

qpp
0.1

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Chapter 1

Namespace Index

1.1 Namespace List

Here is a list of all namespaces with brief descriptions:

qpp	9
qpp::ct	29
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qpp::internal	32
qpp::stat	34
qpp::types	34

Chapter 2

Hierarchical Index

2.1 Class Hierarchy

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

qpp::stat::DiscreteDistribution	35
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exception	
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Chapter 3

Class Index

3.1 Class List

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

qpp::stat::DiscreteDistribution	35
qpp::stat::DiscreteDistributionFromComplex	36
qpp::Exception	38
qpp::stat::NormalDistribution	41
qpp::Timer	41
qpp::stat::UniformRealDistribution	42

Chapter 4

File Index

4.1 File List

Here is a list of all files with brief descriptions:

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include/exception.h	47
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include/qpp.h	55
include/random.h	56
include/stat.h	58
include/timer.h	59
include/types.h	60
include/util.h	62
src/main.cpp	64

Chapter 5

Namespace Documentation

5.1 qpp Namespace Reference

Namespaces

- [ct](#)
- [gt](#)
- [internal](#)
- [stat](#)
- [types](#)

Classes

- class [Exception](#)
- class [Timer](#)

Functions

- `template<typename Scalar >`
`double shannon (const types::DynMat< Scalar > &A)`
- `template<typename Scalar >`
`double renyi (const double alpha, const types::DynMat< Scalar > &A)`
- `template<typename Scalar >`
`double renyi_inf (const types::DynMat< Scalar > &A)`
- `template<typename Scalar >`
`types::cmat funm (const types::DynMat< Scalar > &A, types::cplx(*f)(const types::cplx &))`
- `template<typename Scalar >`
`types::cmat absm (const types::DynMat< Scalar > &A)`
- `template<typename Scalar >`
`types::cmat expm (const types::DynMat< Scalar > &A)`
- `template<typename Scalar >`
`types::cmat logm (const types::DynMat< Scalar > &A)`
- `template<typename Scalar >`
`types::cmat sqrtm (const types::DynMat< Scalar > &A)`
- `template<typename Scalar >`
`types::cmat sinm (const types::DynMat< Scalar > &A)`
- `template<typename Scalar >`
`types::cmat cosm (const types::DynMat< Scalar > &A)`
- `template<typename Scalar >`
`types::cmat povm (const types::DynMat< Scalar > &A, const types::cplx z)`

- `template<typename Scalar >`
`types::DynMat< Scalar > powm_int (const types::DynMat< Scalar > &A, size_t n)`
- `template<typename T >`
`void disp (const T &x, const std::string &separator=" ", std::ostream &os=std::cout)`
- `template<typename T >`
`void displn (const T &x, const std::string &separator=" ", std::ostream &os=std::cout)`
- `template<typename Scalar >`
`void disp (const types::DynMat< Scalar > &A, double chop=ct::chop, std::ostream &os=std::cout)`
- `template<typename Scalar >`
`void displn (const types::DynMat< Scalar > &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 Scalar >`
`void save (const types::DynMat< Scalar > &A, const std::string &fname)`
- `template<typename Scalar >`
`types::DynMat< Scalar > load (const std::string &fname)`
- `template<typename Scalar >`
`types::DynMat< Scalar > loadMATLABmatrix (const std::string &mat_file, const std::string &var_name)`
- `template<>`
`types::DynMat< double > loadMATLABmatrix (const std::string &mat_file, const std::string &var_name)`
- `template<>`
`types::DynMat< types::cplx > loadMATLABmatrix (const std::string &mat_file, const std::string &var_name)`
- `template<typename Scalar >`
`void saveMATLABmatrix (const types::DynMat< Scalar > &A, const std::string &mat_file, const std::string &var_name, const std::string &mode)`
- `template<>`
`void saveMATLABmatrix (const types::DynMat< double > &A, const std::string &mat_file, const std::string &var_name, const std::string &mode)`
- `template<>`
`void saveMATLABmatrix (const types::DynMat< types::cplx > &A, const std::string &mat_file, const std::string &var_name, const std::string &mode)`
- `int _init ()`
- `template<typename Scalar >`
`types::DynMat< Scalar > rand (size_t rows, size_t cols, double a=0, double b=1)`
- `template<>`
`types::DynMat< double > rand (size_t rows, size_t cols, double a, double b)`
- `template<>`
`types::DynMat< types::cplx > rand (size_t rows, size_t cols, double a, double b)`
- `double rand (double a=0, double b=1)`
- `template<typename Scalar >`
`types::DynMat< Scalar > randn (size_t rows, size_t cols, double mean=0, double sigma=1)`
- `template<>`
`types::DynMat< double > randn (size_t rows, size_t cols, double mean, double sigma)`
- `template<>`
`types::DynMat< types::cplx > 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 randH (size_t D)`
- `types::cmat randket (size_t D)`
- `types::cmat randrho (size_t D)`
- `template<typename Scalar >`
`types::DynMat< Scalar > transpose (const types::DynMat< Scalar > &A)`
- `template<typename Scalar >`
`types::DynMat< Scalar > conjugate (const types::DynMat< Scalar > &A)`
- `template<typename Scalar >`
`types::DynMat< Scalar > adjoint (const types::DynMat< Scalar > &A)`

- template<typename Scalar >
Scalar [trace](#) (const [types::DynMat](#)< Scalar > &A)
- template<typename Scalar >
Scalar [sum](#) (const [types::DynMat](#)< Scalar > &A)
- template<typename InputScalar , typename OutputScalar >
[types::DynMat](#)< OutputScalar > [fun](#) (const [types::DynMat](#)< InputScalar > &A, OutputScalar(*f)(const InputScalar &))
- template<typename Scalar >
double [norm](#) (const [types::DynMat](#)< Scalar > &A)
- template<typename Scalar >
[types::cmat evals](#) (const [types::DynMat](#)< Scalar > &A)
- template<typename Scalar >
[types::cmat evects](#) (const [types::DynMat](#)< Scalar > &A)
- template<typename Scalar >
[types::cmat hevals](#) (const [types::DynMat](#)< Scalar > &A)
- template<typename Scalar >
[types::cmat hevects](#) (const [types::DynMat](#)< Scalar > &A)
- template<typename Scalar >
[types::DynMat](#)< Scalar > [kron](#) (const [types::DynMat](#)< Scalar > &A, const [types::DynMat](#)< Scalar > &B)
- template<typename Scalar >
[types::DynMat](#)< Scalar > [kron_list](#) (const std::vector< [types::DynMat](#)< Scalar > > &list)
- template<typename Scalar >
[types::DynMat](#)< Scalar > [kron_pow](#) (const [types::DynMat](#)< Scalar > &A, size_t n)
- template<typename Scalar >
[types::DynMat](#)< Scalar > [reshape](#) (const [types::DynMat](#)< Scalar > &A, size_t rows, size_t cols)
- template<typename Scalar >
[types::DynMat](#)< Scalar > [syspermute](#) (const [types::DynMat](#)< Scalar > &A, const std::vector< size_t > perm, const std::vector< size_t > &dims)
- template<typename Scalar >
[types::DynMat](#)< Scalar > [ptrace2](#) (const [types::DynMat](#)< Scalar > &A, const std::vector< size_t > dims)
- template<typename Scalar >
[types::DynMat](#)< Scalar > [ptrace](#) (const [types::DynMat](#)< Scalar > &A, const std::vector< size_t > &subsys, const std::vector< size_t > &dims)
- template<typename Scalar >
[types::DynMat](#)< Scalar > [ptranspose](#) (const [types::DynMat](#)< Scalar > &A, const std::vector< size_t > &subsys, const std::vector< size_t > &dims)

5.1.1 Function Documentation

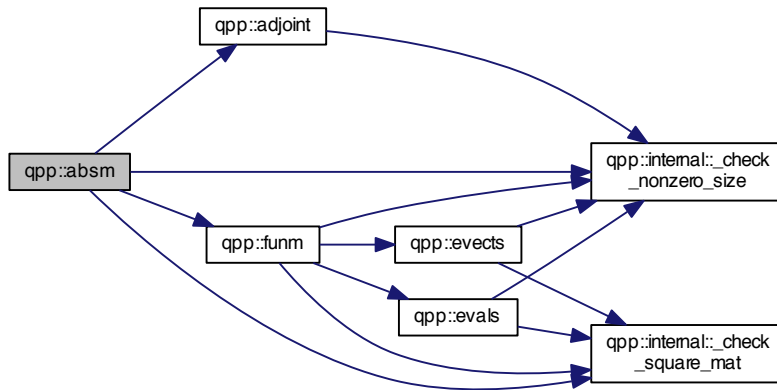
5.1.1.1 int qpp::_init ()

Here is the call graph for this function:



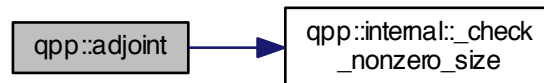
5.1.1.2 `template<typename Scalar > types::cmat qpp::absm (const types::DynMat< Scalar > & A)`

Here is the call graph for this function:



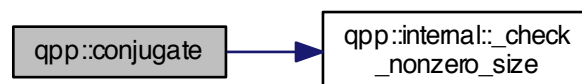
5.1.1.3 `template<typename Scalar > types::DynMat<Scalar> qpp::adjoint (const types::DynMat< Scalar > & A)`

Here is the call graph for this function:



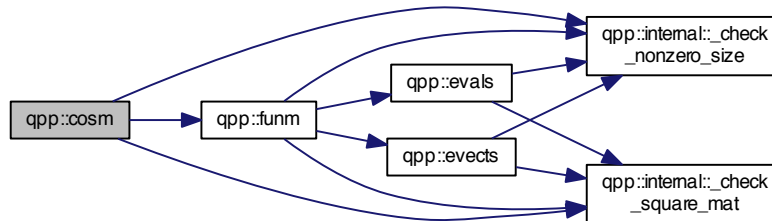
5.1.1.4 `template<typename Scalar > types::DynMat<Scalar> qpp::conjugate (const types::DynMat< Scalar > & A)`

Here is the call graph for this function:



5.1.1.5 `template<typename Scalar > types::cmat qpp::cosm (const types::DynMat< Scalar > & A)`

Here is the call graph for this function:



5.1.1.6 `template<typename T > void qpp::disp (const T & x, const std::string & separator = " ", std::ostream & os = std::cout)`

5.1.1.7 `template<typename Scalar > void qpp::disp (const types::DynMat< Scalar > & A, double chop = ct::chop, std::ostream & os = std::cout)`

5.1.1.8 `void qpp::disp (const types::cplx c, double chop = ct::chop, std::ostream & os = std::cout)` [inline]

Here is the call graph for this function:



5.1.1.9 `template<typename T > void qpp::displn (const T & x, const std::string & separator = " ", std::ostream & os = std::cout)`

Here is the call graph for this function:



5.1.1.10 `template<typename Scalar > void qpp::displn (const types::DynMat< Scalar > & A, double chop = ct:::chop, std::ostream & os = std:::cout)`

Here is the call graph for this function:



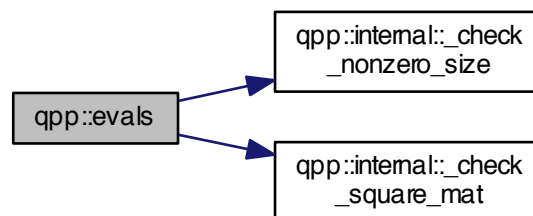
5.1.1.11 `void qpp::displn (const types::cplx c, double chop = ct:::chop, std::ostream & os = std:::cout)`
`[inline]`

Here is the call graph for this function:



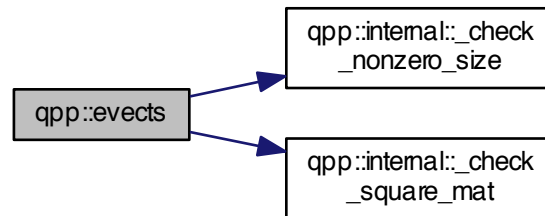
5.1.1.12 `template<typename Scalar > types::cmat qpp::evals (const types::DynMat< Scalar > & A)`

Here is the call graph for this function:



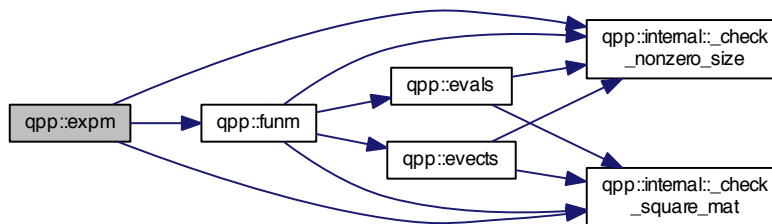
5.1.1.13 `template<typename Scalar > types::cmat qpp::evecs (const types::DynMat< Scalar > & A)`

Here is the call graph for this function:



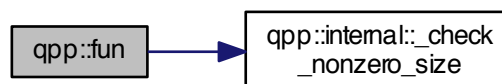
5.1.1.14 `template<typename Scalar > types::cmat qpp::expm (const types::DynMat< Scalar > & A)`

Here is the call graph for this function:



5.1.1.15 `template<typename InputScalar , typename OutputScalar > types::DynMat<OutputScalar> qpp::fun (const types::DynMat< InputScalar > & A, OutputScalar*)(const InputScalar &) f)`

Here is the call graph for this function:



5.1.1.16 `template<typename Scalar > types::cmat qpp::funm (const types::DynMat< Scalar > & A, types::cplx(*) (const types::cplx &) f)`

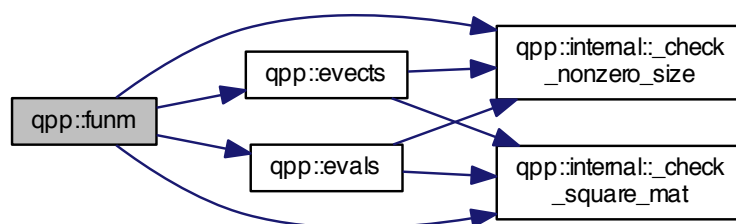
Parameters

A	input matrix
f	function pointer

Returns

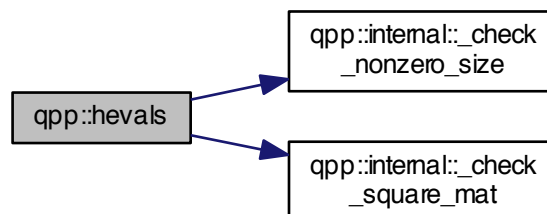
[types::cmat](#)

Here is the call graph for this function:



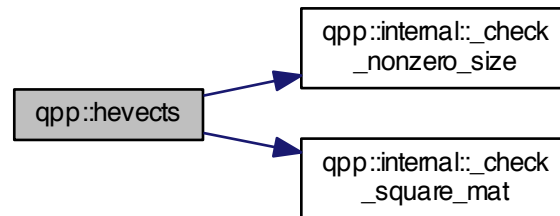
5.1.1.17 `template<typename Scalar> types::cmat qpp::hevals (const types::DynMat< Scalar> & A)`

Here is the call graph for this function:



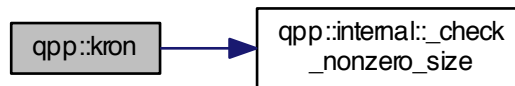
5.1.1.18 `template<typename Scalar > types::cmat qpp::hevects (const types::DynMat< Scalar > & A)`

Here is the call graph for this function:



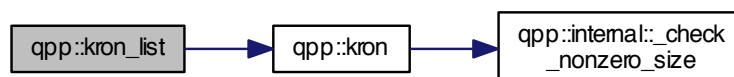
5.1.1.19 `template<typename Scalar > types::DynMat<Scalar> qpp::kron (const types::DynMat< Scalar > & A, const types::DynMat< Scalar > & B)`

Here is the call graph for this function:



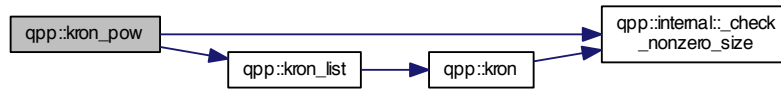
5.1.1.20 `template<typename Scalar > types::DynMat<Scalar> qpp::kron_list (const std::vector< types::DynMat< Scalar >> & list)`

Here is the call graph for this function:



5.1.1.21 `template<typename Scalar > types::DynMat<Scalar> qpp::kron_pow (const types::DynMat< Scalar > & A, size_t n)`

Here is the call graph for this function:



5.1.1.22 `template<typename Scalar > types::DynMat<Scalar> qpp::load (const std::string & fname)`

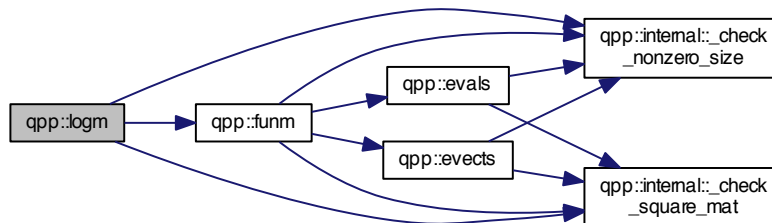
5.1.1.23 `template<typename Scalar > types::DynMat<Scalar> qpp::loadMATLABmatrix (const std::string & mat_file, const std::string & var_name)`

5.1.1.24 `template<> types::DynMat<double> qpp::loadMATLABmatrix (const std::string & mat_file, const std::string & var_name) [inline]`

5.1.1.25 `template<> types::DynMat<types::cplx> qpp::loadMATLABmatrix (const std::string & mat_file, const std::string & var_name) [inline]`

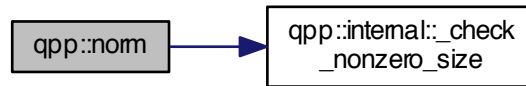
5.1.1.26 `template<typename Scalar > types::cmat qpp::logm (const types::DynMat< Scalar > & A)`

Here is the call graph for this function:



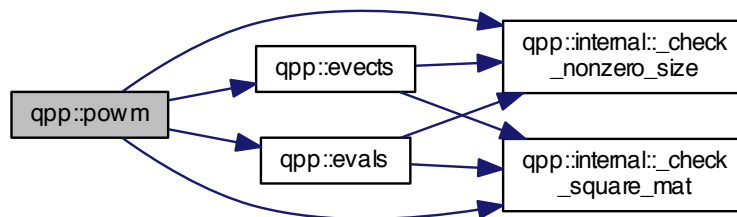
5.1.1.27 `template<typename Scalar > double qpp::norm (const types::DynMat< Scalar > & A)`

Here is the call graph for this function:



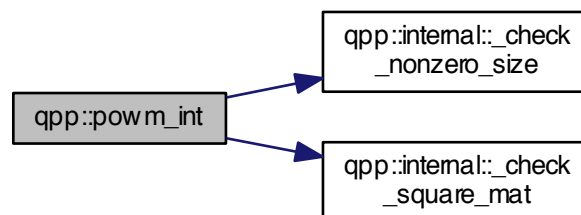
5.1.1.28 `template<typename Scalar > types::cmat qpp::powm (const types::DynMat< Scalar > & A, const types::cplx z)`

Here is the call graph for this function:



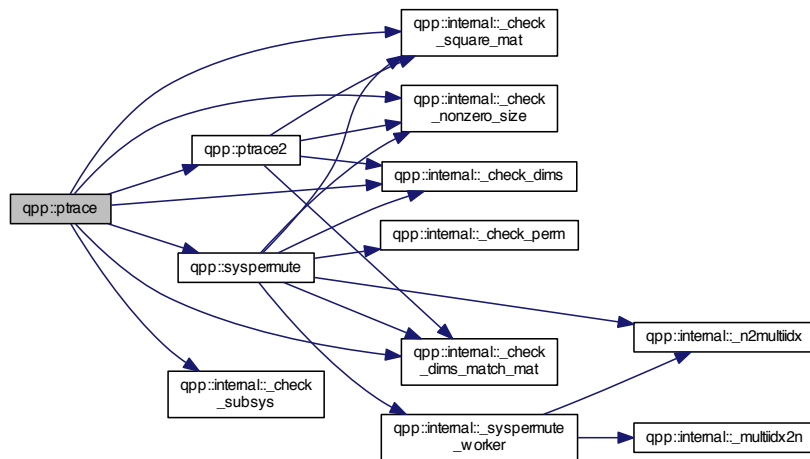
5.1.1.29 `template<typename Scalar > types::DynMat<Scalar> qpp::powm_int (const types::DynMat< Scalar > & A, size_t n)`

Here is the call graph for this function:



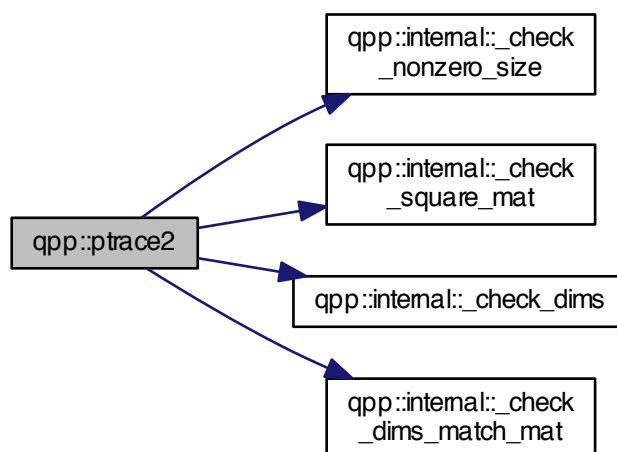
5.1.1.30 `template<typename Scalar> types::DynMat<Scalar> qpp::ptrace (const types::DynMat< Scalar> & A, const std::vector< size_t> & subsys, const std::vector< size_t> & dims)`

Here is the call graph for this function:



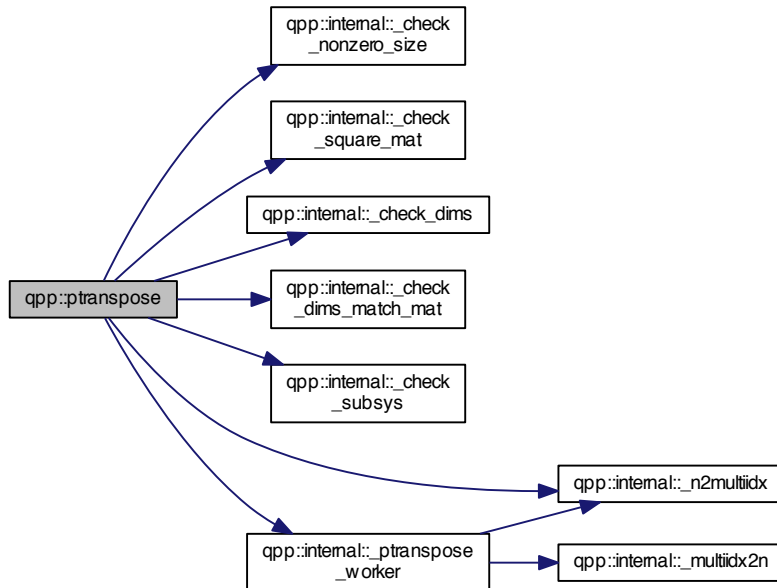
5.1.1.31 `template<typename Scalar> types::DynMat<Scalar> qpp::ptrace2 (const types::DynMat< Scalar> & A, const std::vector< size_t> dims)`

Here is the call graph for this function:



5.1.1.32 `template<typename Scalar > types::DynMat<Scalar> qpp::ptranspose (const types::DynMat< Scalar > & A, const std::vector< size_t > & subsys, const std::vector< size_t > & dims)`

Here is the call graph for this function:



5.1.1.33 `template<typename Scalar > types::DynMat<Scalar> qpp::rand (size_t rows, size_t cols, double a = 0, double b = 1) [inline]`

5.1.1.34 `template<> types::DynMat<double> qpp::rand (size_t rows, size_t cols, double a, double b) [inline]`

5.1.1.35 `template<> types::DynMat<types::cplx> qpp::rand (size_t rows, size_t cols, double a, double b) [inline]`

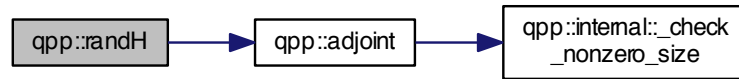
5.1.1.36 `double qpp::rand (double a = 0, double b = 1) [inline]`

Here is the call graph for this function:

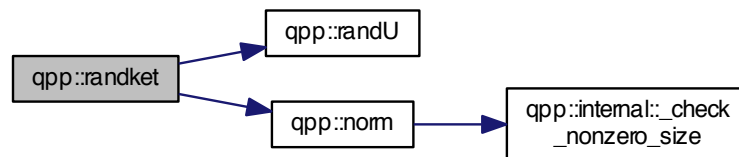


5.1.1.37 `types::cmat qpp::randH (size_t D) [inline]`

Here is the call graph for this function:

5.1.1.38 `types::cmat qpp::randket (size_t D) [inline]`

Here is the call graph for this function:

5.1.1.39 `template<typename Scalar > types::DynMat<Scalar> qpp::randn (size_t rows, size_t cols, double mean = 0, double sigma = 1) [inline]`5.1.1.40 `template<> types::DynMat<double> qpp::randn (size_t rows, size_t cols, double mean, double sigma) [inline]`

Here is the call graph for this function:



5.1.1.41 `template<> types::DynMat<types::cplx> qpp::randn (size_t rows, size_t cols, double mean, double sigma)`
`[inline]`

Here is the call graph for this function:



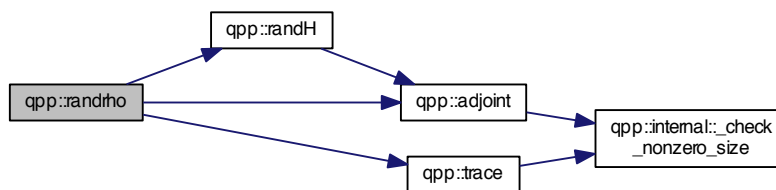
5.1.1.42 `double qpp::randn (double mean = 0, double sigma = 1)` `[inline]`

Here is the call graph for this function:



5.1.1.43 `types::cmat qpp::randrho (size_t D)` `[inline]`

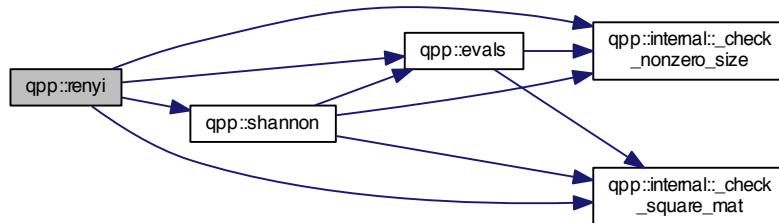
Here is the call graph for this function:



5.1.1.44 `types::cmat qpp::randU (size_t D)` `[inline]`

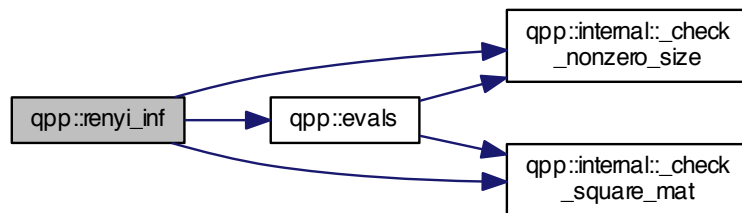
5.1.1.45 `template<typename Scalar > double qpp::renyi (const double alpha, const types::DynMat< Scalar > & A)`

Here is the call graph for this function:



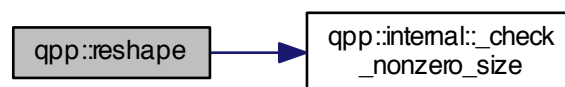
5.1.1.46 `template<typename Scalar > double qpp::renyi_inf (const types::DynMat< Scalar > & A)`

Here is the call graph for this function:



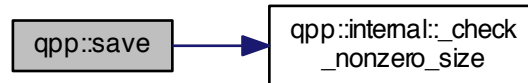
5.1.1.47 `template<typename Scalar > types::DynMat<Scalar> qpp::reshape (const types::DynMat< Scalar > & A, size_t rows, size_t cols)`

Here is the call graph for this function:



5.1.1.48 `template<typename Scalar > void qpp::save (const types::DynMat< Scalar > & A, const std::string & fname)`

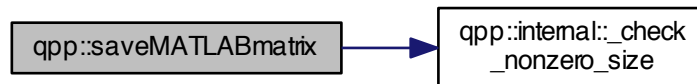
Here is the call graph for this function:



5.1.1.49 `template<typename Scalar > void qpp::saveMATLABmatrix (const types::DynMat< Scalar > & A, const std::string & mat_file, const std::string & var_name, const std::string & mode)`

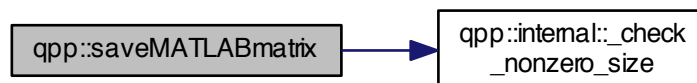
5.1.1.50 `template<> void qpp::saveMATLABmatrix (const types::DynMat< double > & A, const std::string & mat_file, const std::string & var_name, const std::string & mode)`

Here is the call graph for this function:



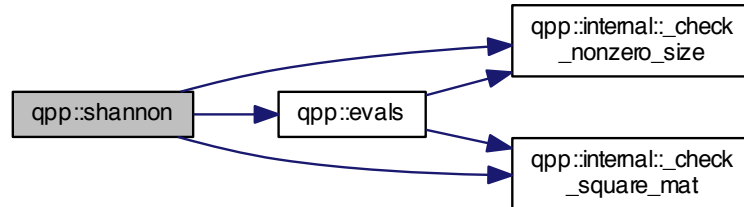
5.1.1.51 `template<> void qpp::saveMATLABmatrix (const types::DynMat< types::cplx > & A, const std::string & mat_file, const std::string & var_name, const std::string & mode)`

Here is the call graph for this function:



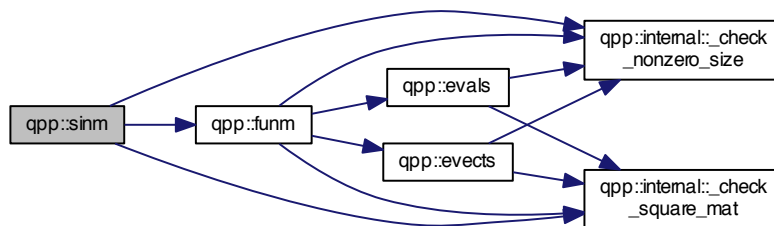
5.1.1.52 `template<typename Scalar > double qpp::shannon (const types::DynMat< Scalar > & A)`

Here is the call graph for this function:



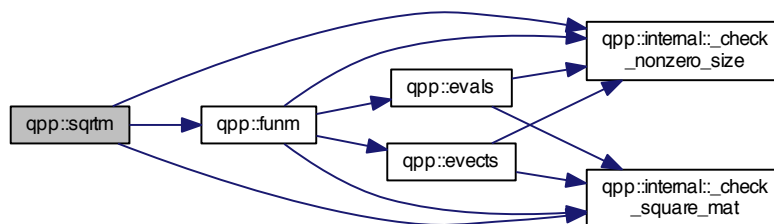
5.1.1.53 `template<typename Scalar > types::cmat qpp::sinm (const types::DynMat< Scalar > & A)`

Here is the call graph for this function:



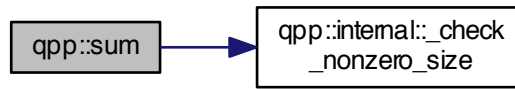
5.1.1.54 `template<typename Scalar > types::cmat qpp::sqrtm (const types::DynMat< Scalar > & A)`

Here is the call graph for this function:



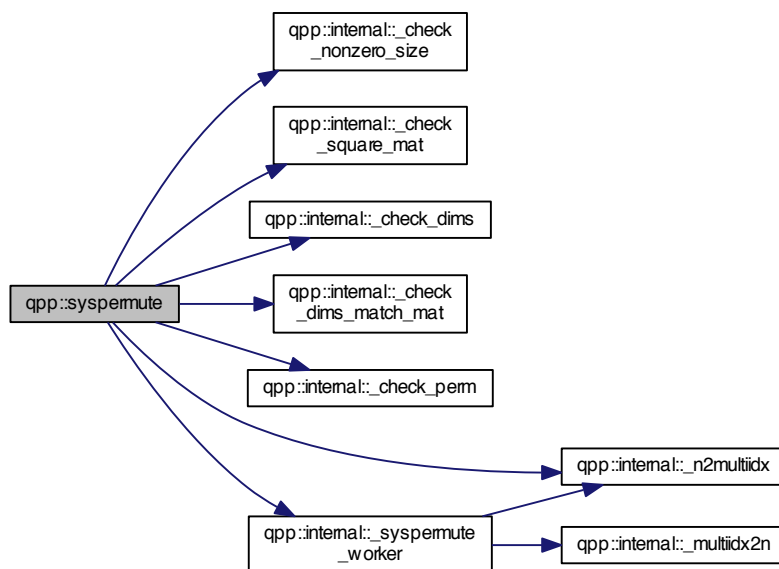
5.1.1.55 `template<typename Scalar > Scalar qpp::sum (const types::DynMat< Scalar > & A)`

