funm (const Eigen::MatrixBase< Derived > &A, types::cplx(*f)(const types::cplx &))
- template<typename Derived >
  types::cmat sqrtm (const Eigen::MatrixBase< Derived > &A)
- template<typename Derived >
  types::cmat absm (const Eigen::MatrixBase< Derived > &A)
- template<typename Derived >
  types::cmat expm (const Eigen::MatrixBase< Derived > &A)
- template<typename Derived >
  types::cmat logm (const Eigen::MatrixBase< Derived > &A)
- template<typename Derived >
  types::cmat sinm (const Eigen::MatrixBase< Derived > &A)
- template<typename Derived >
  types::cmat cosm (const Eigen::MatrixBase< Derived > &A)
- template<typename Derived >
  types::cmat spectralpowm (const Eigen::MatrixBase< Derived > &A, const types::cplx z)
- template<typename Derived >
  types::DynMat< typename
  Derived::Scalar > powm (const Eigen::MatrixBase< Derived > &A, size_t n)
- template<typename OutputScalar , typename Derived >
  types::DynMat< OutputScalar > fun (const Eigen::MatrixBase< Derived > &A, OutputScalar(*f)(const typename Derived::Scalar &))
- template<typename Derived1 , typename Derived2 >
  types::DynMat< typename
  Derived1::Scalar > kron (const Eigen::MatrixBase< Derived1 > &A, const Eigen::MatrixBase< Derived2 > &B)
- template<typename Derived >
  types::DynMat< typename
  Derived::Scalar > kronlist (const std::vector< types::DynMat< typename Derived::Scalar > > &As)
- template<typename Derived >
  types::DynMat< typename
  Derived::Scalar > kronpow (const Eigen::MatrixBase< Derived > &A, size_t n)
- template<typename Derived >
  types::DynMat< typename
  Derived::Scalar > reshape (const Eigen::MatrixBase< Derived > &A, size_t rows, size_t cols)
- template<typename Derived >
  types::DynMat< typename
  Derived::Scalar > syspermute (const Eigen::MatrixBase< Derived > &A, const std::vector< size_t > &perm, const std::vector< size_t > &dims)

- template<typename Derived >
  types::DynMat< typename
  Derived::Scalar > ptrace2 (const Eigen::MatrixBase< Derived > &A, const std::vector< size_t > &dims)
- template<typename Derived >
  types::DynMat< typename
  Derived::Scalar > ptrace (const Eigen::MatrixBase< Derived > &A, const std::vector< size_t > &subsys, const std::vector< size_t > &dims)
- template<typename Derived >
  types::DynMat< typename
  Derived::Scalar > ptranspose (const Eigen::MatrixBase< Derived > &A, const std::vector< size_t > &subsys, const std::vector< size_t > &dims)
- template<typename Derived1 , typename Derived2 >
  types::DynMat< typename
  Derived1::Scalar > comm (const Eigen::MatrixBase< Derived1 > &A, const Eigen::MatrixBase< Derived2 > &B)
- template<typename Derived1 , typename Derived2 >
  types::DynMat< typename
  Derived1::Scalar > anticomm (const Eigen::MatrixBase< Derived1 > &A, const Eigen::MatrixBase< Derived2 > &B)
- template<typename Derived >
  types::DynMat< typename
  Derived::Scalar > proj (const Eigen::MatrixBase< Derived > &V)
- template<typename Derived >
  types::DynMat< typename
  Derived::Scalar > expandout (const Eigen::MatrixBase< Derived > &A, size_t pos, const std::vector< size_t > &dims)
- template<typename Derived >
  types::DynMat< typename
  Derived::Scalar > grams (const std::vector< types::DynMat< typename Derived::Scalar > > &Vs)
- template<typename Derived >
  types::DynMat< typename
  Derived::Scalar > grams (const Eigen::MatrixBase< Derived > &A)
- std::vector< size_t > n2multiidx (size_t n, const std::vector< size_t > &dims)
- size_t multiidx2n (const std::vector< size_t > &midx, const std::vector< size_t > &dims)
- template<typename T >
  void disp (const T &x, const std::string &separator=" ", const std::string &start="[", const std::string &end="]", std::ostream &os=std::cout)
- template<typename T >
  void displn (const T &x, const std::string &separator=" ", const std::string &start="[", const std::string &end="]", std::ostream &os=std::cout)
- template<typename T >
  void disp (const T *x, const size_t n, const std::string &separator=" ", const std::string &start="[", const std::string &end="]", std::ostream &os=std::cout)
- template<typename T >
  void displn (const T *x, const size_t n, const std::string &separator=" ", const std::string &start="[", const std::string &end="]", std::ostream &os=std::cout)
- template<typename Derived >
  void disp (const Eigen::MatrixBase< Derived > &A, double chop=ct::chop, std::ostream &os=std::cout)
- template<typename Derived >
  void displn (const Eigen::MatrixBase< Derived > &A, double chop=ct::chop, std::ostream &os=std::cout)
- void disp (const types::cplx c, double chop=ct::chop, std::ostream &os=std::cout)
- void displn (const types::cplx c, double chop=ct::chop, std::ostream &os=std::cout)
- template<typename Derived >
  void save (const Eigen::MatrixBase< Derived > &A, const std::string &fname)
- template<typename Derived >
  types::DynMat< typename
  Derived::Scalar > load (const std::string &fname)

- template<typename Derived >
  Derived loadMATLABmatrix (const std::string &mat_file, const std::string &var_name)
- template<>
  types::dmat loadMATLABmatrix (const std::string &mat_file, const std::string &var_name)
- template<>
  types::cmat loadMATLABmatrix (const std::string &mat_file, const std::string &var_name)
- template<typename Derived >
  void saveMATLABmatrix (const Eigen::MatrixBase< Derived > &A, const std::string &mat_file, const std::string &var_name, const std::string &mode)
- template<>
  void saveMATLABmatrix (const Eigen::MatrixBase< typename types::dmat > &A, const std::string &mat_file, const std::string &var_name, const std::string &mode)
- template<>
  void saveMATLABmatrix (const Eigen::MatrixBase< typename types::cmat > &A, const std::string &mat_file, const std::string &var_name, const std::string &mode)
- template<typename Derived >
  Derived rand (size_t rows, size_t cols, double a=0, double b=1)
- template<>
  types::dmat rand (size_t rows, size_t cols, double a, double b)
- template<>
  types::cmat rand (size_t rows, size_t cols, double a, double b)
- double rand (double a=0, double b=1)
- template<typename Derived >
  Derived randn (size_t rows, size_t cols, double mean=0, double sigma=1)
- template<>
  types::dmat randn (size_t rows, size_t cols, double mean, double sigma)
- template<>
  types::cmat randn (size_t rows, size_t cols, double mean, double sigma)
- double randn (double mean=0, double sigma=1)
- types::cmat randU (size_t D)
- types::cmat randV (size_t Din, size_t Dout)
- std::vector< types::cmat > randkraus (size_t n, size_t D)
- types::cmat randH (size_t D)
- types::ket randket (size_t D)
- types::cmat randrho (size_t D)

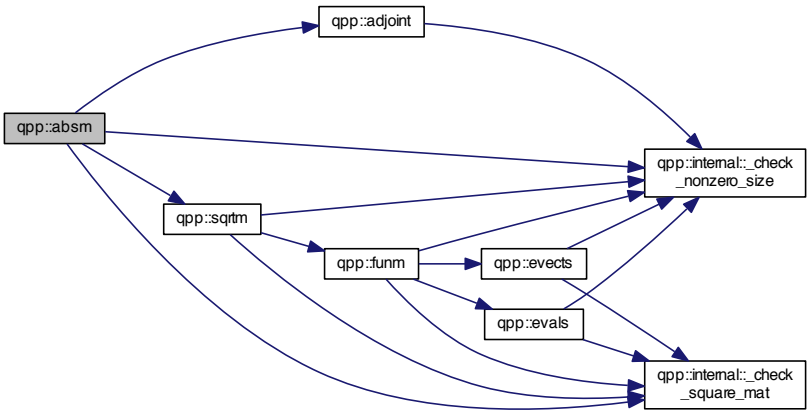
Variables

- RandomDevices & rdevs = RandomDevices::getInstance()
- const Gates & gt = Gates::getInstance()

5.1.1 Function Documentation

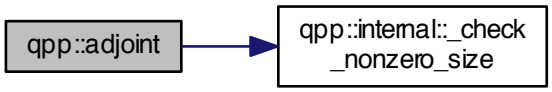
5.1.1.1 template<typename Derived > types::cmat qpp::absm (const Eigen::MatrixBase< Derived > & *A*)

Here is the call graph for this function:



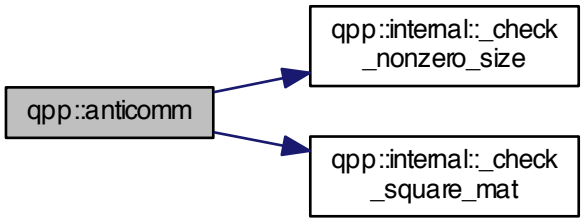
5.1.1.2 template<typename Derived > types::DynMat<typename Derived::Scalar> qpp::adjoint (const Eigen::MatrixBase< Derived > & *A*)

Here is the call graph for this function:



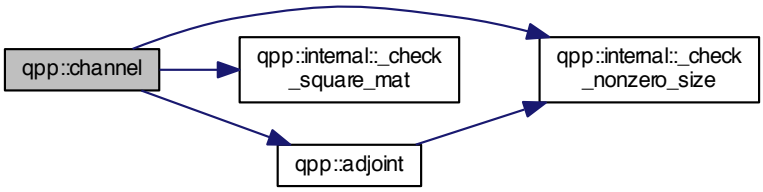
5.1.1.3 template<typename Derived1 , typename Derived2 > types::DynMat<typename Derived1::Scalar> qpp::anticomm (const Eigen::MatrixBase< Derived1 > & *A*, const Eigen::MatrixBase< Derived2 > & *B*)

Here is the call graph for this function:



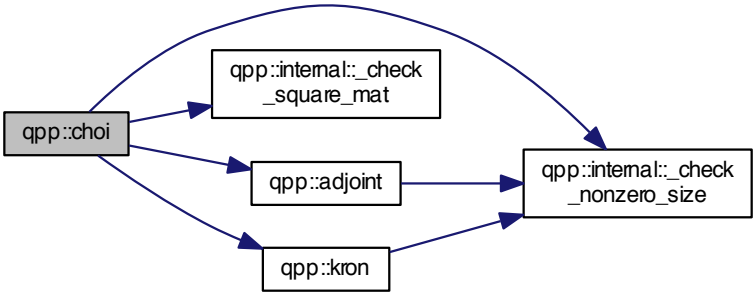
5.1.1.4 types::cmat qpp::channel (const types::cmat & *rho*, const std::vector< types::cmat > & *Ks*)

Here is the call graph for this function:



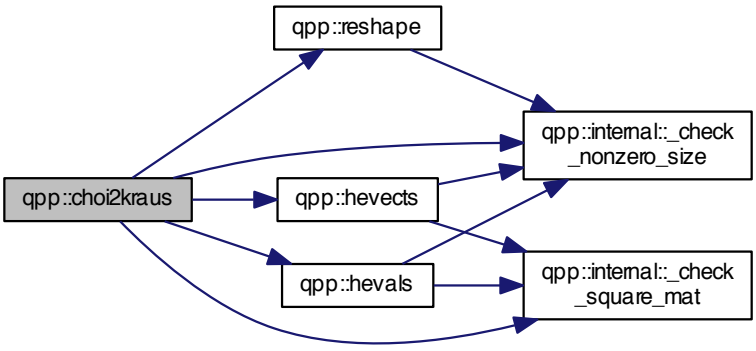
5.1.1.5 types::cmat qpp::choi (const std::vector< types::cmat > & *Ks*)

Here is the call graph for this function:



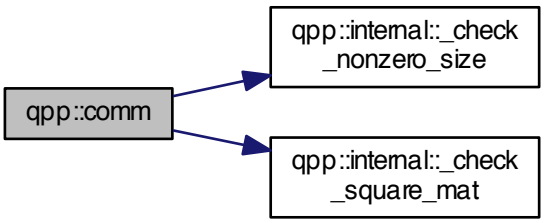
5.1.1.6 std::vector<types::cmat> qpp::choi2kraus (const types::cmat & *A*)

Here is the call graph for this function:



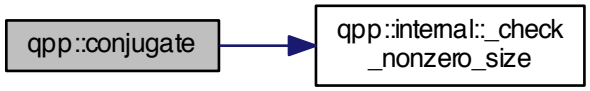
5.1.1.7 template<typename Derived1 , typename Derived2 > types::DynMat<typename Derived1::Scalar> qpp::comm (const Eigen::MatrixBase< Derived1 > & *A*, const Eigen::MatrixBase< Derived2 > & *B*)

Here is the call graph for this function:



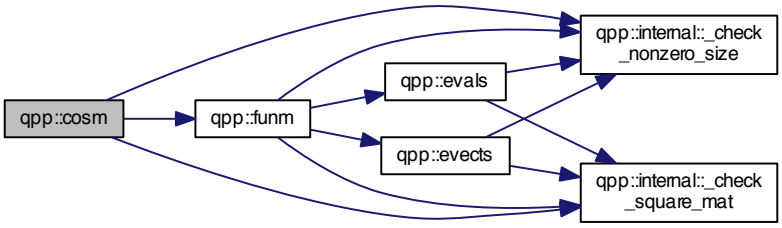
5.1.1.8 template<typename Derived > types::DynMat<typename Derived::Scalar> qpp::conjugate (const Eigen::MatrixBase< Derived > & *A*)

Here is the call graph for this function:



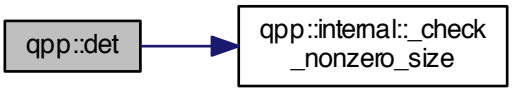
5.1.1.9 template<typename Derived > types::cmat qpp::cosm (const Eigen::MatrixBase< Derived > & *A*)

Here is the call graph for this function:



5.1.1.10 template<typename Derived > Derived::Scalar qpp::det (const Eigen::MatrixBase< Derived > & *A*)

Here is the call graph for this function:



5.1.1.11 template<typename T > void qpp::disp (const T & *x*, const std::string & *separator* = " ", const std::string & *start* = "[", const std::string & *end* = "]", std::ostream & *os* = std::cout)

5.1.1.12 template<typename T > void qpp::disp (const T * *x*, const size_t *n*, const std::string & *separator* = " ", const std::string & *start* = "[", const std::string & *end* = "]", std::ostream & *os* = std::cout)

5.1.1.13 template<typename Derived > void qpp::disp (const Eigen::MatrixBase< Derived > & *A*, double *chop* = ct::chop, std::ostream & *os* = std::cout)

5.1.1.14 void qpp::disp (const types::cplx *c*, double *chop* = ct::chop, std::ostream & *os* = std::cout)

Here is the call graph for this function:

5.1.1.15 template<typename T > void qpp::displn (const T & *x*, const std::string & *separator* = " ", const std::string & *start* = "[", const std::string & *end* = "]", std::ostream & *os* = std::cout)