Here is the call graph for this function:



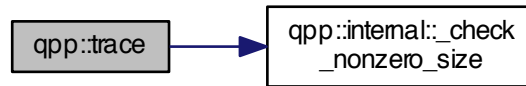
5.1.1.56 `template<typename Scalar > types::DynMat<Scalar> qpp::syspermute (const types::DynMat< Scalar > & A, const std::vector< size_t > perm, const std::vector< size_t > & dims)`

Here is the call graph for this function:



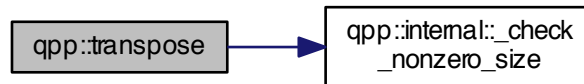
5.1.1.57 `template<typename Scalar > Scalar qpp::trace (const types::DynMat< Scalar > & A)`

Here is the call graph for this function:



5.1.1.58 `template<typename Scalar > types::DynMat<Scalar> qpp::transpose (const types::DynMat< Scalar > & A)`

Here is the call graph for this function:



5.2 qpp::ct Namespace Reference

Functions

- `types::cplx omega (size_t D)`

Variables

- `const double chop = 1e-10`
- `const types::cplx ii = { 0, 1 }`
- `const double pi = 3.141592653589793238462643383279502884`
- `const double ee = 2.718281828459045235360287471352662497`

5.2.1 Function Documentation

5.2.1.1 `types::cplx qpp::ct::omega (size_t D) [inline]`

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 = 2.718281828459045235360287471352662497`

5.2.2.3 `const types::cplx qpp::ct::ii = { 0, 1 }`

5.2.2.4 `const double qpp::ct::pi = 3.141592653589793238462643383279502884`

5.3 qpp::gt Namespace Reference

Functions

- `void _init_gates ()`
- `types::cmat Rtheta (double theta)`
- `types::cmat CU (const types::cmat &U)`
- `types::cmat Zd (size_t D)`
- `types::cmat Fd (size_t D)`
- `types::cmat Xd (size_t D)`
- `types::cmat CUd (const types::cmat &U)`
- `types::cmat TOF (8, 8)`

Variables

- `types::cmat H`
- `types::cmat Id2`
- `types::cmat X`
- `types::cmat Y`
- `types::cmat Z`
- `types::cmat S`
- `types::cmat T`
- `types::cmat CNOT`
- `types::cmat CP`
- `types::cmat TOF`

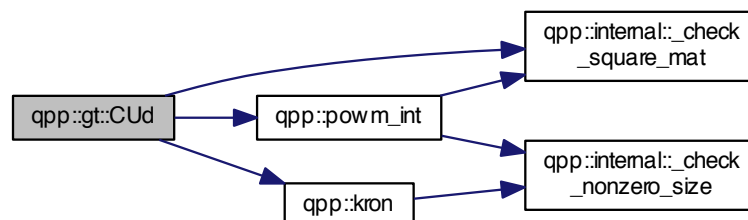
5.3.1 Function Documentation

5.3.1.1 `void qpp::gt::_init_gates () [inline]`

5.3.1.2 `types::cmat qpp::gt::CU (const types::cmat & U) [inline]`

5.3.1.3 `types::cmat qpp::gt::CUd (const types::cmat & U) [inline]`

Here is the call graph for this function:



5.3.1.4 `types::cmat qpp::gt::Fd (size_t D) [inline]`

Here is the call graph for this function:



5.3.1.5 `types::cmat qpp::gt::Rtheta (double theta) [inline]`

5.3.1.6 `types::cmat qpp::gt::TOF (8, 8)`

5.3.1.7 `types::cmat qpp::gt::Xd (size_t D) [inline]`

Here is the call graph for this function:



5.3.1.8 `types::cmat qpp::gt::Zd (size_t D) [inline]`

Here is the call graph for this function:



5.3.2 Variable Documentation

5.3.2.1 `types::cmat qpp::gt::CNOT`

5.3.2.2 `types::cmat qpp::gt::CP`

5.3.2.3 `types::cmat qpp::gt::H`

5.3.2.4 `types::cmat qpp::gt::ld2`

5.3.2.5 `types::cmat qpp::gt::S`

5.3.2.6 `types::cmat qpp::gt::T`

5.3.2.7 `types::cmat qpp::gt::TOF`

5.3.2.8 `types::cmat qpp::gt::X`

5.3.2.9 `types::cmat qpp::gt::Y`

5.3.2.10 `types::cmat qpp::gt::Z`

5.4 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 Scalar >`
`bool _check_square_mat (const types::DynMat< Scalar > &A)`
- `template<typename Scalar >`
`bool _check_vector (const types::DynMat< Scalar > &A)`
- `template<typename Scalar >`
`bool _check_nonzero_size (const types::DynMat< Scalar > &A)`
- `template<typename Scalar >`
`bool _check_dims_match_mat (const std::vector< size_t > &dims, const types::DynMat< Scalar > &A)`
- `bool _check_dims (const std::vector< size_t > &dims)`
- `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 (const size_t *midxcol, size_t numdims, const size_t *cdims, const size_t *cperm, size_t i, size_t j, size_t &iperm, size_t &jperm, const types::DynMat< Scalar > &A, 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)`

5.4.1 Function Documentation

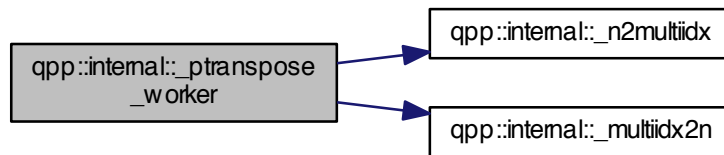
5.4.1.1 `bool qpp::internal::_check_dims (const std::vector< size_t > & dims) [inline]`

5.4.1.2 `template<typename Scalar > bool qpp::internal::_check_dims_match_mat (const std::vector< size_t > & dims, const types::DynMat< Scalar > & A)`

5.4.1.3 `bool qpp::internal::_check_eq_dims (const std::vector< size_t > & dims, size_t dim) [inline]`

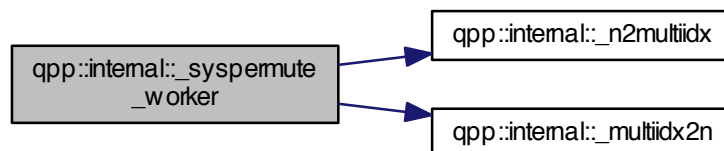
- 5.4.1.4 `template<typename Scalar > bool qpp::internal::_check_nonzero_size (const types::DynMat< Scalar > & A)`
- 5.4.1.5 `bool qpp::internal::_check_perm (const std::vector< size_t > & perm, const std::vector< size_t > & dims)`
[inline]
- 5.4.1.6 `template<typename Scalar > bool qpp::internal::_check_square_mat (const types::DynMat< Scalar > & A)`
- 5.4.1.7 `bool qpp::internal::_check_subsys (const std::vector< size_t > & subsys, const std::vector< size_t > & dims)`
[inline]
- 5.4.1.8 `template<typename Scalar > bool qpp::internal::_check_vector (const types::DynMat< Scalar > & A)`
- 5.4.1.9 `size_t qpp::internal::_multiidx2n (const size_t * midx, size_t numdims, const size_t * dims)` [inline]
- 5.4.1.10 `void qpp::internal::_n2multiidx (size_t n, size_t numdims, const size_t * dims, size_t * result)` [inline]
- 5.4.1.11 `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)` [inline]

Here is the call graph for this function:



- 5.4.1.12 `template<typename Scalar > void qpp::internal::_syspermute_worker (const size_t * midxcol, size_t numdims, const size_t * cdims, const size_t * cperm, size_t i, size_t j, size_t & iperm, size_t & jperm, const types::DynMat< Scalar > & A, types::DynMat< Scalar > & result)` [inline]

Here is the call graph for this function:



5.5 qpp::stat Namespace Reference

Classes

- class [NormalDistribution](#)
- class [UniformRealDistribution](#)
- class [DiscreteDistribution](#)
- class [DiscreteDistributionFromComplex](#)

Variables

- `std::random_device` [_rd](#)
- `std::mt19937` [_rng](#)

5.5.1 Variable Documentation

5.5.1.1 `std::random_device` [qpp::stat::_rd](#)

5.5.1.2 `std::mt19937` [qpp::stat::_rng](#)

5.6 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](#)
- `template<typename Expression >`
using [Expression2DynMat](#) = `Eigen::Matrix< typename Expression::Scalar, Eigen::Dynamic, Eigen::Dynamic >`
- `template<typename Scalar >`
using [DynMat](#) = `Eigen::Matrix< Scalar, Eigen::Dynamic, Eigen::Dynamic >`

5.6.1 Typedef Documentation

5.6.1.1 typedef `Eigen::MatrixXcd` [qpp::types::cmat](#)

5.6.1.2 typedef `std::complex<double>` [qpp::types::cplx](#)

5.6.1.3 typedef `Eigen::MatrixXd` [qpp::types::dmat](#)

5.6.1.4 `template<typename Scalar > using` [qpp::types::DynMat](#) = `typedef Eigen::Matrix<Scalar, Eigen::Dynamic, Eigen::Dynamic>`

5.6.1.5 `template<typename Expression > using` [qpp::types::Expression2DynMat](#) = `typedef Eigen::Matrix<typename Expression::Scalar, Eigen::Dynamic, Eigen::Dynamic>`

5.6.1.6 typedef `Eigen::MatrixXf` [qpp::types::fmat](#)

5.6.1.7 typedef `Eigen::MatrixXi` [qpp::types::imat](#)

Chapter 6

Class Documentation

6.1 qpp::stat::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::stat::DiscreteDistribution::DiscreteDistribution (InputIterator first, InputIterator last)` `[inline]`

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

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

6.1.2 Member Function Documentation

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

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

6.1.3 Member Data Documentation

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

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

- [include/stat.h](#)

6.2 qpp::stat::DiscreteDistributionFromComplex Class Reference

```
#include <stat.h>
```

Public Member Functions

- `template<typename InputIterator >`
[DiscreteDistributionFromComplex](#) (InputIterator first, InputIterator last)
- [DiscreteDistributionFromComplex](#) (std::initializer_list< [types::cplx](#) > amplitudes)
- [DiscreteDistributionFromComplex](#) (std::vector< [types::cplx](#) > amplitudes)
- [DiscreteDistributionFromComplex](#) (const [types::cmat](#) &v)
- `size_t` [sample](#) ()
- `std::vector< double >` [probabilities](#) ()

Protected Member Functions

- `template<typename InputIterator >`
`std::vector< double >` [cplx2amplitudes](#) (InputIterator first, InputIterator last)

Protected Attributes

- `std::discrete_distribution`
`< size_t >` [_d](#)

6.2.1 Constructor & Destructor Documentation

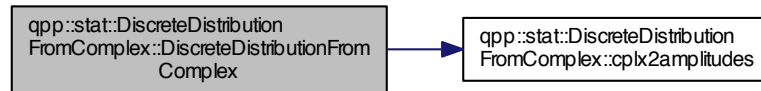
6.2.1.1 `template<typename InputIterator > qpp::stat::DiscreteDistributionFromComplex::DiscreteDistributionFromComplex (`
`InputIterator first, InputIterator last)` `[inline]`

Here is the call graph for this function:



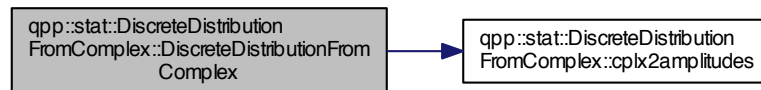
6.2.1.2 `qpp::stat::DiscreteDistributionFromComplex::DiscreteDistributionFromComplex (std::initializer_list< types::cplx > amplitudes) [inline]`

Here is the call graph for this function:



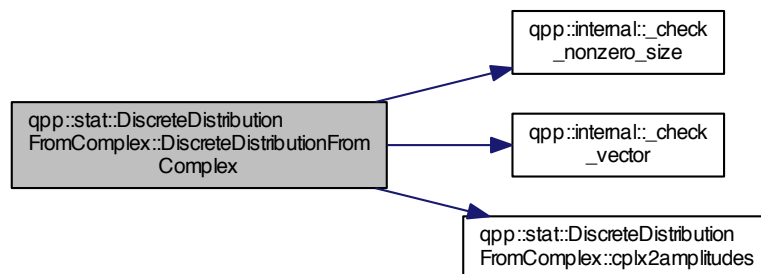
6.2.1.3 `qpp::stat::DiscreteDistributionFromComplex::DiscreteDistributionFromComplex (std::vector< types::cplx > amplitudes) [inline]`

Here is the call graph for this function:



6.2.1.4 `qpp::stat::DiscreteDistributionFromComplex::DiscreteDistributionFromComplex (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::stat::DiscreteDistributionFromComplex::cplx2amplitudes (InputIterator first, InputIterator last) [inline], [protected]`

6.2.2.2 `std::vector<double> qpp::stat::DiscreteDistributionFromComplex::probabilities () [inline]`

6.2.2.3 `size_t qpp::stat::DiscreteDistributionFromComplex::sample () [inline]`

6.2.3 Member Data Documentation

6.2.3.1 `std::discrete_distribution<size_t> qpp::stat::DiscreteDistributionFromComplex::_d [protected]`

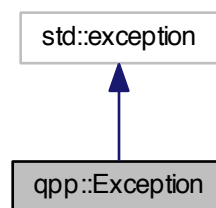
The documentation for this class was generated from the following file:

- include/[stat.h](#)

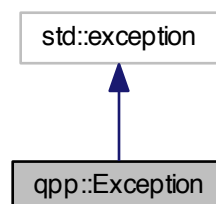
6.3 qpp::Exception Class Reference

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

Inheritance diagram for qpp::Exception:



Collaboration diagram for qpp::Exception:



Public Types

- enum [Type](#) {
[Type::UNKNOWN_EXCEPTION](#) = 0, [Type::MATRIX_NOT_SQUARE](#), [Type::MATRIX_NOT_VECTOR](#), [Type::MATRIX_ZERO_SIZE](#),
[Type::DIMS_MISMATCH_MATRIX](#), [Type::DIMS_HAVE_ZERO](#), [Type::DIMS_NOT_EQUAL](#), [Type::SUBSYS_MISMATCH_DIMS](#),
[Type::PERM_MISMATCH_DIMS](#), [Type::NOT_QUBIT_GATE](#), [Type::NOT_QUBIT_SUBSYS](#), [Type::OUT_OF_RANGE](#),
[Type::UNDEFINED_TYPE](#), [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 noexcept override
- 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]

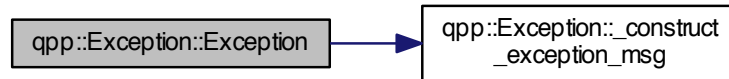
Enumerator

UNKNOWN_EXCEPTION
MATRIX_NOT_SQUARE
MATRIX_NOT_VECTOR
MATRIX_ZERO_SIZE
DIMS_MISMATCH_MATRIX
DIMS_HAVE_ZERO
DIMS_NOT_EQUAL
SUBSYS_MISMATCH_DIMS
PERM_MISMATCH_DIMS
NOT_QUBIT_GATE
NOT_QUBIT_SUBSYS
OUT_OF_RANGE
UNDEFINED_TYPE
CUSTOM_EXCEPTION

6.3.2 Constructor & Destructor Documentation

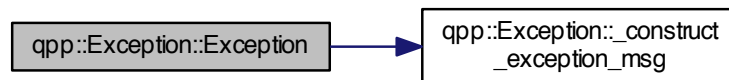
6.3.2.1 `qpp::Exception::Exception (const std::string & where, const Type & type)` `[inline]`

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/exception.h](#)

6.4 qpp::stat::NormalDistribution Class Reference

```
#include <stat.h>
```

Public Member Functions

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

Protected Attributes

- std::normal_distribution [_d](#)

6.4.1 Constructor & Destructor Documentation

6.4.1.1 `qpp::stat::NormalDistribution::NormalDistribution (double mean = 0, double sigma = 1)` [inline]

6.4.2 Member Function Documentation

6.4.2.1 `double qpp::stat::NormalDistribution::sample ()` [inline]

6.4.3 Member Data Documentation

6.4.3.1 `std::normal_distribution qpp::stat::NormalDistribution::_d` [protected]

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

- include/[stat.h](#)

6.5 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)

6.5.1 Constructor & Destructor Documentation

6.5.1.1 `qpp::Timer::Timer ()` `[inline]`

6.5.1.2 `virtual qpp::Timer::~~Timer ()` `[virtual],[default]`

6.5.2 Member Function Documentation

6.5.2.1 `double qpp::Timer::seconds () const` `[inline]`

6.5.2.2 `void qpp::Timer::tic ()` `[inline]`

6.5.2.3 `void qpp::Timer::toc ()` `[inline]`

6.5.3 Friends And Related Function Documentation

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

6.5.4 Member Data Documentation

6.5.4.1 `std::chrono::high_resolution_clock::time_point qpp::Timer::_end` `[protected]`

6.5.4.2 `std::chrono::high_resolution_clock::time_point qpp::Timer::_start` `[protected]`

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

- `include/timer.h`

6.6 qpp::stat::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`

6.6.1 Constructor & Destructor Documentation

6.6.1.1 `qpp::stat::UniformRealDistribution::UniformRealDistribution (double a = 0, double b = 1)` `[inline]`

6.6.2 Member Function Documentation

6.6.2.1 `double qpp::stat::UniformRealDistribution::sample ()` `[inline]`

6.6.3 Member Data Documentation

6.6.3.1 std::uniform_real_distribution qpp::stat::UniformRealDistribution::_d [protected]

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

- include/[stat.h](#)

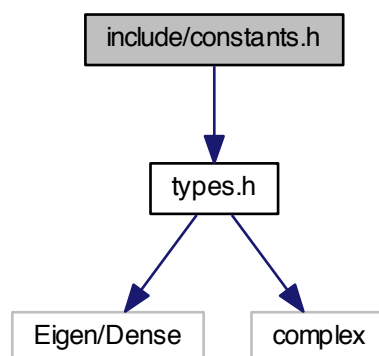
Chapter 7

File Documentation

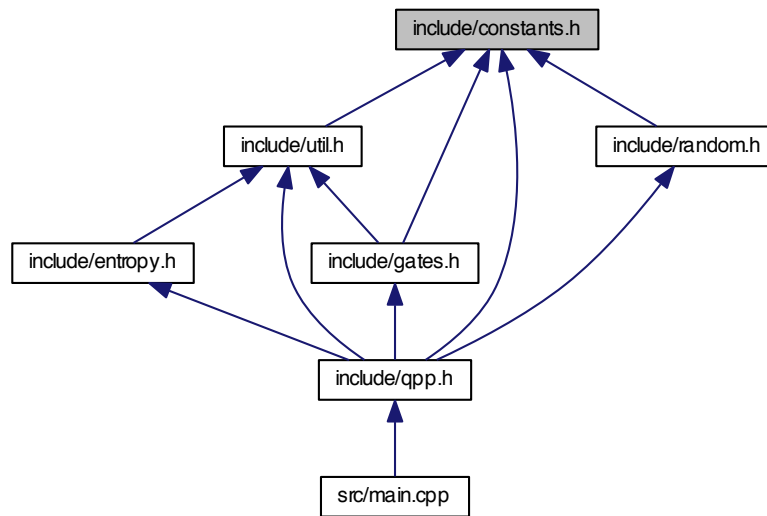
7.1 include/constants.h File Reference

```
#include "types.h"
```

Include dependency graph for constants.h:



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



Namespaces

- [qpp](#)
- [qpp::ct](#)

Functions

- `types::cplx qpp::ct::omega (size_t D)`

Variables

- `const double qpp::ct::chop = 1e-10`
- `const types::cplx qpp::ct::ii = { 0, 1 }`
- `const double qpp::ct::pi = 3.141592653589793238462643383279502884`
- `const double qpp::ct::ee = 2.718281828459045235360287471352662497`

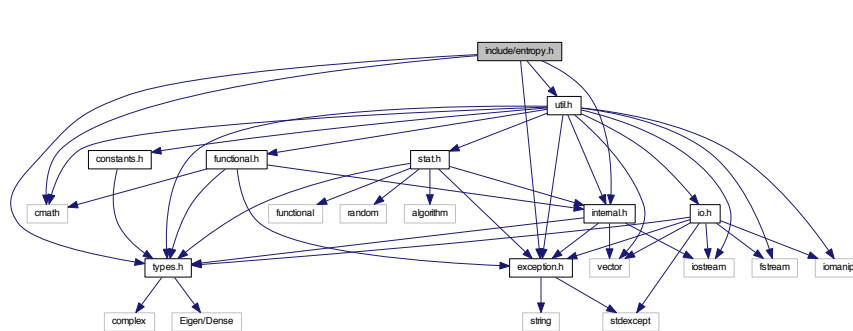
7.2 include/entropy.h File Reference

```

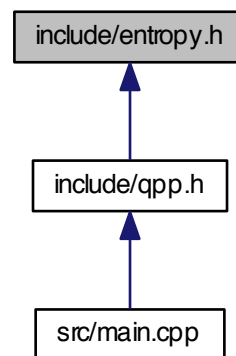
#include <cmath>
#include "types.h"
#include "util.h"
#include "internal.h"
#include "exception.h"

```

Include dependency graph for entropy.h:



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



Namespaces

- [qpp](#)