Here is the call graph for this function:

5.1.1.16 template<typename T > void qpp::displn (const T * *x*, const size_t *n*, const std::string & *separator* = " ", const std::string & *start* = "[", const std::string & *end* = "]", std::ostream & *os* = std::cout)

Here is the call graph for this function:

5.1.1.17 template<typename Derived > void qpp::displn (const Eigen::MatrixBase< Derived > & *A*, double *chop* = ct::chop, std::ostream & *os* = std::cout)

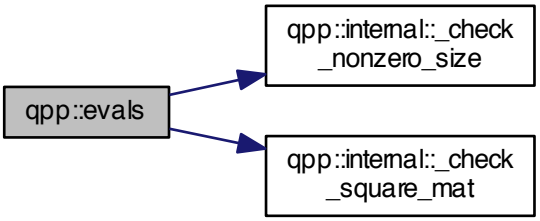
Here is the call graph for this function:

5.1.1.18 void qpp::displn (const types::cplx *c*, double *chop* = ct::chop, std::ostream & *os* = std::cout)

Here is the call graph for this function:

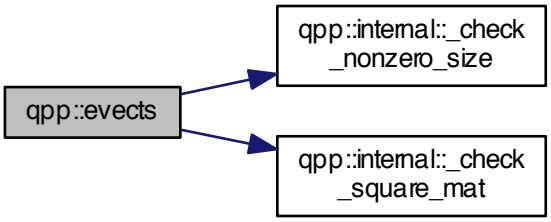
5.1.1.19 template<typename Derived > types::cmat qpp::evals (const Eigen::MatrixBase< Derived > & *A*)

Here is the call graph for this function:



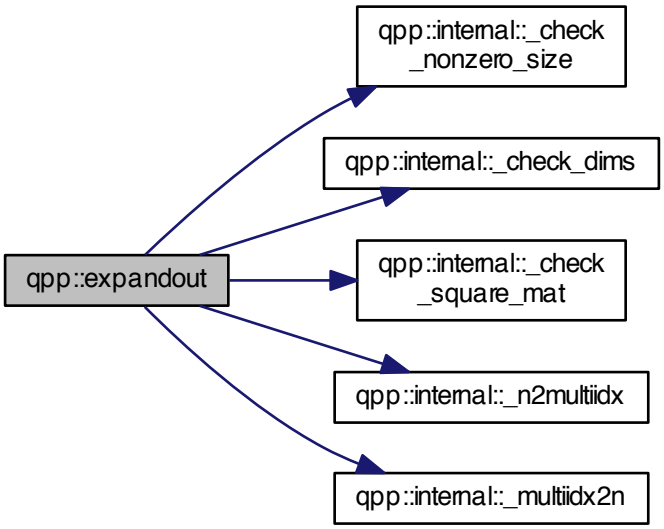
5.1.1.20 template<typename Derived > types::cmat qpp::evects (const Eigen::MatrixBase< Derived > & *A*)

Here is the call graph for this function:



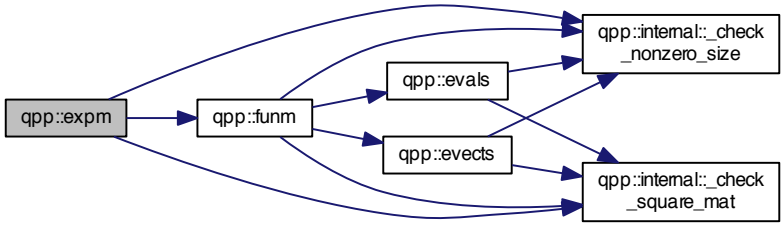
5.1.1.21 template<typename Derived > types::DynMat<typename Derived::Scalar> qpp::expandout (const Eigen::MatrixBase< Derived > & *A*, size_t *pos*, const std::vector< size_t > & *dims*)

Here is the call graph for this function:



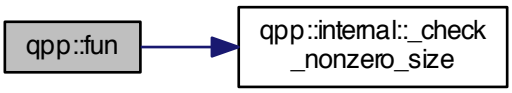
5.1.1.22 template<typename Derived > types::cmat qpp::expm (const Eigen::MatrixBase< Derived > & *A*)

Here is the call graph for this function:



5.1.1.23 template<typename OutputScalar , typename Derived > types::DynMat<OutputScalar> qpp::fun (const Eigen::MatrixBase< Derived > & *A*, OutputScalar(*)(const typename Derived::Scalar &) *f*)

Here is the call graph for this function:



5.1.1.24 template<typename Derived > types::cmat qpp::funm (const Eigen::MatrixBase< Derived > & *A*, types::cplx(*)(const types::cplx &) *f*)

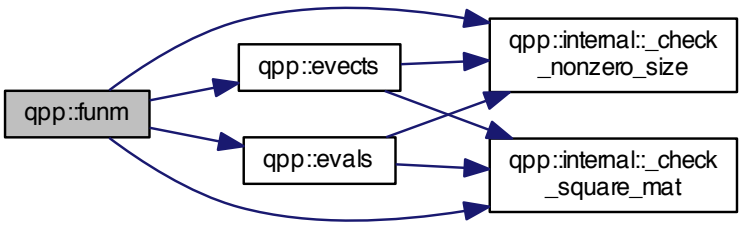
Parameters

A	input matrix
f	function pointer

Returns

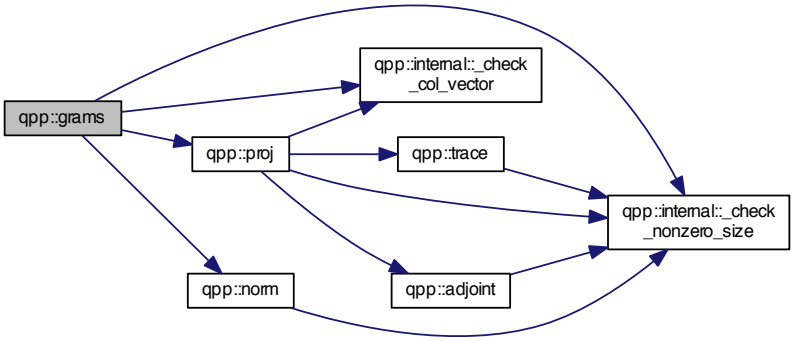
types::cmat

Here is the call graph for this function:



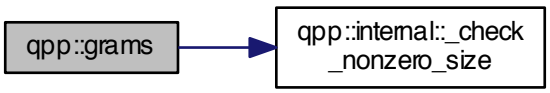
5.1.1.25 template<typename Derived > types::DynMat<typename Derived::Scalar> qpp::grams (const std::vector< types::DynMat< typename Derived::Scalar > > & *Vs*)

Here is the call graph for this function:



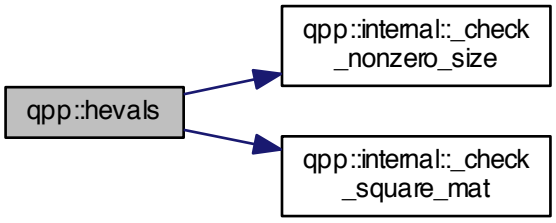
5.1.1.26 template<typename Derived > types::DynMat<typename Derived::Scalar> qpp::grams (const Eigen::MatrixBase< Derived > & *A*)

Here is the call graph for this function:



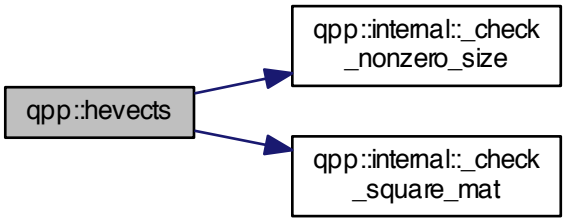
5.1.1.27 template<typename Derived > types::cmat qpp::hevals (const Eigen::MatrixBase< Derived > & *A*)

Here is the call graph for this function:



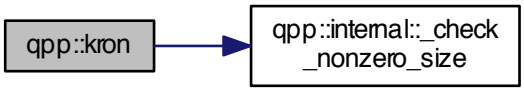
5.1.1.28 template<typename Derived > types::cmat qpp::hevects (const Eigen::MatrixBase< Derived > & *A*)

Here is the call graph for this function:



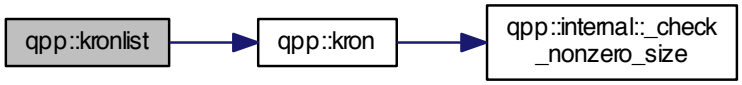
5.1.1.29 template<typename Derived1 , typename Derived2 > types::DynMat<typename Derived1::Scalar> qpp::kron (const Eigen::MatrixBase< Derived1 > & *A*, const Eigen::MatrixBase< Derived2 > & *B*)

Here is the call graph for this function:



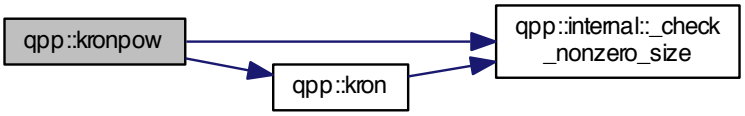
5.1.1.30 template<typename Derived > types::DynMat<typename Derived::Scalar> qpp::kronlist (const std::vector< types::DynMat< typename Derived::Scalar > > & *As*)

Here is the call graph for this function:



5.1.1.31 template<typename Derived > types::DynMat<typename Derived::Scalar> qpp::kronpow (const Eigen::MatrixBase< Derived > & *A*, size_t *n*)

Here is the call graph for this function:



5.1.1.32 template<typename Derived > types::DynMat<typename Derived::Scalar> qpp::load (const std::string & *fname*)

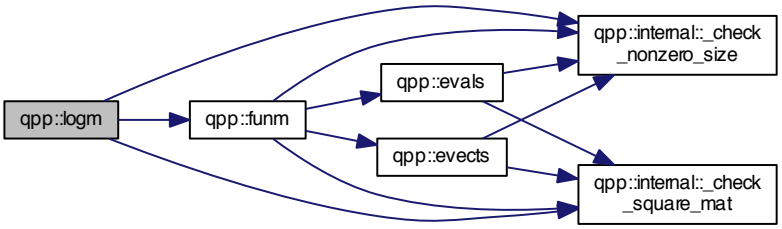
5.1.1.33 template<typename Derived > Derived qpp::loadMATLABmatrix (const std::string & *mat_file*, const std::string & *var_name*)

5.1.1.34 template<> types::dmat qpp::loadMATLABmatrix (const std::string & *mat_file*, const std::string & *var_name*)

5.1.1.35 template<> types::cmat qpp::loadMATLABmatrix (const std::string & *mat_file*, const std::string & *var_name*)

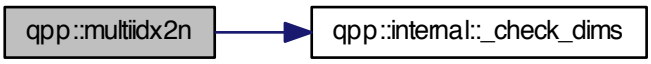
5.1.1.36 template<typename Derived > types::cmat qpp::logm (const Eigen::MatrixBase< Derived > & *A*)

Here is the call graph for this function:



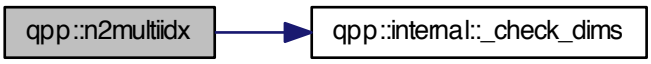
5.1.1.37 size_t qpp::multiidx2n (const std::vector< size_t > & *midx*, const std::vector< size_t > & *dims*)

Here is the call graph for this function:



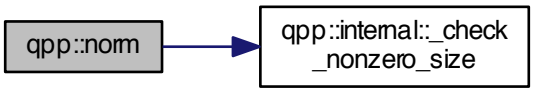
5.1.1.38 std::vector<size_t> qpp::n2multiidx (size_t *n*, const std::vector< size_t > & *dims*)

Here is the call graph for this function:



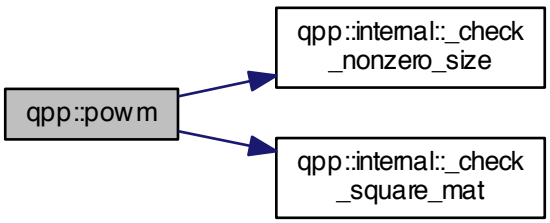
5.1.1.39 template<typename Derived > double qpp::norm (const Eigen::MatrixBase< Derived > & *A*)

Here is the call graph for this function:



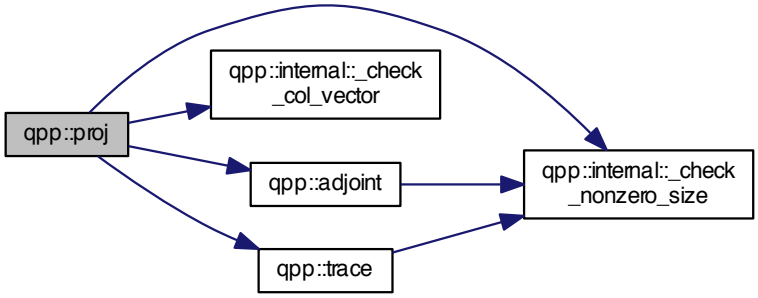
5.1.1.40 template<typename Derived > types::DynMat<typename Derived::Scalar> qpp::powm (const Eigen::MatrixBase< Derived > & *A*, size_t *n*)

Here is the call graph for this function:



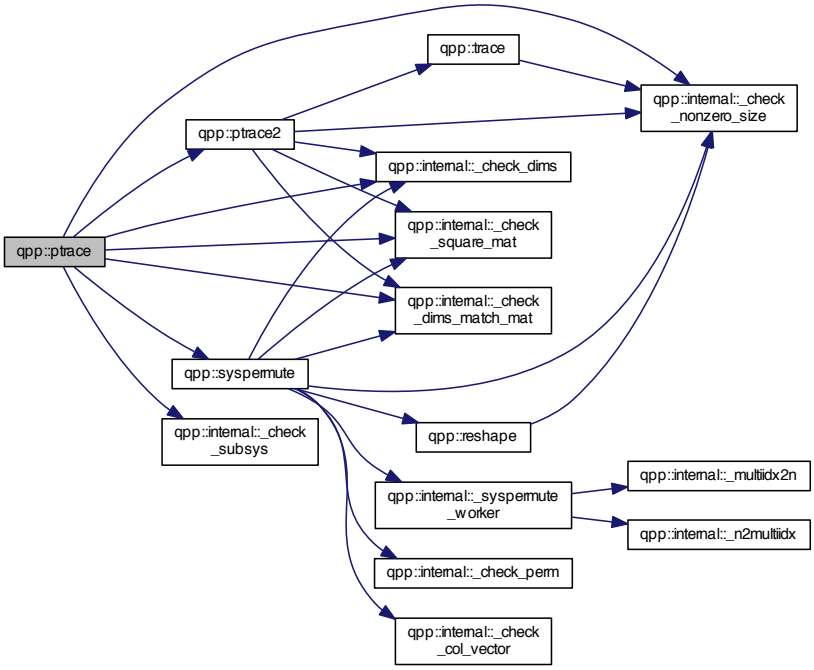
5.1.1.41 template<typename Derived > types::DynMat<typename Derived::Scalar> qpp::proj (const Eigen::MatrixBase< Derived > & *V*)

Here is the call graph for this function:



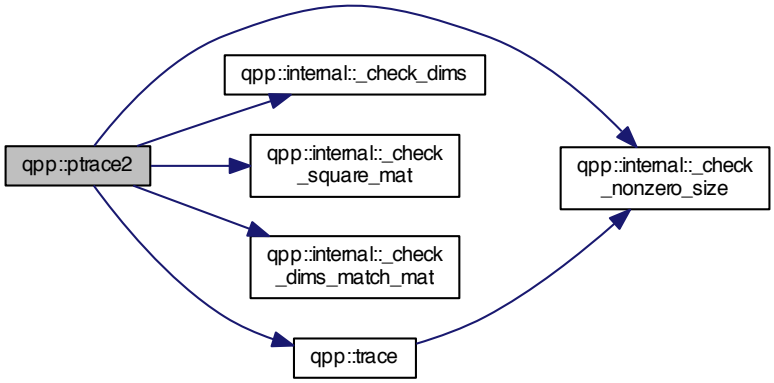
5.1.1.42 template<typename Derived > types::DynMat<typename Derived::Scalar> qpp::ptrace (const Eigen::MatrixBase< Derived > & *A*, const std::vector< size_t > & *subsys*, const std::vector< size_t > & *dims*)

Here is the call graph for this function:



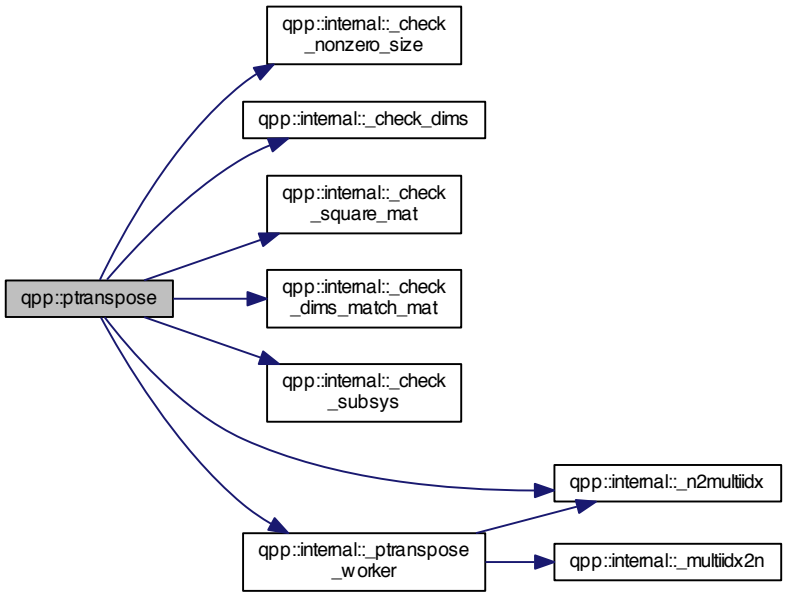
5.1.1.43 template<typename Derived > types::DynMat<typename Derived::Scalar> qpp::ptrace2 (const Eigen::MatrixBase< Derived > & *A*, const std::vector< size_t > & *dims*)

Here is the call graph for this function:



5.1.1.44 template<typename Derived > types::DynMat<typename Derived::Scalar> qpp::ptranspose (const Eigen::MatrixBase< Derived > & *A*, const std::vector< size_t > & *subsys*, const std::vector< size_t > & *dims*)

Here is the call graph for this function:



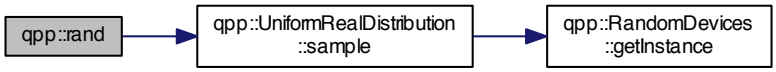
5.1.1.45 template<typename Derived > Derived qpp::rand (size_t *rows*, size_t *cols*, double *a* = 0, double *b* = 1)

5.1.1.46 template<> types::dmat qpp::rand (size_t *rows*, size_t *cols*, double *a*, double *b*)

5.1.1.47 template<> types::cmat qpp::rand (size_t *rows*, size_t *cols*, double *a*, double *b*)

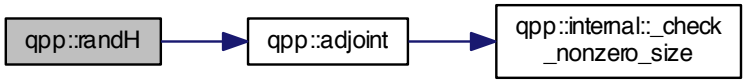
5.1.1.48 double qpp::rand (double *a* = 0, double *b* = 1)

Here is the call graph for this function:



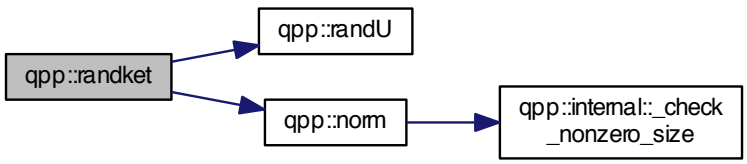
5.1.1.49 types::cmat qpp::randH (size_t *D*)

Here is the call graph for this function:



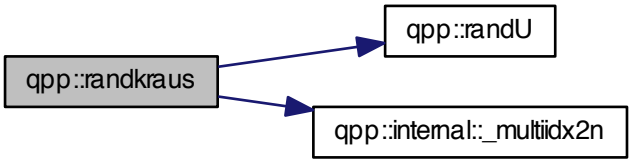
5.1.1.50 types::ket qpp::randket (size_t *D*)

Here is the call graph for this function:



5.1.1.51 std::vector<types::cmat> qpp::randkraus (size_t *n*, size_t *D*)

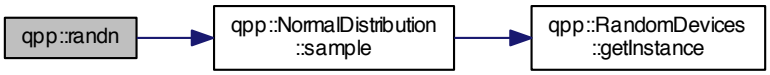
Here is the call graph for this function:



5.1.1.52 template<typename Derived > Derived qpp::randn (size_t *rows*, size_t *cols*, double *mean* = 0, double *sigma* = 1)

5.1.1.53 template<> types::dmat qpp::randn (size_t *rows*, size_t *cols*, double *mean*, double *sigma*)

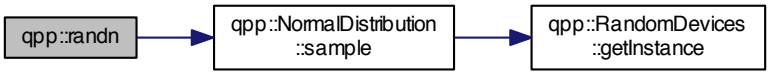
Here is the call graph for this function:



5.1.1.54 template<> types::cmat qpp::randn (size_t *rows*, size_t *cols*, double *mean*, double *sigma*)

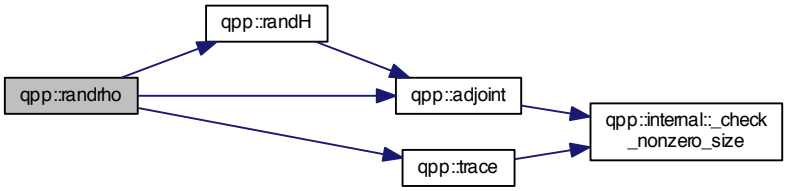
5.1.1.55 double qpp::randn (double *mean* = 0, double *sigma* = 1)

Here is the call graph for this function:



5.1.1.56 types::cmat qpp::randrho (size_t *D*)

Here is the call graph for this function:



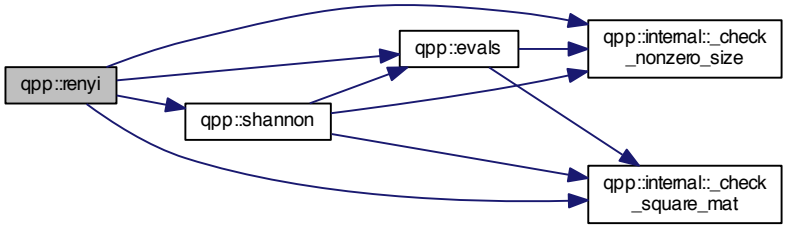
5.1.1.57 types::cmat qpp::randU (size_t *D*)

5.1.1.58 types::cmat qpp::randV (size_t *Din*, size_t *Dout*)

Here is the call graph for this function:

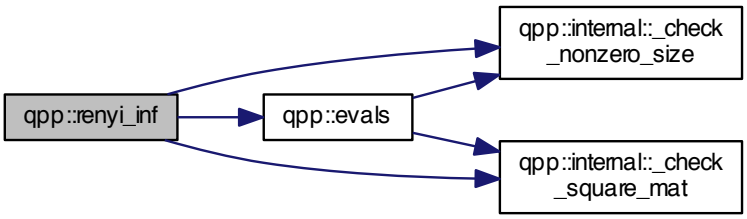
5.1.1.59 template<typename Derived > double qpp::renyi (const double *alpha*, const Eigen::MatrixBase< Derived > & *A*)

Here is the call graph for this function:



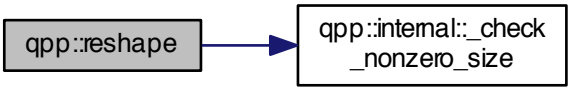
5.1.1.60 template<typename Derived > double qpp::renyi_inf (const Eigen::MatrixBase< Derived > & *A*)

Here is the call graph for this function:



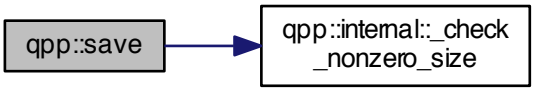
5.1.1.61 template<typename Derived > types::DynMat<typename Derived::Scalar> qpp::reshape (const Eigen::MatrixBase< Derived > & *A*, size_t *rows*, size_t *cols*)

Here is the call graph for this function:



5.1.1.62 template<typename Derived > void qpp::save (const Eigen::MatrixBase< Derived > & *A*, const std::string & *fname*)

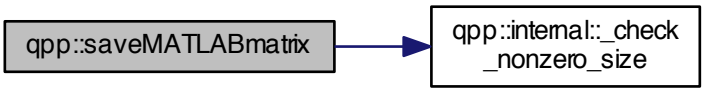
Here is the call graph for this function:



5.1.1.63 template<typename Derived > void qpp::saveMATLABmatrix (const Eigen::MatrixBase< Derived > & *A*, const std::string & *mat_file*, const std::string & *var_name*, const std::string & *mode*)

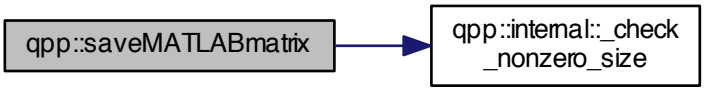
5.1.1.64 template<> void qpp::saveMATLABmatrix (const Eigen::MatrixBase< typename types::dmat > & *A*, const std::string & *mat_file*, const std::string & *var_name*, const std::string & *mode*)

Here is the call graph for this function:



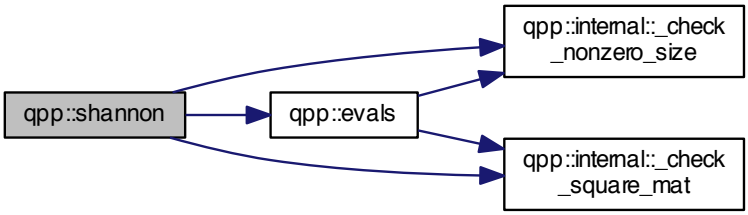
5.1.1.65 template<> void qpp::saveMATLABmatrix (const Eigen::MatrixBase< typename types::cmat > & *A*, const std::string & *mat_file*, const std::string & *var_name*, const std::string & *mode*)

Here is the call graph for this function:



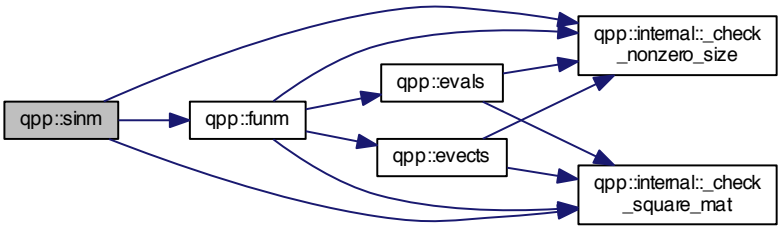
5.1.1.66 template<typename Derived > double qpp::shannon (const Eigen::MatrixBase< Derived > & *A*)

Here is the call graph for this function:



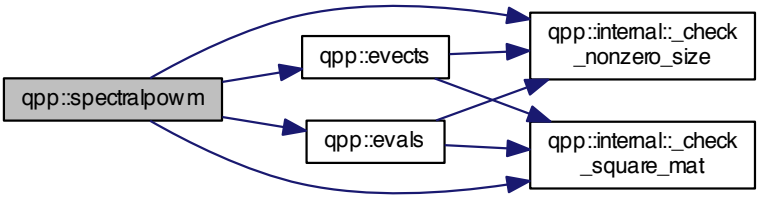
5.1.1.67 template<typename Derived > types::cmat qpp::sinm (const Eigen::MatrixBase< Derived > & *A*)

Here is the call graph for this function:



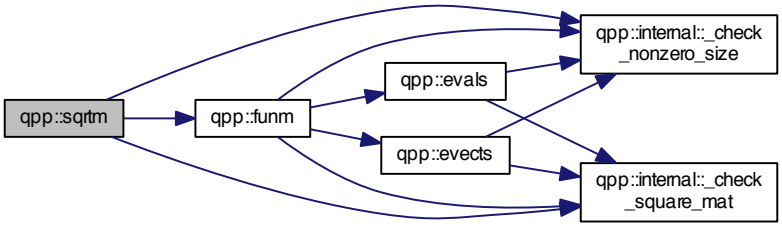
5.1.1.68 template<typename Derived > types::cmat qpp::spectralpowm (const Eigen::MatrixBase< Derived > & *A*, const types::cplx *z*)

Here is the call graph for this function:



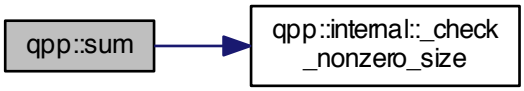
5.1.1.69 template<typename Derived > types::cmat qpp::sqrtm (const Eigen::MatrixBase< Derived > & *A*)

Here is the call graph for this function:



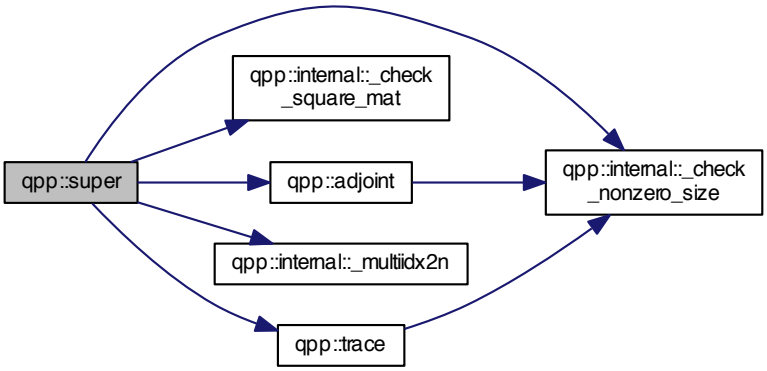
5.1.1.70 template<typename Derived > Derived::Scalar qpp::sum (const Eigen::MatrixBase< Derived > & *A*)

Here is the call graph for this function:



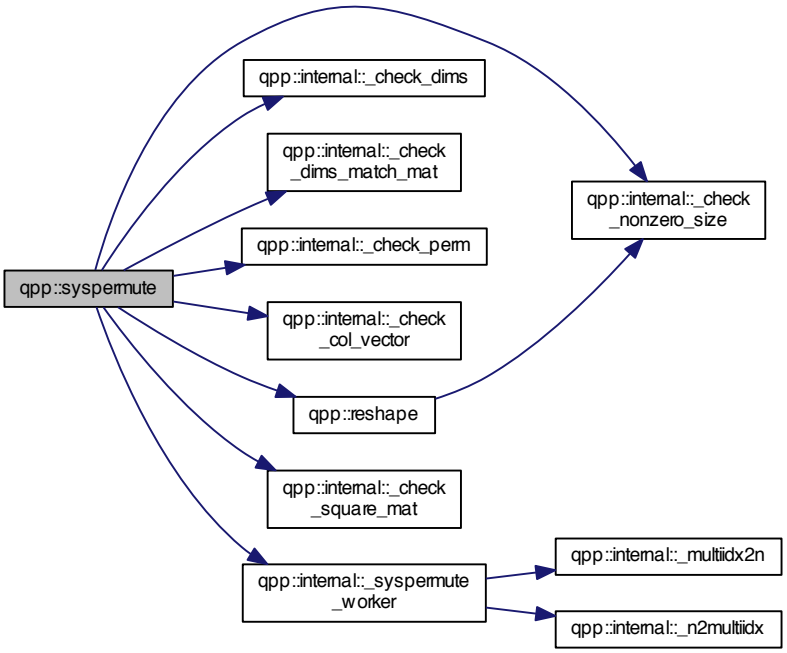
5.1.1.71 types::cmat qpp::super (const std::vector< types::cmat > & *Ks*)

Here is the call graph for this function:



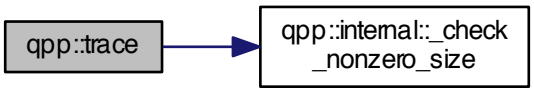
5.1.1.72 template<typename Derived > types::DynMat<typename Derived::Scalar> qpp::syspermute (const Eigen::MatrixBase< Derived > & *A*, const std::vector< size_t > & *perm*, const std::vector< size_t > & *dims*)

Here is the call graph for this function:



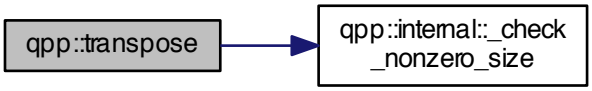
5.1.1.73 template<typename Derived > Derived::Scalar qpp::trace (const Eigen::MatrixBase< Derived > & *A*)

Here is the call graph for this function:



5.1.1.74 template<typename Derived > types::DynMat<typename Derived::Scalar> qpp::transpose (const Eigen::MatrixBase< Derived > & *A*)

Here is the call graph for this function:



5.1.2 Variable Documentation

5.1.2.1 const Gates& qpp::gt = Gates::getInstance()

5.1.2.2 RandomDevices& qpp::rdevs = RandomDevices::getInstance()

5.2 qpp::ct Namespace Reference

Functions

- std::complex< double > omega (size_t D)

Variables

- const double chop = 1e-10
- const double eps = 1e-14
- const std::complex< double > ii = { 0, 1 }
- const double pi = 3.14159265358979323846264338327950288 4
- const double ee = 2.71828182845904523536028747135266249 7

5.2.1 Function Documentation

5.2.1.1 std::complex<double> qpp::ct::omega (size_t *D*)

5.2.2 Variable Documentation

5.2.2.1 const double qpp::ct::chop = 1e-10

5.2.2.2 const double qpp::ct::ee = 2.71828182845904523536028747135266249 7

5.2.2.3 const double qpp::ct::eps = 1e-14

5.2.2.4 const std::complex<double> qpp::ct::ii = { 0, 1 }

5.2.2.5 const double qpp::ct::pi = 3.14159265358979323846264338327950288 4

5.3 qpp::internal Namespace Reference

Functions

- void _n2multiidx (size_t n, size_t numdims, const size_t *dims, size_t *result)
- size_t _multiidx2n (const size_t *midx, size_t numdims, const size_t *dims)
- template<typename Derived >
  bool _check_square_mat (const Eigen::MatrixBase< Derived > &A)
- template<typename Derived >
  bool _check_vector (const Eigen::MatrixBase< Derived > &A)
- template<typename Derived >
  bool _check_row_vector (const Eigen::MatrixBase< Derived > &A)
- template<typename Derived >
  bool _check_col_vector (const Eigen::MatrixBase< Derived > &A)
- template<typename T >
  bool _check_nonzero_size (const T &x)
- bool _check_dims (const std::vector< size_t > &dims)
- template<typename Derived >
  bool _check_dims_match_mat (const std::vector< size_t > &dims, const Eigen::MatrixBase< Derived > &A)
- bool _check_eq_dims (const std::vector< size_t > &dims, size_t dim)
- bool _check_subsys (const std::vector< size_t > &subsys, const std::vector< size_t > &dims)
- bool _check_perm (const std::vector< size_t > &perm, const std::vector< size_t > &dims)
- template<typename Scalar >
  void _syspermute_worker (size_t numdims, const size_t *cdims, const size_t *cperm, size_t i, size_t &iperm, const types::DynMat< Scalar > &V, types::DynMat< Scalar > &result)
- template<typename Scalar >
  void _ptranspose_worker (const size_t *midxcol, size_t numdims, size_t numsubsys, const size_t *cdims, const size_t *csubsys, size_t i, size_t j, size_t &iperm, size_t &jperm, const types::DynMat< Scalar > &A, types::DynMat< Scalar > &result)

5.3.1 Function Documentation

5.3.1.1 template<typename Derived > bool qpp::internal::_check_col_vector (const Eigen::MatrixBase< Derived > & *A*)

5.3.1.2 bool qpp::internal::_check_dims (const std::vector< size_t > & *dims*)

5.3.1.3 template<typename Derived > bool qpp::internal::_check_dims_match_mat (const std::vector< size_t > & *dims*, const Eigen::MatrixBase< Derived > & *A*)

5.3.1.4 bool qpp::internal::_check_eq_dims (const std::vector< size_t > & *dims*, size_t *dim*)

5.3.1.5 template<typename T > bool qpp::internal::_check_nonzero_size (const T & *x*)

5.3.1.6 bool qpp::internal::_check_perm (const std::vector< size_t > & *perm*, const std::vector< size_t > & *dims*)

5.3.1.7 template<typename Derived > bool qpp::internal::_check_row_vector (const Eigen::MatrixBase< Derived > & *A*)

5.3.1.8 template<typename Derived > bool qpp::internal::_check_square_mat (const Eigen::MatrixBase< Derived > & *A*)

5.3.1.9 bool qpp::internal::_check_subsys (const std::vector< size_t > & *subsys*, const std::vector< size_t > & *dims*)

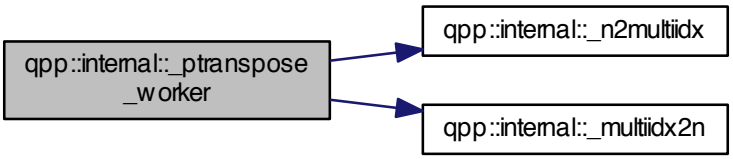
5.3.1.10 template<typename Derived > bool qpp::internal::_check_vector (const Eigen::MatrixBase< Derived > & *A*)

5.3.1.11 size_t qpp::internal::_multiidx2n (const size_t * *midx*, size_t *numdims*, const size_t * *dims*)

5.3.1.12 void qpp::internal::_n2multiidx (size_t *n*, size_t *numdims*, const size_t * *dims*, size_t * *result*)

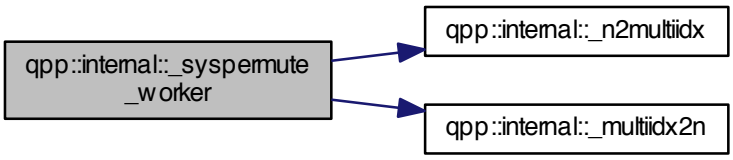
5.3.1.13 template<typename Scalar > void qpp::internal::_ptranspose_worker (const size_t * *midxcol*, size_t *numdims*, size_t *numsubsys*, const size_t * *cdims*, const size_t * *csubsys*, size_t *i*, size_t *j*, size_t & *iperm*, size_t & *jperm*, const types::DynMat< Scalar > & *A*, types::DynMat< Scalar > & *result*)

Here is the call graph for this function:



5.3.1.14 template<typename Scalar > void qpp::internal::_syspermute_worker (size_t *numdims*, const size_t * *cdims*, const size_t * *cperm*, size_t *i*, size_t & *iperm*, const types::DynMat< Scalar > & *V*, types::DynMat< Scalar > & *result*)

Here is the call graph for this function:



5.4 qpp::types Namespace Reference

Typedefs

- typedef std::complex< double > cplx
- typedef Eigen::MatrixXcd cmat
- typedef Eigen::MatrixXd dmat
- typedef Eigen::MatrixXf fmat
- typedef Eigen::MatrixXi imat
- typedef Eigen::Matrix< cplx, Eigen::Dynamic, 1 > ket
- typedef Eigen::Matrix< cplx, 1, Eigen::Dynamic > bra
- template<typename Scalar > using DynMat = Eigen::Matrix< Scalar, Eigen::Dynamic, Eigen::Dynamic >

5.4.1 Typedef Documentation

5.4.1.1 typedef Eigen::Matrix<cplx, 1, Eigen::Dynamic> qpp::types::bra

5.4.1.2 typedef Eigen::MatrixXcd qpp::types::cmat

5.4.1.3 typedef std::complex<double> qpp::types::cplx

5.4.1.4 typedef Eigen::MatrixXd qpp::types::dmat

5.4.1.5 template<typename Scalar > using qpp::types::DynMat = typedef Eigen::Matrix<Scalar, Eigen::Dynamic, Eigen::Dynamic>

5.4.1.6 typedef Eigen::MatrixXf qpp::types::fmat

5.4.1.7 typedef Eigen::MatrixXi qpp::types::imat

5.4.1.8 typedef Eigen::Matrix<cplx, Eigen::Dynamic, 1> qpp::types::ket

Chapter 6

Class Documentation

6.1 qpp::DiscreteDistribution Class Reference

`#include <stat.h>`

Public Member Functions

- template<typename InputIterator >
  DiscreteDistribution (InputIterator first, InputIterator last)
- DiscreteDistribution (std::initializer_list< double > weights)
- DiscreteDistribution (std::vector< double > weights)
- size_t sample ()
- std::vector< double > probabilities ()

Protected Attributes

- std::discrete_distribution
  < size_t > _d

6.1.1 Constructor & Destructor Documentation

6.1.1.1 template<typename InputIterator > qpp::DiscreteDistribution::DiscreteDistribution (InputIterator *first,* InputIterator *last*) [inline]

6.1.1.2 qpp::DiscreteDistribution::DiscreteDistribution (std::initializer_list< double > *weights*) [inline]

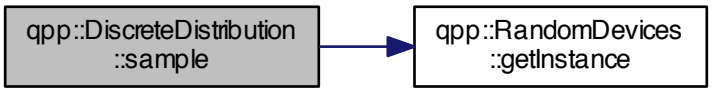
6.1.1.3 qpp::DiscreteDistribution::DiscreteDistribution (std::vector< double > *weights*) [inline]

6.1.2 Member Function Documentation

6.1.2.1 std::vector<double> qpp::DiscreteDistribution::probabilities ( ) [inline]

6.1.2.2 size_t qpp::DiscreteDistribution::sample ( ) [inline]

Here is the call graph for this function:



6.1.3 Member Data Documentation

6.1.3.1 std::discrete_distribution<size_t> qpp::DiscreteDistribution::_d [protected]

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

- include/classes/stat.h

6.2 qpp::DiscreteDistributionAbsSquare Class Reference

`#include <stat.h>`

Public Member Functions

- template<typename InputIterator >
  DiscreteDistributionAbsSquare (InputIterator first, InputIterator last)
- DiscreteDistributionAbsSquare (std::initializer_list< types::cplx > amplitudes)
- DiscreteDistributionAbsSquare (std::vector< types::cplx > amplitudes)
- DiscreteDistributionAbsSquare (const types::cmat &V)
- size_t sample ()
- std::vector< double > probabilities ()

Protected Member Functions

- template<typename InputIterator >
  std::vector< double > cplx2weights (InputIterator first, InputIterator last)

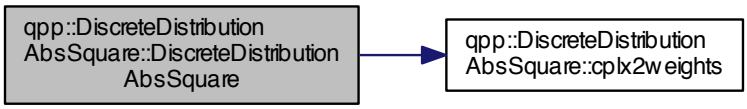
Protected Attributes

- std::discrete_distribution
  < size_t > _d

6.2.1 Constructor & Destructor Documentation

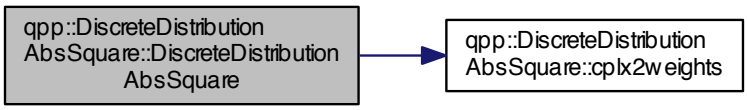
6.2.1.1 template<typename InputIterator > qpp::DiscreteDistributionAbsSquare::DiscreteDistributionAbsSquare (InputIterator *first*, InputIterator *last*) [inline]

Here is the call graph for this function:



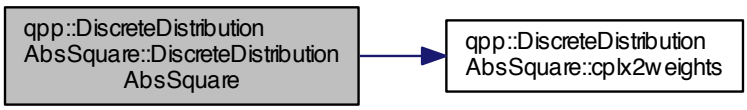
6.2.1.2 qpp::DiscreteDistributionAbsSquare::DiscreteDistributionAbsSquare (std::initializer_list< types::cplx > *amplitudes*) [inline]

Here is the call graph for this function:



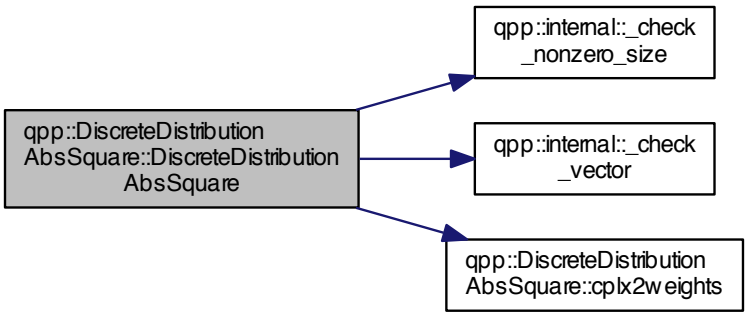
6.2.1.3 qpp::DiscreteDistributionAbsSquare::DiscreteDistributionAbsSquare (std::vector< types::cplx > *amplitudes*) [inline]

Here is the call graph for this function:



6.2.1.4 qpp::DiscreteDistributionAbsSquare::DiscreteDistributionAbsSquare (const types::cmat & *V*) [inline]

Here is the call graph for this function:



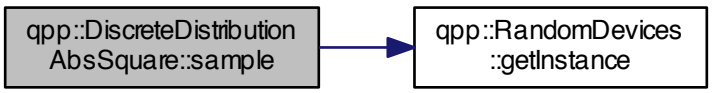
6.2.2 Member Function Documentation

6.2.2.1 template<typename InputIterator > std::vector<double> qpp::DiscreteDistributionAbsSquare::cplx2weights (InputIterator *first,* InputIterator *last*) [inline], [protected]

6.2.2.2 std::vector<double> qpp::DiscreteDistributionAbsSquare::probabilities ( ) [inline]

6.2.2.3 size_t qpp::DiscreteDistributionAbsSquare::sample ( ) [inline]

Here is the call graph for this function:



6.2.3 Member Data Documentation

6.2.3.1 std::discrete_distribution<size_t> qpp::DiscreteDistributionAbsSquare::_d [protected]

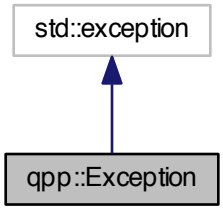
The documentation for this class was generated from the following file:

- include/classes/stat.h

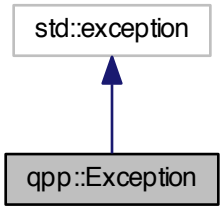
6.3 qpp::Exception Class Reference

```
#include <exception.h>
```

Inheritance diagram for qpp::Exception:



Collaboration diagram for qpp::Exception:



Public Types

- enum Type {
  Type::UNKNOWN_EXCEPTION = 0, Type::ZERO_SIZE, Type::MATRIX_NOT_SQUARE, Type::MATRIX_NOT_CVECTOR,
  Type::MATRIX_NOT_RVECTOR, Type::MATRIX_NOT_VECTOR, Type::DIMS_INVALID, Type::DIMS_NOT_EQUAL,
  Type::DIMS_MISMATCH_MATRIX, Type::SUBSYS_MISMATCH_DIMS, Type::PERM_MISMATCH_DIMS, Type::NOT_QUBIT_GATE,
  Type::NOT_QUBIT_SUBSYS, Type::OUT_OF_RANGE, Type::UNDEFINED_TYPE, Type::TYPE_MISMATCH,
  Type::CUSTOM_EXCEPTION }

Public Member Functions

- Exception (const std::string &where, const Type &type)
- Exception (const std::string &where, const std::string &custom)
- virtual const char * what () const noexceptoverride
- virtual ~Exception () noexcept

Private Member Functions

- std::string _construct_exception_msg ()

Private Attributes

- std::string _where
- std::string _msg
- Type _type
- std::string _custom

6.3.1 Member Enumeration Documentation

6.3.1.1 enum qpp::Exception::Type [strong]

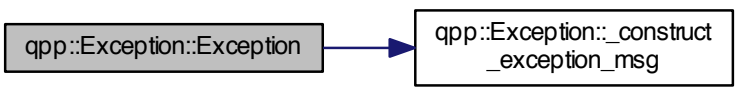
Enumerator

UNKNOWN_EXCEPTION
ZERO_SIZE
MATRIX_NOT_SQUARE
MATRIX_NOT_CVECTOR
MATRIX_NOT_RVECTOR
MATRIX_NOT_VECTOR
DIMS_INVALID
DIMS_NOT_EQUAL
DIMS_MISMATCH_MATRIX
SUBSYS_MISMATCH_DIMS
PERM_MISMATCH_DIMS
NOT_QUBIT_GATE
NOT_QUBIT_SUBSYS
OUT_OF_RANGE
UNDEFINED_TYPE
TYPE_MISMATCH
CUSTOM_EXCEPTION

6.3.2 Constructor & Destructor Documentation

6.3.2.1 qpp::Exception::Exception (const std::string & *where*, const Type & *type*) [inline]

Here is the call graph for this function:



6.3.2.2 qpp::Exception::Exception (const std::string & *where*, const std::string & *custom*) [inline]

Here is the call graph for this function:

6.3.2.3 virtual qpp::Exception::~Exception ( ) [inline], [virtual], [noexcept]

6.3.3 Member Function Documentation

6.3.3.1 std::string qpp::Exception::_construct_exception_msg ( ) [inline], [private]

6.3.3.2 virtual const char* qpp::Exception::what ( ) const [inline], [override], [virtual], [noexcept]

6.3.4 Member Data Documentation

6.3.4.1 std::string qpp::Exception::_custom [private]

6.3.4.2 std::string qpp::Exception::_msg [private]

6.3.4.3 Type qpp::Exception::_type [private]

6.3.4.4 std::string qpp::Exception::_where [private]

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

- include/classes/exception.h

6.4 qpp::Gates Class Reference

```
#include <gates.h>
```

Public Member Functions

- Gates (const Gates &)=delete
- Gates & operator= (const Gates &)=delete
- virtual ~Gates ()=default
- types::cmat Rtheta (double theta) const
- types::cmat Id (size_t D) const
- types::cmat Zd (size_t D) const
- types::cmat Fd (size_t D) const
- types::cmat Xd (size_t D) const
- types::cmat CTRL (const types::cmat &A, const std::vector< size_t > &ctrl, const std::vector< size_t > &gate, size_t n, size_t D=2) const

Static Public Member Functions

- static const Gates & getInstance ()

Public Attributes

- types::cmat Id2
- types::cmat H
- types::cmat X
- types::cmat Y
- types::cmat Z
- types::cmat S
- types::cmat T
- types::cmat CNOTab
- types::cmat CZ
- types::cmat CS
- types::cmat CNOTba
- types::cmat SWAP
- types::cmat TOF
- types::cmat FRED
- types::ket x0
- types::ket x1
- types::ket y0
- types::ket y1
- types::ket z0
- types::ket z1
- types::cmat px0
- types::cmat px1
- types::cmat py0
- types::cmat py1
- types::cmat pz0
- types::cmat pz1
- types::ket b00
- types::ket b01
- types::ket b10
- types::ket b11
- types::cmat pb00
- types::cmat pb01
- types::cmat pb10
- types::cmat pb11

Private Member Functions

- Gates ()

6.4.1 Constructor & Destructor Documentation

6.4.1.1 qpp::Gates::Gates ( ) [inline], [private]

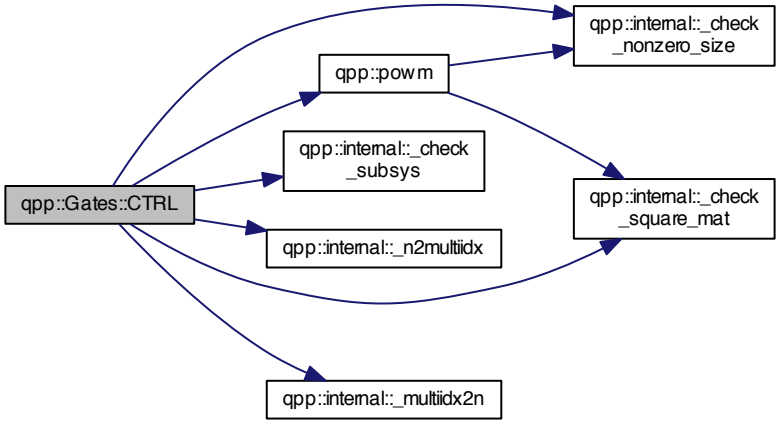
6.4.1.2 qpp::Gates::Gates (const Gates &) [delete]

6.4.1.3 virtual qpp::Gates::~Gates ( ) [virtual], [default]

6.4.2 Member Function Documentation

6.4.2.1 types::cmat qpp::Gates::CTRL (const types::cmat & *A*, const std::vector< size_t > & *ctrl*, const std::vector< size_t > & *gate*, size_t *n*, size_t *D* = 2) const [inline]

Here is the call graph for this function:



6.4.2.2 types::cmat qpp::Gates::Fd (size_t *D*) const [inline]

Here is the call graph for this function:

6.4.2.3 static const Gates& qpp::Gates::getInstance ( ) [inline], [static]

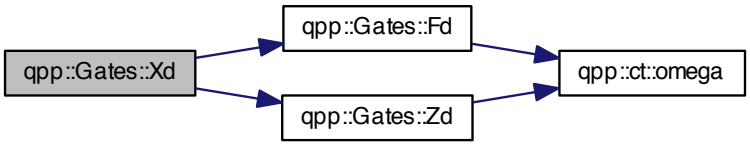
6.4.2.4 types::cmat qpp::Gates::Id (size_t *D*) const [inline]

6.4.2.5 Gates& qpp::Gates::operator= (const Gates &) [delete]

6.4.2.6 types::cmat qpp::Gates::Rtheta (double *theta*) const [inline]

6.4.2.7 types::cmat qpp::Gates::Xd (size_t *D*) const [inline]

Here is the call graph for this function:



6.4.2.8 types::cmat qpp::Gates::Zd (size_t *D*) const [inline]

Here is the call graph for this function:

6.4.3 Member Data Documentation

6.4.3.1 types::ket qpp::Gates::b00

6.4.3.2 types::ket qpp::Gates::b01

6.4.3.3 types::ket qpp::Gates::b10

6.4.3.4 types::ket qpp::Gates::b11

6.4.3.5 types::cmat qpp::Gates::CNOTab

6.4.3.6 types::cmat qpp::Gates::CNOTba

6.4.3.7 types::cmat qpp::Gates::CS

6.4.3.8 types::cmat qpp::Gates::CZ

6.4.3.9 types::cmat qpp::Gates::FRED

6.4.3.10 types::cmat qpp::Gates::H

6.4.3.11 types::cmat qpp::Gates::Id2

6.4.3.12 types::cmat qpp::Gates::pb00

6.4.3.13 types::cmat qpp::Gates::pb01

6.4.3.14 types::cmat qpp::Gates::pb10

6.4.3.15 types::cmat qpp::Gates::pb11

6.4.3.16 types::cmat qpp::Gates::px0

6.4.3.17 types::cmat qpp::Gates::px1

6.4.3.18 types::cmat qpp::Gates::py0

6.4.3.19 types::cmat qpp::Gates::py1

6.4.3.20 types::cmat qpp::Gates::pz0

6.4.3.21 types::cmat qpp::Gates::pz1

6.4.3.22 types::cmat qpp::Gates::S

6.4.3.23 types::cmat qpp::Gates::SWAP

6.4.3.24 types::cmat qpp::Gates::T

6.4.3.25 types::cmat qpp::Gates::TOF

6.4.3.26 types::cmat qpp::Gates::X

6.4.3.27 types::ket qpp::Gates::x0

6.4.3.28 types::ket qpp::Gates::x1

6.4.3.29 types::cmat qpp::Gates::Y

6.4.3.30 types::ket qpp::Gates::y0

6.4.3.31 types::ket qpp::Gates::y1

6.4.3.32 types::cmat qpp::Gates::Z

6.4.3.33 types::ket qpp::Gates::z0

6.4.3.34 types::ket qpp::Gates::z1

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

- include/classes/gates.h

6.5 qpp::NormalDistribution Class Reference

`#include <stat.h>`

Public Member Functions

- NormalDistribution (double mean=0, double sigma=1)
- double sample ()

Protected Attributes

- std::normal_distribution _d

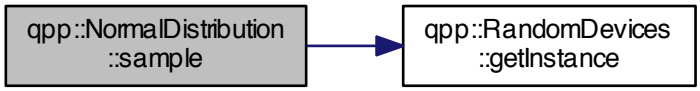
6.5.1 Constructor & Destructor Documentation

6.5.1.1 qpp::NormalDistribution::NormalDistribution (double *mean* = 0, double *sigma* = 1) [inline]

6.5.2 Member Function Documentation

6.5.2.1 double qpp::NormalDistribution::sample ( ) [inline]

Here is the call graph for this function:



6.5.3 Member Data Documentation

6.5.3.1 std::normal_distribution qpp::NormalDistribution::_d [protected]

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

- include/classes/stat.h

6.6 qpp::Qudit Class Reference

```
#include <qudit.h>
```

Public Member Functions

- Qudit (const types::cmat &rho=Gates::getInstance().pz0)
- size_t measure (const types::cmat &U, bool destructive=false)
- size_t measure (bool destructive=false)
- types::cmat getRho () const
- size_t getD () const
- virtual ~Qudit ()=default

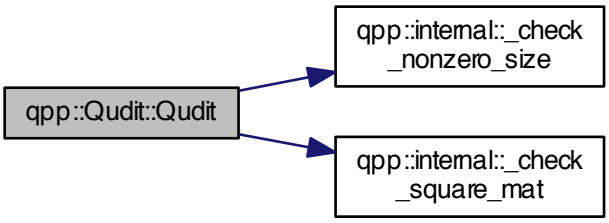
Private Attributes

- types::cmat _rho
- size_t _D

6.6.1 Constructor & Destructor Documentation

6.6.1.1 qpp::Qudit::Qudit (const types::cmat & *rho* = Gates::getInstance().pz0) [inline]

Here is the call graph for this function:



6.6.1.2 virtual qpp::Qudit::~Qudit ( ) [virtual], [default]

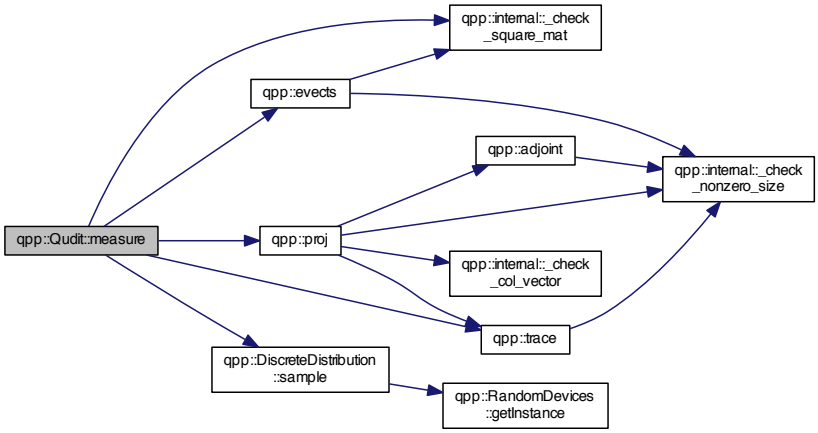
6.6.2 Member Function Documentation

6.6.2.1 size_t qpp::Qudit::getD ( ) const [inline]

6.6.2.2 types::cmat qpp::Qudit::getRho ( ) const [inline]

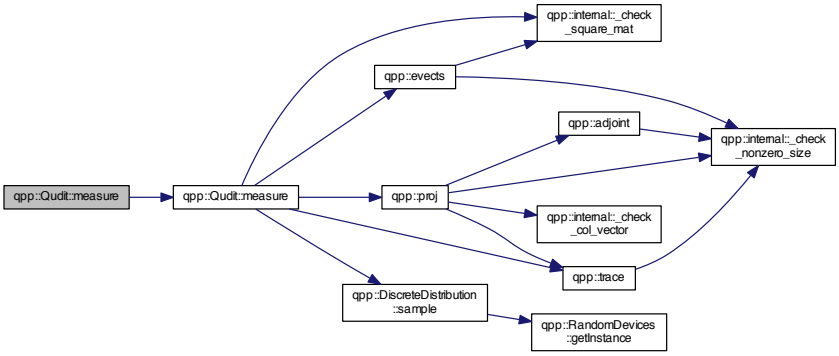
6.6.2.3 size_t qpp::Qudit::measure (const types::cmat & *U*, bool *destructive* = false) [inline]