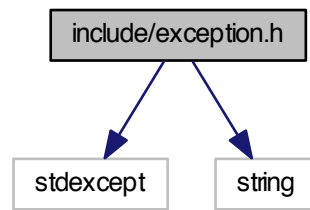
Functions

- `template<typename Scalar >`
`double qpp::shannon (const types::DynMat< Scalar > &A)`
- `template<typename Scalar >`
`double qpp::renyi (const double alpha, const types::DynMat< Scalar > &A)`
- `template<typename Scalar >`
`double qpp::renyi_inf (const types::DynMat< Scalar > &A)`

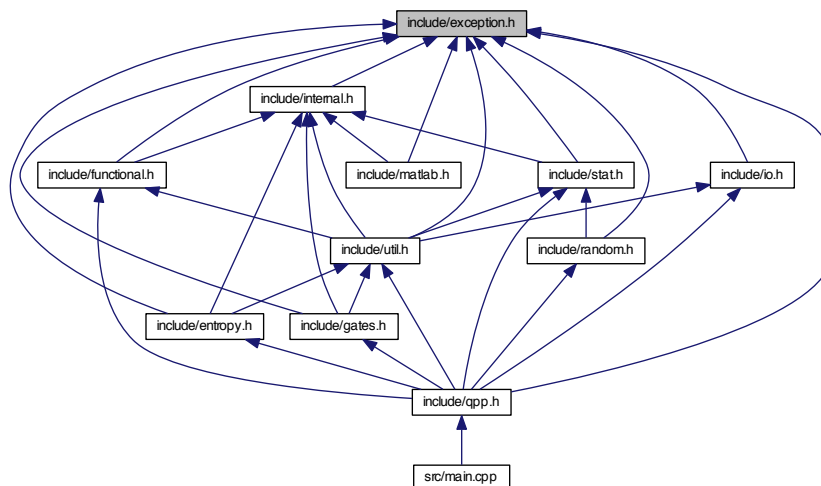
7.3 include/exception.h File Reference

```
#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](#)

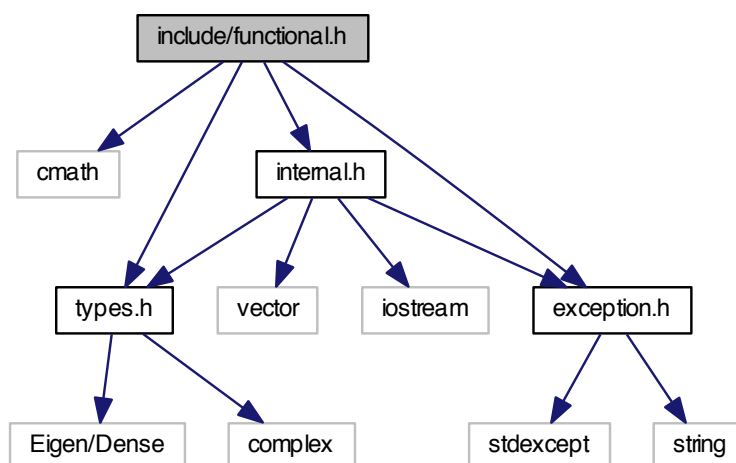
7.4 include/functional.h File Reference

```

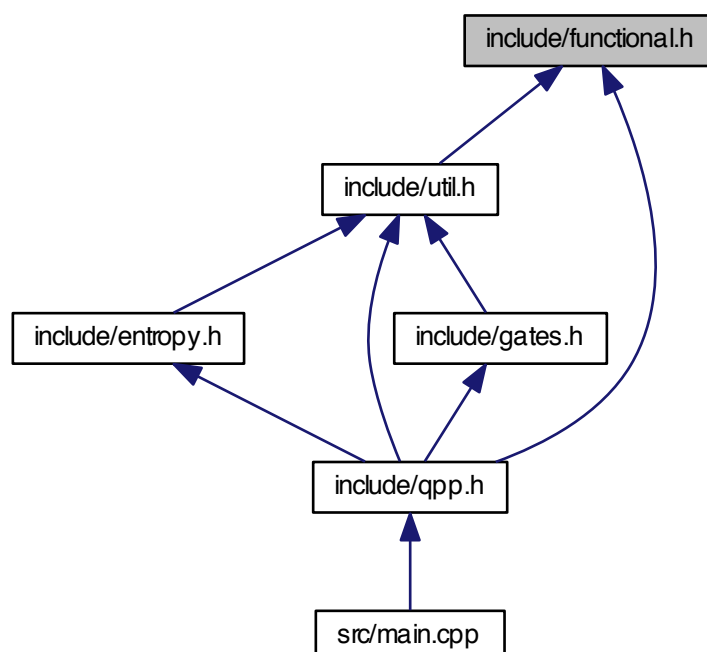
#include <cmath>
#include "types.h"
#include "internal.h"
#include "exception.h"

```


Include dependency graph for functional.h:



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



Namespaces

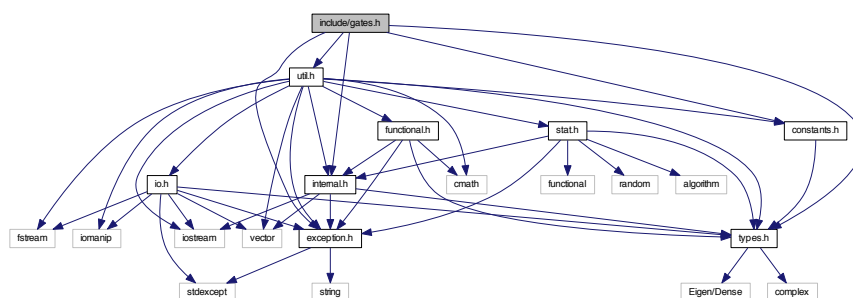
- [qpp](#)

Functions

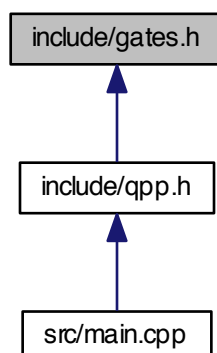
- `template<typename Scalar >`
`types::cmat qpp::funm (const types::DynMat< Scalar > &A, types::cplx(*f)(const types::cplx &))`
- `template<typename Scalar >`
`types::cmat qpp::absm (const types::DynMat< Scalar > &A)`
- `template<typename Scalar >`
`types::cmat qpp::expm (const types::DynMat< Scalar > &A)`
- `template<typename Scalar >`
`types::cmat qpp::logm (const types::DynMat< Scalar > &A)`
- `template<typename Scalar >`
`types::cmat qpp::sqrtm (const types::DynMat< Scalar > &A)`
- `template<typename Scalar >`
`types::cmat qpp::sinm (const types::DynMat< Scalar > &A)`
- `template<typename Scalar >`
`types::cmat qpp::cosm (const types::DynMat< Scalar > &A)`
- `template<typename Scalar >`
`types::cmat qpp::powm (const types::DynMat< Scalar > &A, const types::cplx z)`
- `template<typename Scalar >`
`types::DynMat< Scalar > qpp::powm_int (const types::DynMat< Scalar > &A, size_t n)`

7.5 include/gates.h File Reference

```
#include "types.h"
#include "constants.h"
#include "util.h"
#include "internal.h"
#include "exception.h"
Include dependency graph for gates.h:
```



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



Namespaces

- [qpp](#)
- [qpp::gt](#)

Functions

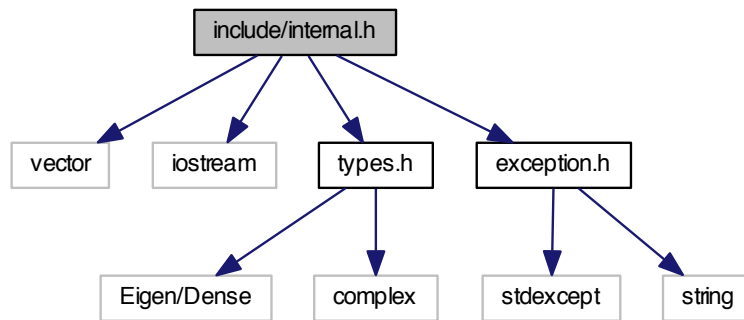
- void [qpp::gt::_init_gates](#) ()
- [types::cmat qpp::gt::Rtheta](#) (double theta)
- [types::cmat qpp::gt::CU](#) (const [types::cmat](#) &U)
- [types::cmat qpp::gt::Zd](#) (size_t D)
- [types::cmat qpp::gt::Fd](#) (size_t D)
- [types::cmat qpp::gt::Xd](#) (size_t D)
- [types::cmat qpp::gt::CUd](#) (const [types::cmat](#) &U)

Variables

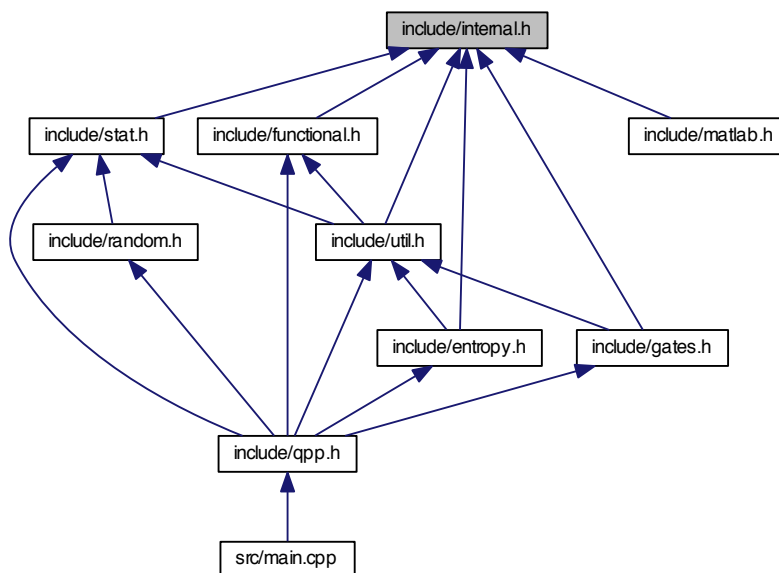
- [types::cmat qpp::gt::H](#)
- [types::cmat qpp::gt::Id2](#)
- [types::cmat qpp::gt::X](#)
- [types::cmat qpp::gt::Y](#)
- [types::cmat qpp::gt::Z](#)
- [types::cmat qpp::gt::S](#)
- [types::cmat qpp::gt::T](#)
- [types::cmat qpp::gt::CNOT](#)
- [types::cmat qpp::gt::CP](#)
- [types::cmat qpp::gt::TOF](#)

7.6 include/internal.h File Reference