Here is the call graph for this function:



6.6.2.4 size_t qpp::Qudit::measure (bool *destructive* = false) [inline]

Here is the call graph for this function:



6.6.3 Member Data Documentation

6.6.3.1 size_t qpp::Qudit::_D [private]

6.6.3.2 types::cmat qpp::Qudit::_rho [private]

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

- include/classes/qudit.h

6.7 qpp::RandomDevices Class Reference

`#include <randevs.h>`

Public Member Functions

- RandomDevices (const RandomDevices &)=delete
- RandomDevices & operator= (const RandomDevices &)=delete
- virtual ~RandomDevices ()=default

Static Public Member Functions

- static RandomDevices & getInstance ()

Public Attributes

- std::random_device _rd
- std::mt19937 _rng

Private Member Functions

- RandomDevices ()

6.7.1 Constructor & Destructor Documentation

6.7.1.1 qpp::RandomDevices::RandomDevices ( ) [inline], [private]

6.7.1.2 qpp::RandomDevices::RandomDevices (const RandomDevices &) [delete]

6.7.1.3 virtual qpp::RandomDevices::~RandomDevices ( ) [virtual], [default]

6.7.2 Member Function Documentation

6.7.2.1 static RandomDevices& qpp::RandomDevices::getInstance ( ) [inline], [static]

6.7.2.2 RandomDevices& qpp::RandomDevices::operator= (const RandomDevices &) [delete]

6.7.3 Member Data Documentation

6.7.3.1 std::random_device qpp::RandomDevices::_rd

6.7.3.2 std::mt19937 qpp::RandomDevices::_rng

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

- include/classes/randevs.h

6.8 qpp::Timer Class Reference

`#include <timer.h>`

Public Member Functions

- Timer ()
- void tic ()
- void toc ()
- double seconds () const
- virtual ~Timer ()=default

Protected Attributes

- std::chrono::high_resolution_clock::time_point _start
- std::chrono::high_resolution_clock::time_point _end

Friends

- std::ostream & operator<< (std::ostream &os, const Timer &rhs)

6.8.1 Constructor & Destructor Documentation

6.8.1.1 qpp::Timer::Timer ( ) [inline]

6.8.1.2 virtual qpp::Timer::~Timer ( ) [virtual], [default]

6.8.2 Member Function Documentation

6.8.2.1 double qpp::Timer::seconds ( ) const [inline]

6.8.2.2 void qpp::Timer::tic ( ) [inline]

6.8.2.3 void qpp::Timer::toc ( ) [inline]

6.8.3 Friends And Related Function Documentation

6.8.3.1 std::ostream& operator<< (std::ostream & *os*, const Timer & *rhs*) [friend]

6.8.4 Member Data Documentation

6.8.4.1 std::chrono::high_resolution_clock::time_point qpp::Timer::_end [protected]

6.8.4.2 std::chrono::high_resolution_clock::time_point qpp::Timer::_start [protected]

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

- include/classes/timer.h

6.9 qpp::UniformRealDistribution Class Reference

`#include <stat.h>`

Public Member Functions

- UniformRealDistribution (double a=0, double b=1)
- double sample ()

Protected Attributes

- std::uniform_real_distribution _d

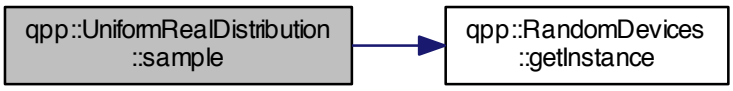
6.9.1 Constructor & Destructor Documentation

6.9.1.1 qpp::UniformRealDistribution::UniformRealDistribution (double *a* = 0, double *b* = 1) [inline]

6.9.2 Member Function Documentation

6.9.2.1 double qpp::UniformRealDistribution::sample ( ) [inline]

Here is the call graph for this function:



6.9.3 Member Data Documentation

6.9.3.1 std::uniform_real_distribution qpp::UniformRealDistribution::_d [protected]

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

- include/classes/stat.h

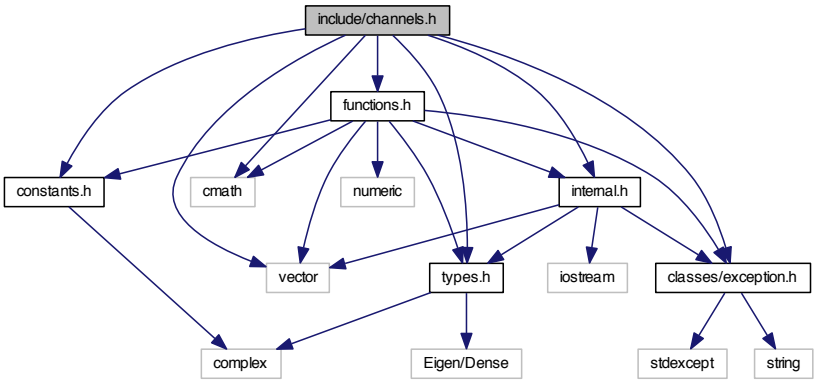
Chapter 7

File Documentation

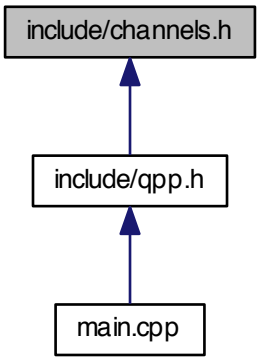
7.1 include/channels.h File Reference

```
#include <cmath>
#include <vector>
#include "constants.h"
#include "functions.h"
#include "internal.h"
#include "types.h"
#include "classes/exception.h"
```

Include dependency graph for channels.h:



This graph shows which files directly or indirectly include this file:



Namespaces

- qpp

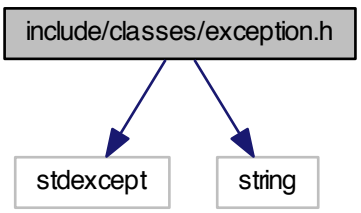
Functions

- types::cmat qpp::channel (const types::cmat &rho, const std::vector< types::cmat > &Ks)
- types::cmat qpp::super (const std::vector< types::cmat > &Ks)
- types::cmat qpp::choi (const std::vector< types::cmat > &Ks)
- std::vector< types::cmat > qpp::choi2kraus (const types::cmat &A)

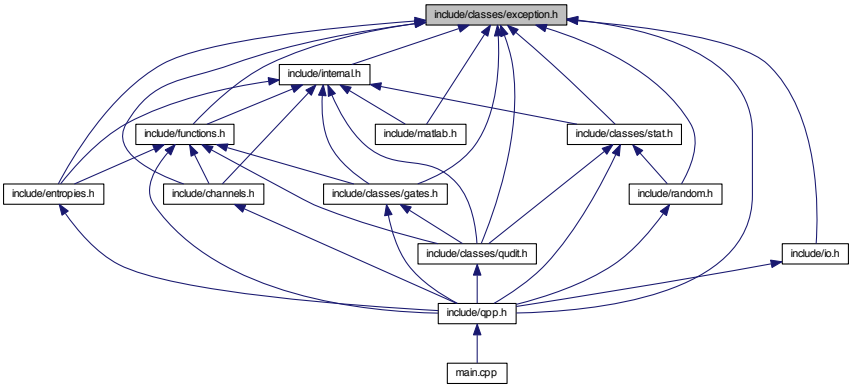
7.2 include/classes/exception.h File Reference

```
#include <stdexcept>
#include <string>
```

Include dependency graph for exception.h:



This graph shows which files directly or indirectly include this file:



Classes

- class qpp::Exception

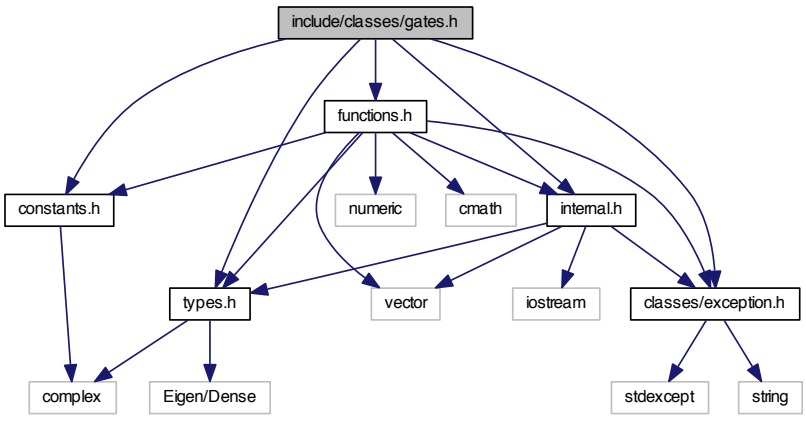
Namespaces

- qpp

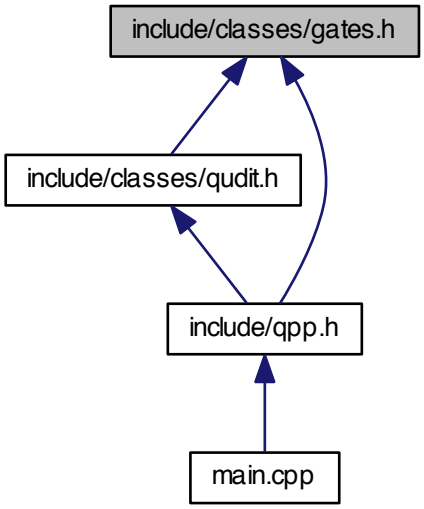
7.3 include/classes/gates.h File Reference

```
#include "constants.h"
#include "functions.h"
#include "exception.h"
#include "internal.h"
#include "types.h"
```

Include dependency graph for gates.h:



This graph shows which files directly or indirectly include this file:



Classes

- class qpp::Gates

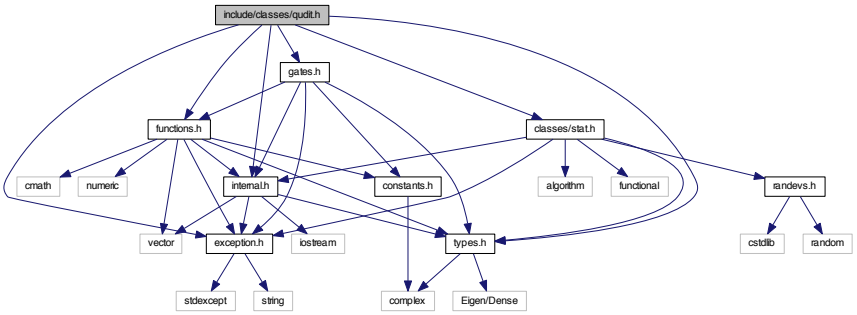
Namespaces

- qpp

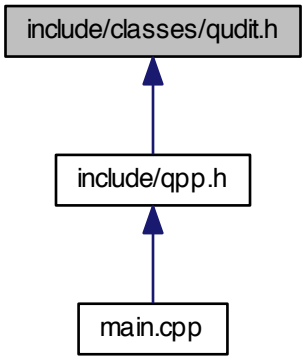
7.4 include/classes/qudit.h File Reference

```
#include "exception.h"
#include "functions.h"
#include "gates.h"
#include "internal.h"
#include "types.h"
#include "classes/stat.h"
```

Include dependency graph for qudit.h:



This graph shows which files directly or indirectly include this file:



Classes

- class qpp::Qudit

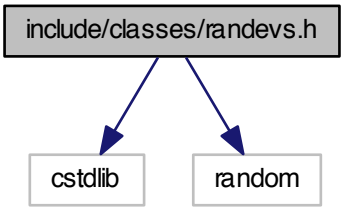
Namespaces

- qpp

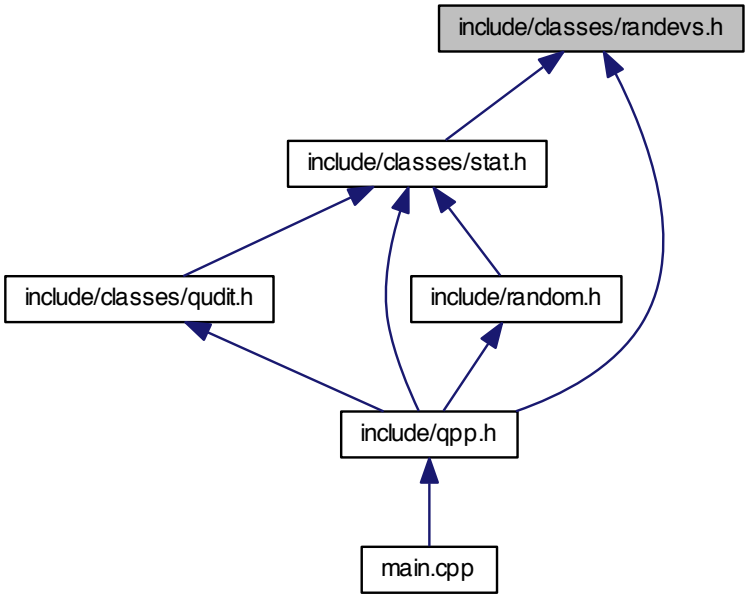
7.5 include/classes/randevs.h File Reference

```
#include <cstdlib>
#include <random>
```

Include dependency graph for randevs.h:



This graph shows which files directly or indirectly include this file:



Classes

- class qpp::RandomDevices

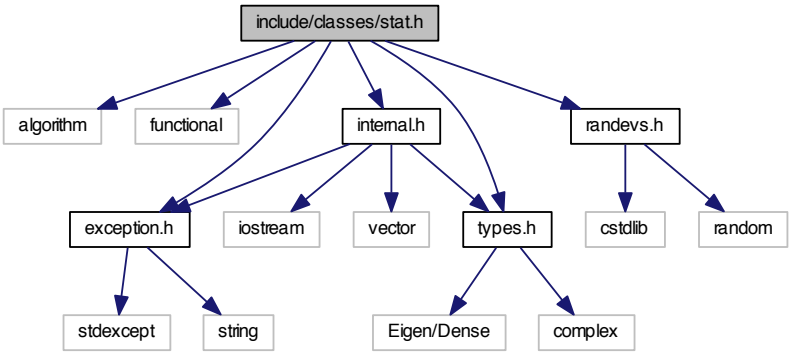
Namespaces

- qpp

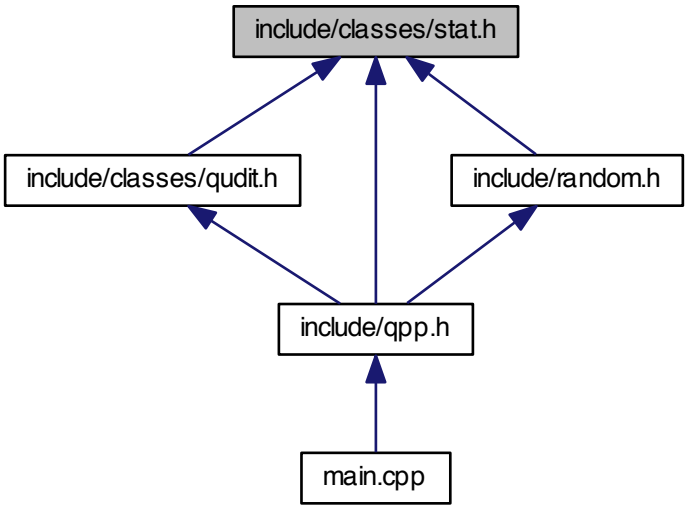
7.6 include/classes/stat.h File Reference

```
#include <algorithm>
#include <functional>
#include "exception.h"
#include "internal.h"
#include "randevs.h"
#include "types.h"
```