```
#include <vector>
#include <iostream>
#include "types.h"
#include "exception.h"
Include dependency graph for internal.h:
```



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



Namespaces

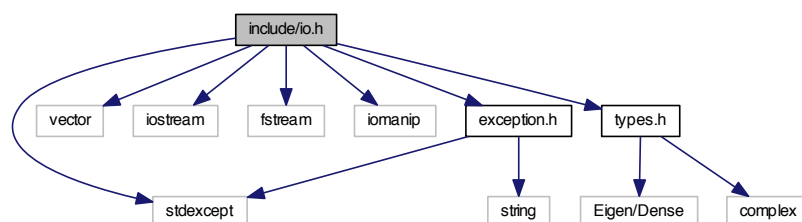
- [qpp](#)
- [qpp::internal](#)

Functions

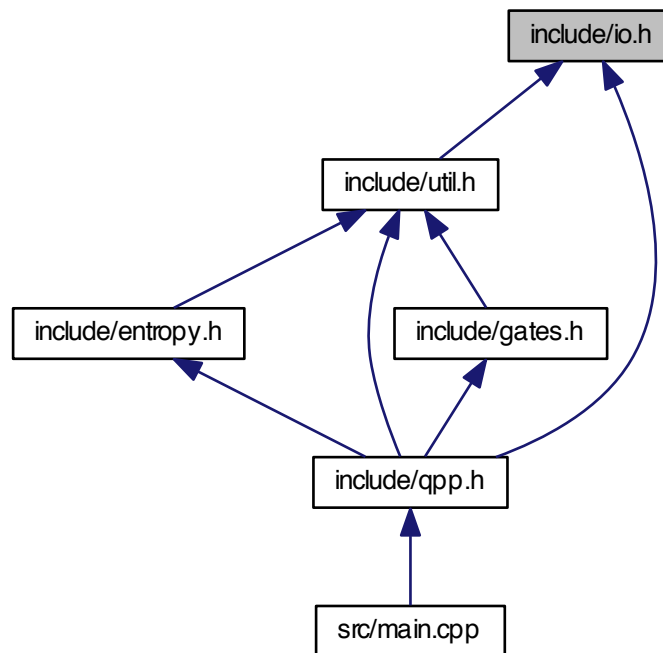
- void [qpp::internal::_n2multiidx](#) (size_t n, size_t numdims, const size_t *dims, size_t *result)
- size_t [qpp::internal::_multiidx2n](#) (const size_t *midx, size_t numdims, const size_t *dims)
- template<typename Scalar >
bool [qpp::internal::_check_square_mat](#) (const types::DynMat< Scalar > &A)
- template<typename Scalar >
bool [qpp::internal::_check_vector](#) (const types::DynMat< Scalar > &A)
- template<typename Scalar >
bool [qpp::internal::_check_nonzero_size](#) (const types::DynMat< Scalar > &A)
- template<typename Scalar >
bool [qpp::internal::_check_dims_match_mat](#) (const std::vector< size_t > &dims, const types::DynMat< Scalar > &A)
- bool [qpp::internal::_check_dims](#) (const std::vector< size_t > &dims)
- 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](#) (const size_t *midxcol, size_t numdims, const size_t *cdims, const size_t *cperm, size_t i, size_t j, size_t &iperm, size_t &jperm, const types::DynMat< Scalar > &A, types::DynMat< Scalar > &result)
- template<typename Scalar >
void [qpp::internal::_ptrtranspose_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)

7.7 include/io.h File Reference

```
#include <stdexcept>
#include <vector>
#include <iostream>
#include <fstream>
#include <iomanip>
#include "types.h"
#include "exception.h"
Include dependency graph for io.h:
```



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



Namespaces

- [qpp](#)

Functions

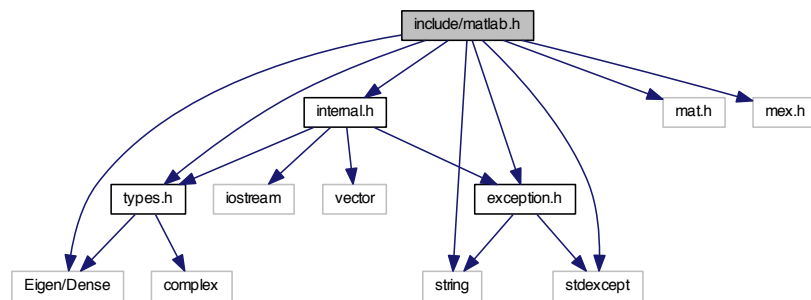
- `template<typename T >`
`void qpp::disp (const T &x, const std::string &separator=" ", std::ostream &os=std::cout)`
- `template<typename T >`
`void qpp::displn (const T &x, const std::string &separator=" ", std::ostream &os=std::cout)`
- `template<typename Scalar >`
`void qpp::disp (const types::DynMat< Scalar > &A, double chop=ct::chop, std::ostream &os=std::cout)`
- `template<typename Scalar >`
`void qpp::displn (const types::DynMat< Scalar > &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 Scalar >`
`void qpp::save (const types::DynMat< Scalar > &A, const std::string &fname)`
- `template<typename Scalar >`
`types::DynMat< Scalar > qpp::load (const std::string &fname)`

7.8 include/matlab.h File Reference

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

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

Include dependency graph for matlab.h:



Namespaces

- [qpp](#)

Functions

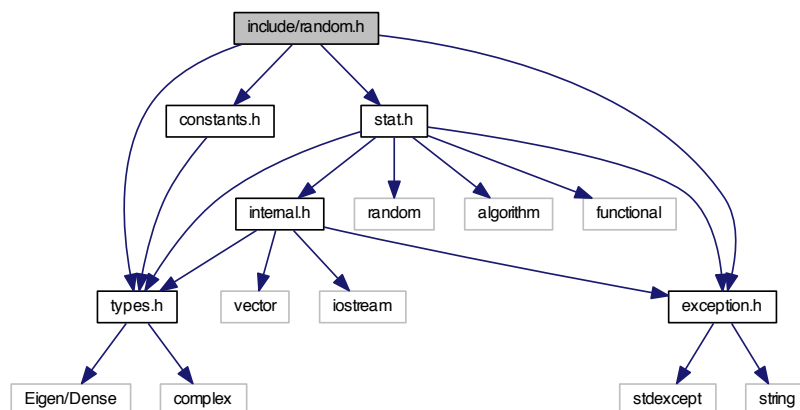
- `template<typename Scalar >`
`types::DynMat< Scalar > qpp::loadMATLABmatrix (const std::string &mat_file, const std::string &var_name)`
- `template<>`
`types::DynMat< double > qpp::loadMATLABmatrix (const std::string &mat_file, const std::string &var_name)`
- `template<>`
`types::DynMat< types::cplx > qpp::loadMATLABmatrix (const std::string &mat_file, const std::string &var_name)`
- `template<typename Scalar >`
`void qpp::saveMATLABmatrix (const types::DynMat< Scalar > &A, const std::string &mat_file, const std::string &var_name, const std::string &mode)`
- `template<>`
`void qpp::saveMATLABmatrix (const types::DynMat< double > &A, const std::string &mat_file, const std::string &var_name, const std::string &mode)`
- `template<>`
`void qpp::saveMATLABmatrix (const types::DynMat< types::cplx > &A, const std::string &mat_file, const std::string &var_name, const std::string &mode)`

7.9 include/qpp.h File Reference

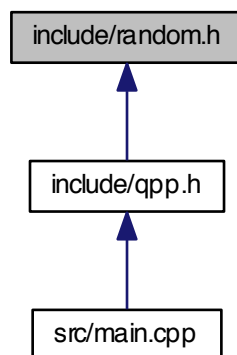
```
#include <cstdlib>
```



```
#include "stat.h"
#include "constants.h"
#include "exception.h"
Include dependency graph for random.h:
```



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



Namespaces

- [qpp](#)

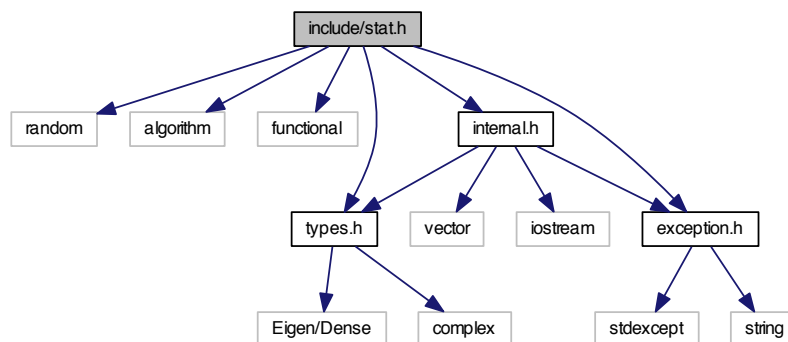
Functions

- `template<typename Scalar >`
`types::DynMat< Scalar > qpp::rand (size_t rows, size_t cols, double a=0, double b=1)`
- `template<>`
`types::DynMat< double > qpp::rand (size_t rows, size_t cols, double a, double b)`

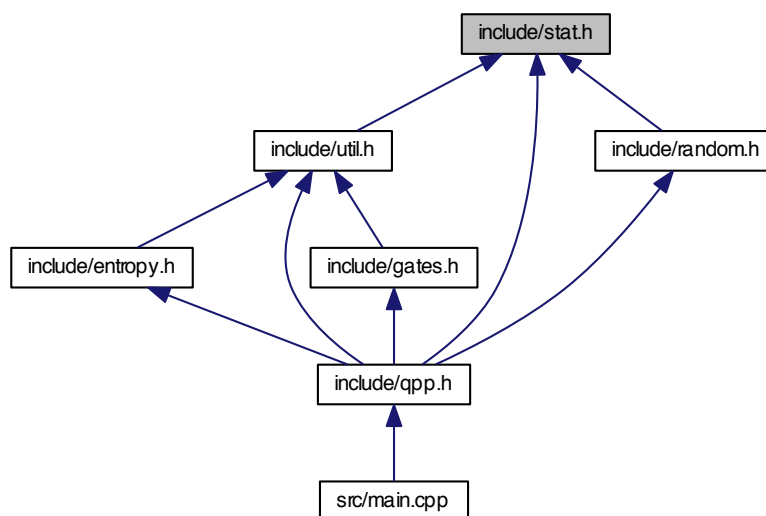
- `template<>`
`types::DynMat< types::cplx > qpp::rand (size_t rows, size_t cols, double a, double b)`
- `double qpp::rand (double a=0, double b=1)`
- `template<typename Scalar >`
`types::DynMat< Scalar > qpp::randn (size_t rows, size_t cols, double mean=0, double sigma=1)`
- `template<>`
`types::DynMat< double > qpp::randn (size_t rows, size_t cols, double mean, double sigma)`
- `template<>`
`types::DynMat< types::cplx > 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::randH (size_t D)`
- `types::cmat qpp::randket (size_t D)`
- `types::cmat qpp::randrho (size_t D)`

7.11 include/stat.h File Reference

```
#include <random>
#include <algorithm>
#include <functional>
#include "types.h"
#include "internal.h"
#include "exception.h"
Include dependency graph for stat.h:
```



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



Classes

- class [qpp::stat::NormalDistribution](#)
- class [qpp::stat::UniformRealDistribution](#)
- class [qpp::stat::DiscreteDistribution](#)
- class [qpp::stat::DiscreteDistributionFromComplex](#)

Namespaces

- [qpp](#)
- [qpp::stat](#)

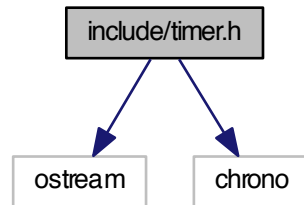
Variables

- `std::random_device` [qpp::stat::_rd](#)
- `std::mt19937` [qpp::stat::_rng](#)

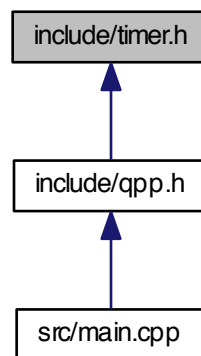
7.12 include/timer.h File Reference

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

Include dependency graph for timer.h:



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



Classes

- class `qpp::Timer`

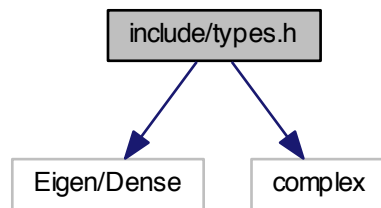
Namespaces

- `qpp`

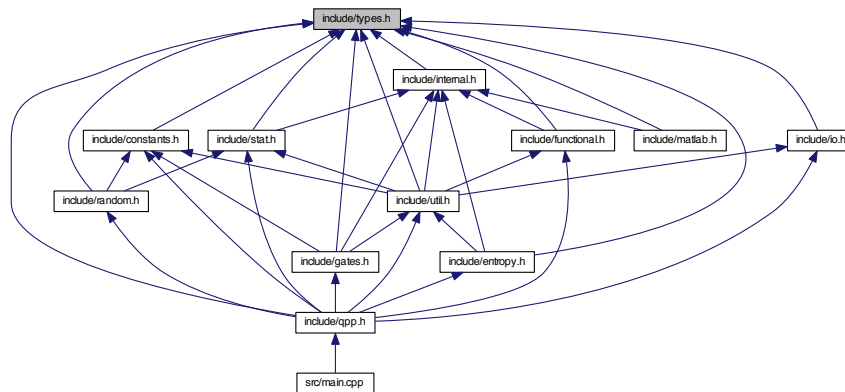
7.13 include/types.h File Reference

```
#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](#)

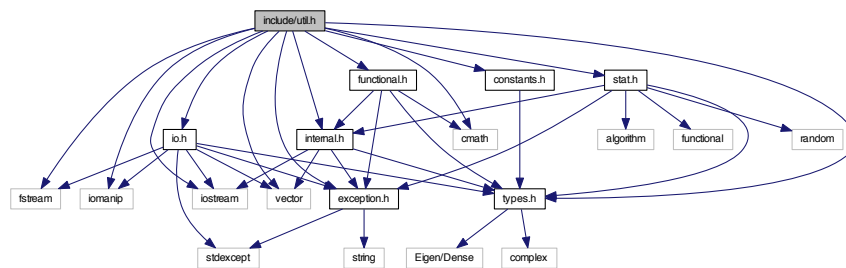
Typedefs

- `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`
- `template<typename Expression >`
`using qpp::types::Expression2DynMat = Eigen::Matrix< typename Expression::Scalar, Eigen::Dynamic, Eigen::Dynamic >`
- `template<typename Scalar >`
`using qpp::types::DynMat = Eigen::Matrix< Scalar, Eigen::Dynamic, Eigen::Dynamic >`

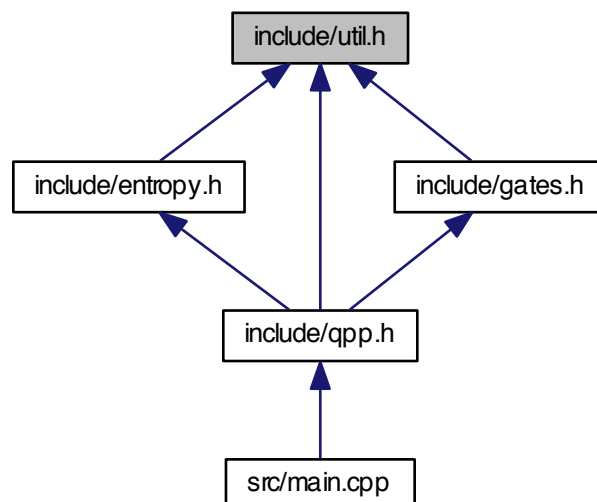
7.14 include/util.h File Reference

```
#include <vector>
#include <iostream>
#include <fstream>
#include <iomanip>
#include <cmath>
#include "types.h"
#include "constants.h"
#include "internal.h"
#include "stat.h"
#include "io.h"
#include "functional.h"
#include "exception.h"
```

Include dependency graph for util.h:



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



Namespaces

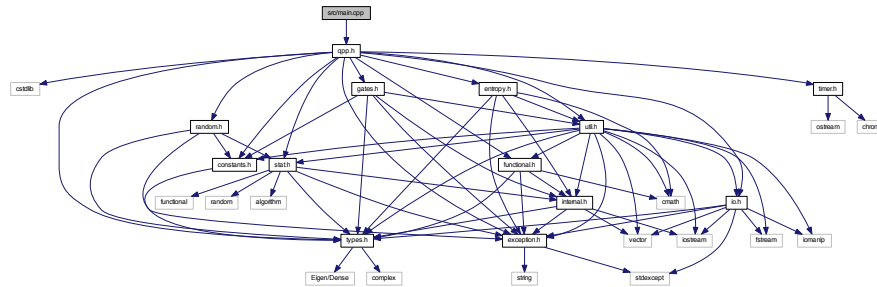
- [qpp](#)

Functions

- `template<typename Scalar >`
`types::DynMat< Scalar > qpp::transpose (const types::DynMat< Scalar > &A)`
- `template<typename Scalar >`
`types::DynMat< Scalar > qpp::conjugate (const types::DynMat< Scalar > &A)`
- `template<typename Scalar >`
`types::DynMat< Scalar > qpp::adjoint (const types::DynMat< Scalar > &A)`
- `template<typename Scalar >`
`Scalar qpp::trace (const types::DynMat< Scalar > &A)`
- `template<typename Scalar >`
`Scalar qpp::sum (const types::DynMat< Scalar > &A)`
- `template<typename InputScalar , typename OutputScalar >`
`types::DynMat< OutputScalar > qpp::fun (const types::DynMat< InputScalar > &A, OutputScalar(*f)(const InputScalar &))`
- `template<typename Scalar >`
`double qpp::norm (const types::DynMat< Scalar > &A)`
- `template<typename Scalar >`
`types::cmat qpp::evals (const types::DynMat< Scalar > &A)`
- `template<typename Scalar >`
`types::cmat qpp::evecs (const types::DynMat< Scalar > &A)`
- `template<typename Scalar >`
`types::cmat qpp::hevals (const types::DynMat< Scalar > &A)`
- `template<typename Scalar >`
`types::cmat qpp::hevecs (const types::DynMat< Scalar > &A)`
- `template<typename Scalar >`
`types::DynMat< Scalar > qpp::kron (const types::DynMat< Scalar > &A, const types::DynMat< Scalar > &B)`
- `template<typename Scalar >`
`types::DynMat< Scalar > qpp::kron_list (const std::vector< types::DynMat< Scalar > > &list)`
- `template<typename Scalar >`
`types::DynMat< Scalar > qpp::kron_pow (const types::DynMat< Scalar > &A, size_t n)`
- `template<typename Scalar >`
`types::DynMat< Scalar > qpp::reshape (const types::DynMat< Scalar > &A, size_t rows, size_t cols)`
- `template<typename Scalar >`
`types::DynMat< Scalar > qpp::syspermute (const types::DynMat< Scalar > &A, const std::vector< size_t > perm, const std::vector< size_t > &dims)`
- `template<typename Scalar >`
`types::DynMat< Scalar > qpp::ptrace2 (const types::DynMat< Scalar > &A, const std::vector< size_t > dims)`
- `template<typename Scalar >`
`types::DynMat< Scalar > qpp::ptrace (const types::DynMat< Scalar > &A, const std::vector< size_t > &subsys, const std::vector< size_t > &dims)`
- `template<typename Scalar >`
`types::DynMat< Scalar > qpp::ptranspose (const types::DynMat< Scalar > &A, const std::vector< size_t > &subsys, const std::vector< size_t > &dims)`

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

Include dependency graph for main.cpp:



- `int main ()`

7.15.1.1 int main ()

```

graph LR
    main[main] --> qpp_init[qpp::init]
    main --> qpp_gt_init_gates[qpp::gt::init_gates]
    main --> qpp_disp[qpp::disp]
    main --> qpp_stat[qpp::stat::DiscreteDistributionFromComplex::probabilities]
    main --> qpp_timer_toc[qpp::Timer::toc]
    main --> qpp_timer_tic[qpp::Timer::tic]
    main --> qpp_trace[qpp::trace]
    main --> qpp_timer_seconds[qpp::Timer::seconds]
    main --> qpp_systemmute[qpp::systemmute]
    main --> qpp_transpose[qpp::transpose]
    main --> qpp_trace2[qpp::trace2]
    main --> qpp_transpose_worker[qpp::internal::transpose_worker]
    main --> qpp_check_dims_match_mat[qpp::internal::check_dims_match_mat]
    main --> qpp_check_square_mat[qpp::internal::check_square_mat]
    main --> qpp_check_dims[qpp::internal::check_dims]
    main --> qpp_check_nonzero_size[qpp::internal::check_nonzero_size]
    main --> qpp_check_pem[qpp::internal::check_pem]
    main --> qpp_check_subsys[qpp::internal::check_subsys]
    main --> qpp_multidx2n[qpp::internal::multidx2n]
    qpp_systemmute --> qpp_internal_systemmute_worker[qpp::internal::systemmute_worker]
    qpp_transpose --> qpp_internal_transpose_worker[qpp::internal::transpose_worker]
    qpp_trace --> qpp_internal_check_dims_match_mat[qpp::internal::check_dims_match_mat]
    qpp_trace --> qpp_internal_check_square_mat[qpp::internal::check_square_mat]
    qpp_trace --> qpp_internal_check_dims[qpp::internal::check_dims]
    qpp_trace --> qpp_internal_check_nonzero_size[qpp::internal::check_nonzero_size]
    qpp_trace --> qpp_internal_check_pem[qpp::internal::check_pem]
    qpp_trace --> qpp_internal_check_subsys[qpp::internal::check_subsys]
    qpp_trace2 --> qpp_internal_check_dims_match_mat[qpp::internal::check_dims_match_mat]
    qpp_trace2 --> qpp_internal_check_square_mat[qpp::internal::check_square_mat]
    qpp_trace2 --> qpp_internal_check_dims[qpp::internal::check_dims]
    qpp_trace2 --> qpp_internal_check_nonzero_size[qpp::internal::check_nonzero_size]
    qpp_trace2 --> qpp_internal_check_pem[qpp::internal::check_pem]
    qpp_trace2 --> qpp_internal_check_subsys[qpp::internal::check_subsys]
    qpp_transpose_worker --> qpp_multidx2n[qpp::internal::multidx2n]
    qpp_multidx2n --> qpp_multidx2n[qpp::internal::multidx2n]
  
```