Include dependency graph for stat.h:



This graph shows which files directly or indirectly include this file:



Classes

- class qpp::NormalDistribution

- class qpp::UniformRealDistribution
- class qpp::DiscreteDistribution
- class qpp::DiscreteDistributionAbsSquare

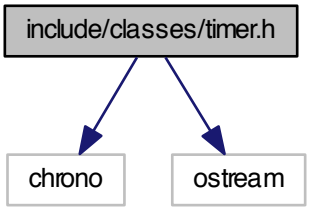
Namespaces

- qpp

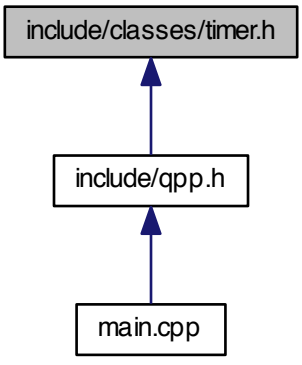
7.7 include/classes/timer.h File Reference

```
#include <chrono>
#include <ostream>
```

Include dependency graph for timer.h:



This graph shows which files directly or indirectly include this file:



Classes

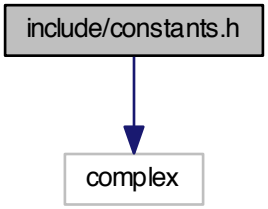
- class qpp::Timer

Namespaces

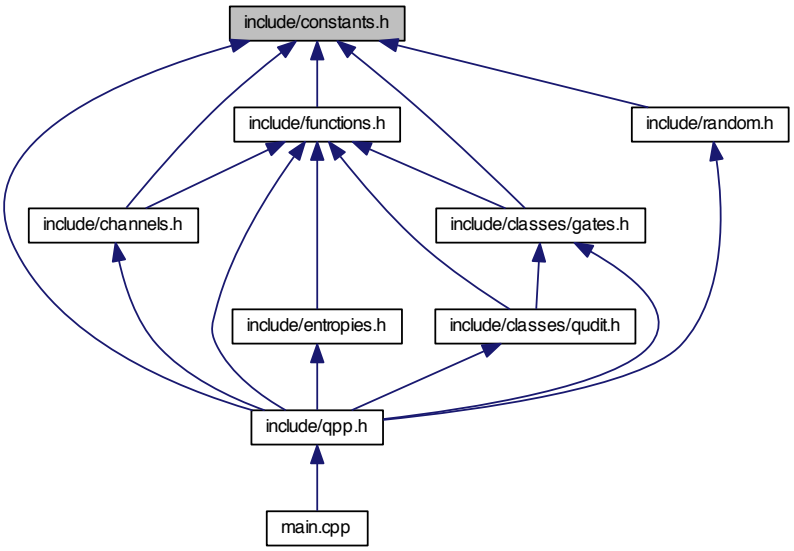
- qpp

7.8 include/constants.h File Reference

`#include <complex>`
Include dependency graph for constants.h:



This graph shows which files directly or indirectly include this file:



Namespaces

- qpp
- qpp::ct

Functions

- std::complex< double > qpp::ct::omega (size_t D)

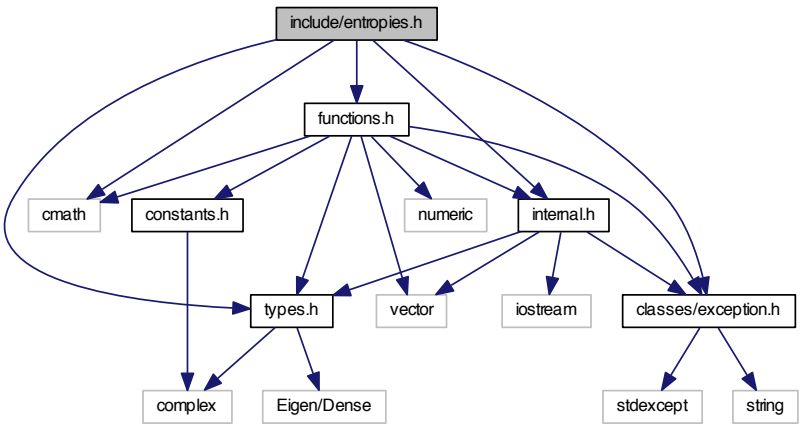
Variables

- const double qpp::ct::chop = 1e-10
- const double qpp::ct::eps = 1e-14
- const std::complex< double > qpp::ct::ii = { 0, 1 }
- const double qpp::ct::pi = 3.14159265358979323846264338327950288 4
- const double qpp::ct::ee = 2.71828182845904523536028747135266249 7

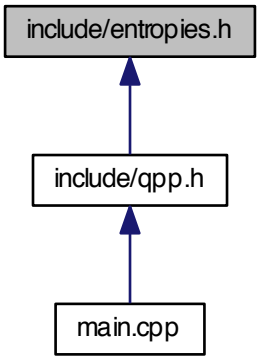
7.9 include/entropies.h File Reference

```
#include <cmath>
#include "functions.h"
#include "internal.h"
#include "types.h"
#include "classes/exception.h"
```

Include dependency graph for entropies.h:



This graph shows which files directly or indirectly include this file:



Namespaces

- qpp

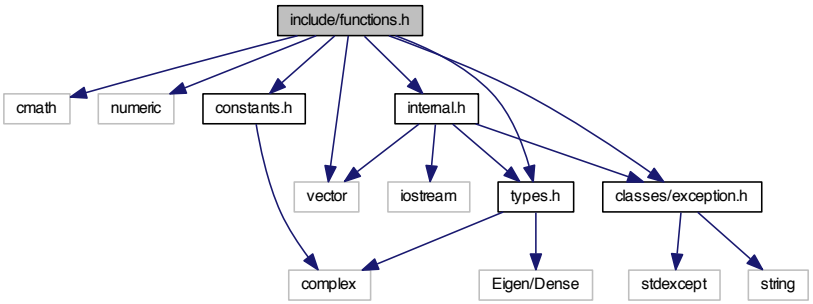
Functions

- template<typename Derived >
  double qpp::shannon (const Eigen::MatrixBase< Derived > &A)
- template<typename Derived >
  double qpp::renyi (const double alpha, const Eigen::MatrixBase< Derived > &A)
- template<typename Derived >
  double qpp::renyi_inf (const Eigen::MatrixBase< Derived > &A)

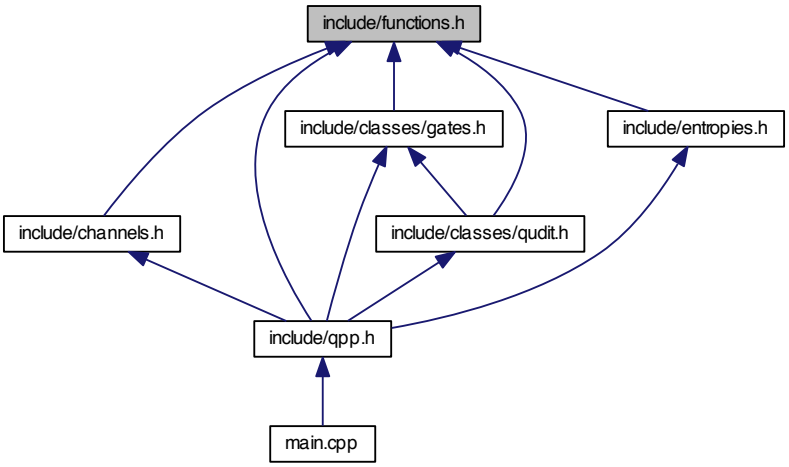
7.10 include/functions.h File Reference

```
#include <cmath>
#include <numeric>
#include <vector>
#include "constants.h"
#include "internal.h"
#include "types.h"
#include "classes/exception.h"
```

Include dependency graph for functions.h:



This graph shows which files directly or indirectly include this file:



Namespaces

- qpp

Functions

- template<typename Derived >
  types::DynMat< typename
  Derived::Scalar > qpp::transpose (const Eigen::MatrixBase< Derived > &A)
- template<typename Derived >
  types::DynMat< typename
  Derived::Scalar > qpp::conjugate (const Eigen::MatrixBase< Derived > &A)
- template<typename Derived >
  types::DynMat< typename
  Derived::Scalar > qpp::adjoint (const Eigen::MatrixBase< Derived > &A)

- template<typename Derived >
  Derived::Scalar qpp::trace (const Eigen::MatrixBase< Derived > &A)
- template<typename Derived >
  Derived::Scalar qpp::det (const Eigen::MatrixBase< Derived > &A)
- template<typename Derived >
  Derived::Scalar qpp::sum (const Eigen::MatrixBase< Derived > &A)
- template<typename Derived >
  double qpp::norm (const Eigen::MatrixBase< Derived > &A)
- template<typename Derived >
  types::cmat qpp::evals (const Eigen::MatrixBase< Derived > &A)
- template<typename Derived >
  types::cmat qpp::evects (const Eigen::MatrixBase< Derived > &A)
- template<typename Derived >
  types::cmat qpp::hevals (const Eigen::MatrixBase< Derived > &A)
- template<typename Derived >
  types::cmat qpp::hevects (const Eigen::MatrixBase< Derived > &A)
- template<typename Derived >
  types::cmat qpp::funm (const Eigen::MatrixBase< Derived > &A, types::cplx(*f)(const types::cplx &))
- template<typename Derived >
  types::cmat qpp::sqrtm (const Eigen::MatrixBase< Derived > &A)
- template<typename Derived >
  types::cmat qpp::absm (const Eigen::MatrixBase< Derived > &A)
- template<typename Derived >
  types::cmat qpp::expm (const Eigen::MatrixBase< Derived > &A)
- template<typename Derived >
  types::cmat qpp::logm (const Eigen::MatrixBase< Derived > &A)
- template<typename Derived >
  types::cmat qpp::sinm (const Eigen::MatrixBase< Derived > &A)
- template<typename Derived >
  types::cmat qpp::cosm (const Eigen::MatrixBase< Derived > &A)
- template<typename Derived >
  types::cmat qpp::spectralpowm (const Eigen::MatrixBase< Derived > &A, const types::cplx z)
- template<typename Derived >
  types::DynMat< typename
  Derived::Scalar > qpp::powm (const Eigen::MatrixBase< Derived > &A, size_t n)
- template<typename OutputScalar , typename Derived >
  types::DynMat< OutputScalar > qpp::fun (const Eigen::MatrixBase< Derived > &A, OutputScalar(*f)(const typename Derived::Scalar &))
- template<typename Derived1 , typename Derived2 >
  types::DynMat< typename
  Derived1::Scalar > qpp::kron (const Eigen::MatrixBase< Derived1 > &A, const Eigen::MatrixBase< Derived2 > &B)
- template<typename Derived >
  types::DynMat< typename
  Derived::Scalar > qpp::kronlist (const std::vector< types::DynMat< typename Derived::Scalar > > &As)
- template<typename Derived >
  types::DynMat< typename
  Derived::Scalar > qpp::kronpow (const Eigen::MatrixBase< Derived > &A, size_t n)
- template<typename Derived >
  types::DynMat< typename
  Derived::Scalar > qpp::reshape (const Eigen::MatrixBase< Derived > &A, size_t rows, size_t cols)
- template<typename Derived >
  types::DynMat< typename
  Derived::Scalar > qpp::syspermute (const Eigen::MatrixBase< Derived > &A, const std::vector< size_t > &perm, const std::vector< size_t > &dims)

- template<typename Derived >
  types::DynMat< typename
  Derived::Scalar > qpp::ptrace2 (const Eigen::MatrixBase< Derived > &A, const std::vector< size_t >
  &dims)

- template<typename Derived >
  types::DynMat< typename
  Derived::Scalar > qpp::ptrace (const Eigen::MatrixBase< Derived > &A, const std::vector< size_t > &sub-
  sys, const std::vector< size_t > &dims)

- template<typename Derived >
  types::DynMat< typename
  Derived::Scalar > qpp::ptranspose (const Eigen::MatrixBase< Derived > &A, const std::vector< size_t >
  &subsys, const std::vector< size_t > &dims)

- template<typename Derived1 , typename Derived2 >
  types::DynMat< typename
  Derived1::Scalar > qpp::comm (const Eigen::MatrixBase< Derived1 > &A, const Eigen::MatrixBase< De-
  rived2 > &B)

- template<typename Derived1 , typename Derived2 >
  types::DynMat< typename
  Derived1::Scalar > qpp::anticomm (const Eigen::MatrixBase< Derived1 > &A, const Eigen::MatrixBase<
  Derived2 > &B)

- template<typename Derived >
  types::DynMat< typename
  Derived::Scalar > qpp::proj (const Eigen::MatrixBase< Derived > &V)

- template<typename Derived >
  types::DynMat< typename
  Derived::Scalar > qpp::expandout (const Eigen::MatrixBase< Derived > &A, size_t pos, const std::vector<
  size_t > &dims)

- template<typename Derived >
  types::DynMat< typename
  Derived::Scalar > qpp::grams (const std::vector< types::DynMat< typename Derived::Scalar > > &Vs)

- template<typename Derived >
  types::DynMat< typename
  Derived::Scalar > qpp::grams (const Eigen::MatrixBase< Derived > &A)

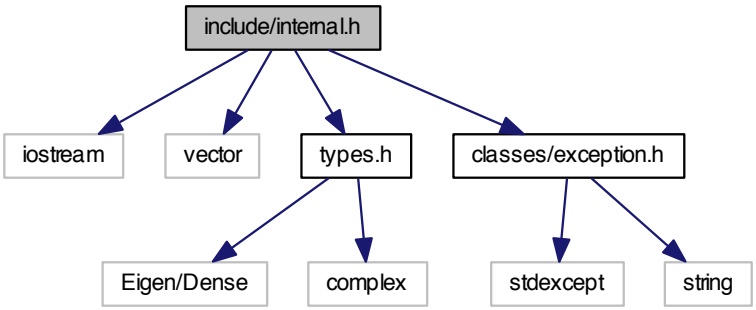
- std::vector< size_t > qpp::n2multiidx (size_t n, const std::vector< size_t > &dims)

- size_t qpp::multiidx2n (const std::vector< size_t > &midx, const std::vector< size_t > &dims)

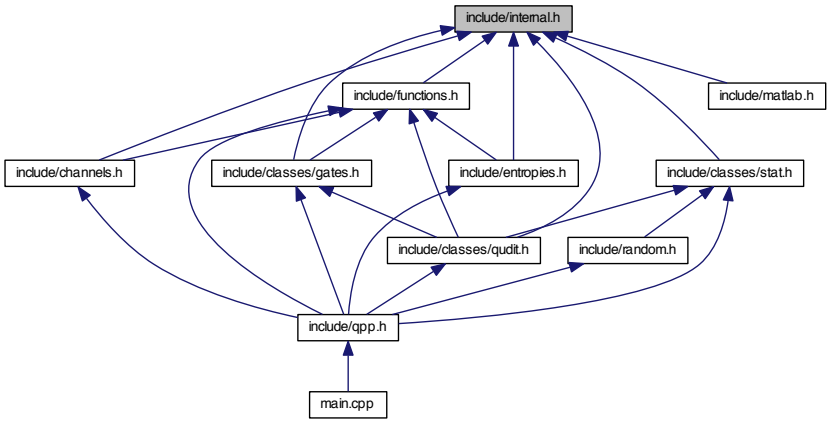
7.11 include/internal.h File Reference

```
#include <iostream>
#include <vector>
#include "types.h"
#include "classes/exception.h"
```

Include dependency graph for internal.h:



This graph shows which files directly or indirectly include this file:



Namespaces

- qpp
- qpp::internal

Functions

- void qpp::internal::_n2multiidx (size_t n, size_t numdims, const size_t *dims, size_t *result)
- size_t qpp::internal::_multiidx2n (const size_t *midx, size_t numdims, const size_t *dims)
- template<typename Derived >
  bool qpp::internal::_check_square_mat (const Eigen::MatrixBase< Derived > &A)
- template<typename Derived >
  bool qpp::internal::_check_vector (const Eigen::MatrixBase< Derived > &A)
- template<typename Derived >
  bool qpp::internal::_check_row_vector (const Eigen::MatrixBase< Derived > &A)
- template<typename Derived >
  bool qpp::internal::_check_col_vector (const Eigen::MatrixBase< Derived > &A)

- template<typename T >
  bool qpp::internal::_check_nonzero_size (const T &x)

- bool qpp::internal::_check_dims (const std::vector< size_t > &dims)

- template<typename Derived >
  bool qpp::internal::_check_dims_match_mat (const std::vector< size_t > &dims, const Eigen::MatrixBase< Derived > &A)

- bool qpp::internal::_check_eq_dims (const std::vector< size_t > &dims, size_t dim)

- bool qpp::internal::_check_subsys (const std::vector< size_t > &subsys, const std::vector< size_t > &dims)

- bool qpp::internal::_check_perm (const std::vector< size_t > &perm, const std::vector< size_t > &dims)

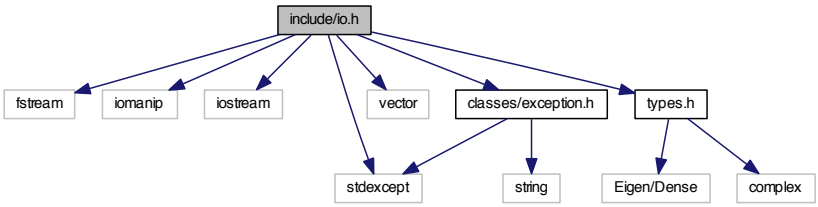
- template<typename Scalar >
  void qpp::internal::_syspermute_worker (size_t numdims, const size_t *cdims, const size_t *cperm, size_t i, size_t &iperm, const types::DynMat< Scalar > &V, types::DynMat< Scalar > &result)

- template<typename Scalar >
  void qpp::internal::_ptranspose_worker (const size_t *midxcol, size_t numdims, size_t numsubsys, const size_t *cdims, const size_t *csubsys, size_t i, size_t j, size_t &iperm, size_t &jperm, const types::DynMat< Scalar > &A, types::DynMat< Scalar > &result)

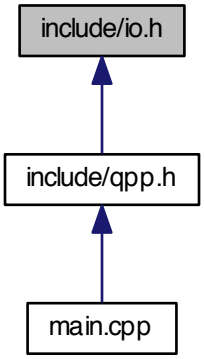
7.12 include/io.h File Reference

```
#include <fstream>
#include <iomanip>
#include <iostream>
#include <stdexcept>
#include <vector>
#include "types.h"
#include "classes/exception.h"
```

Include dependency graph for io.h:



This graph shows which files directly or indirectly include this file:



Namespaces

- qpp

Functions

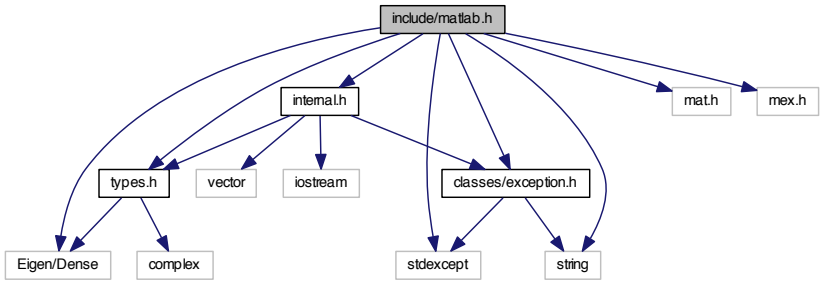
- template<typename T >
  void qpp::disp (const T &x, const std::string &separator=" ", const std::string &start="[", const std::string &end="]", std::ostream &os=std::cout)
- template<typename T >
  void qpp::displn (const T &x, const std::string &separator=" ", const std::string &start="[", const std::string &end="]", std::ostream &os=std::cout)
- template<typename T >
  void qpp::disp (const T *x, const size_t n, const std::string &separator=" ", const std::string &start="[", const std::string &end="]", std::ostream &os=std::cout)
- template<typename T >
  void qpp::displn (const T *x, const size_t n, const std::string &separator=" ", const std::string &start="[", const std::string &end="]", std::ostream &os=std::cout)
- template<typename Derived >
  void qpp::disp (const Eigen::MatrixBase< Derived > &A, double chop=ct::chop, std::ostream &os=std::cout)
- template<typename Derived >
  void qpp::displn (const Eigen::MatrixBase< Derived > &A, double chop=ct::chop, std::ostream &os=std::cout)
- void qpp::disp (const types::cplx c, double chop=ct::chop, std::ostream &os=std::cout)
- void qpp::displn (const types::cplx c, double chop=ct::chop, std::ostream &os=std::cout)
- template<typename Derived >
  void qpp::save (const Eigen::MatrixBase< Derived > &A, const std::string &fname)
- template<typename Derived >
  types::DynMat< typename
  Derived::Scalar > qpp::load (const std::string &fname)

7.13 include/matlab.h File Reference

```
#include <Eigen/Dense>
```

```
#include <stdexcept>
#include <string>
#include "internal.h"
#include "types.h"
#include "classes/exception.h"
#include "mat.h"
#include "mex.h"
```

Include dependency graph for matlab.h:



Namespaces

- qpp

Functions

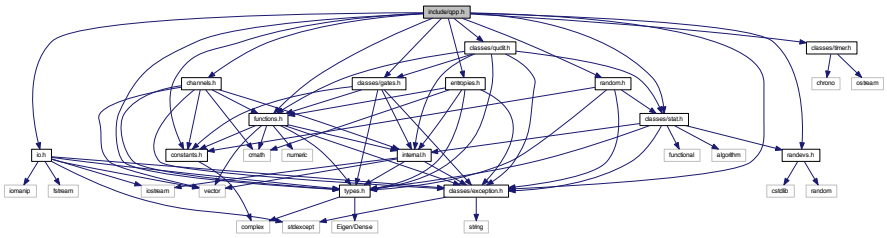
- template<typename Derived >
  Derived qpp::loadMATLABmatrix (const std::string &mat_file, const std::string &var_name)
- template<>
  types::dmat qpp::loadMATLABmatrix (const std::string &mat_file, const std::string &var_name)
- template<>
  types::cmat qpp::loadMATLABmatrix (const std::string &mat_file, const std::string &var_name)
- template<typename Derived >
  void qpp::saveMATLABmatrix (const Eigen::MatrixBase< Derived > &A, const std::string &mat_file, const std::string &var_name, const std::string &mode)
- template<>
  void qpp::saveMATLABmatrix (const Eigen::MatrixBase< typename types::dmat > &A, const std::string &mat_file, const std::string &var_name, const std::string &mode)
- template<>
  void qpp::saveMATLABmatrix (const Eigen::MatrixBase< typename types::cmat > &A, const std::string &mat_file, const std::string &var_name, const std::string &mode)

7.14 include/qpp.h File Reference

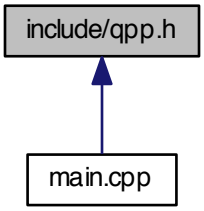
```
#include "channels.h"
```

```
#include "constants.h"
#include "entropies.h"
#include "functions.h"
#include "io.h"
#include "random.h"
#include "types.h"
#include "classes/exception.h"
#include "classes/gates.h"
#include "classes/qudit.h"
#include "classes/randevs.h"
#include "classes/stat.h"
#include "classes/timer.h"
```

Include dependency graph for qpp.h:



This graph shows which files directly or indirectly include this file:



Namespaces

- qpp

Variables

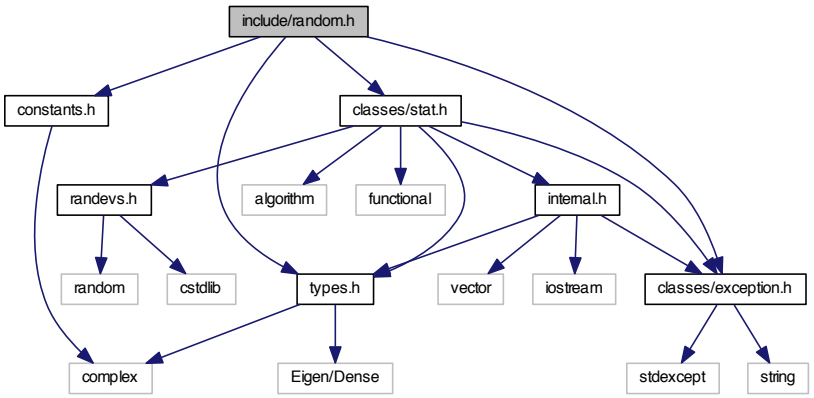
- RandomDevices & qpp::rdevs = RandomDevices::getInstance()
- const Gates & qpp::gt = Gates::getInstance()

7.15 include/random.h File Reference

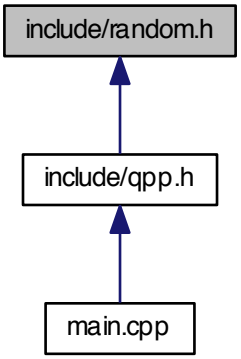
```
#include "constants.h"
```

```
#include "types.h"
#include "classes/exception.h"
#include "classes/stat.h"
```

Include dependency graph for random.h:



This graph shows which files directly or indirectly include this file:



Namespaces

- qpp

Functions

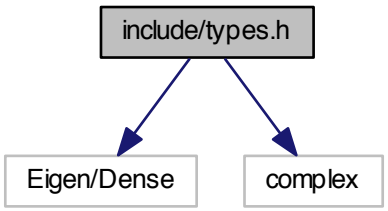
- template<typename Derived >
  Derived qpp::rand (size_t rows, size_t cols, double a=0, double b=1)
- template<>
  types::dmat qpp::rand (size_t rows, size_t cols, double a, double b)
- template<>
  types::cmat qpp::rand (size_t rows, size_t cols, double a, double b)

- double qpp::rand (double a=0, double b=1)
- template<typename Derived >
  Derived qpp::randn (size_t rows, size_t cols, double mean=0, double sigma=1)
- template<>
  types::dmat qpp::randn (size_t rows, size_t cols, double mean, double sigma)
- template<>
  types::cmat qpp::randn (size_t rows, size_t cols, double mean, double sigma)
- double qpp::randn (double mean=0, double sigma=1)
- types::cmat qpp::randU (size_t D)
- types::cmat qpp::randV (size_t Din, size_t Dout)
- std::vector< types::cmat > qpp::randkraus (size_t n, size_t D)
- types::cmat qpp::randH (size_t D)
- types::ket qpp::randket (size_t D)
- types::cmat qpp::randrho (size_t D)

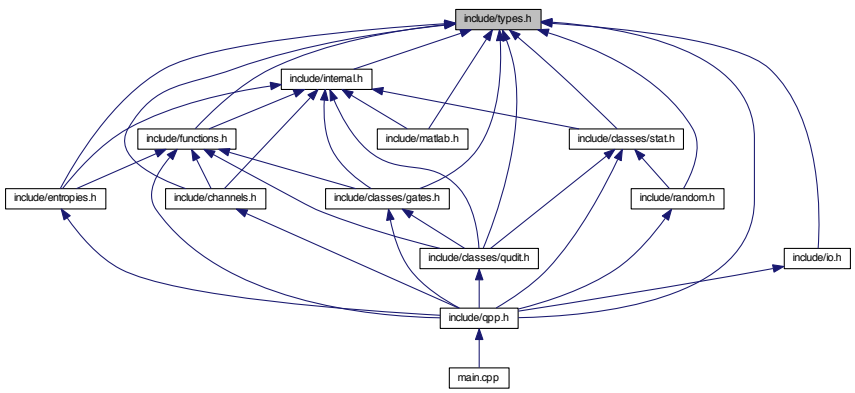
7.16 include/types.h File Reference

```
#include <Eigen/Dense>
#include <complex>
```

Include dependency graph for types.h:



This graph shows which files directly or indirectly include this file:



Namespaces

- qpp
- qpp::types

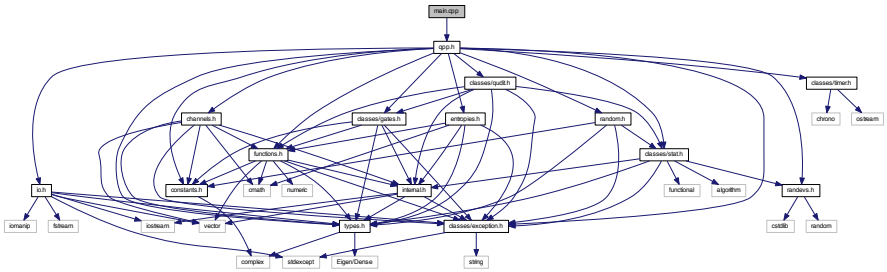
Typedefs

- typedef std::complex< double > qpp::types::cplx
- typedef Eigen::MatrixXcd qpp::types::cmat
- typedef Eigen::MatrixXd qpp::types::dmat
- typedef Eigen::MatrixXf qpp::types::fmat
- typedef Eigen::MatrixXi qpp::types::imat
- typedef Eigen::Matrix< cplx, Eigen::Dynamic, 1 > qpp::types::ket
- typedef Eigen::Matrix< cplx, 1, Eigen::Dynamic > qpp::types::bra
- template<typename Scalar >
  using qpp::types::DynMat = Eigen::Matrix< Scalar, Eigen::Dynamic, Eigen::Dynamic >

7.17 main.cpp File Reference

```
#include "qpp.h"
```

Include dependency graph for main.cpp:



Functions

- int main ()

7.17.1 Function Documentation

7.17.1.1 int main ( )