

qpp
0.1

Generated by Doxygen 1.8.5

Mon Apr 14 2014 01:01:06

Contents

1	Namespace Index	1
1.1	Namespace List	1
2	Hierarchical Index	3
2.1	Class Hierarchy	3
3	Class Index	5
3.1	Class List	5
4	File Index	7
4.1	File List	7
5	Namespace Documentation	9
5.1	qpp Namespace Reference	9
5.1.1	Function Documentation	13
5.1.1.1	absm	13
5.1.1.2	adjoint	13
5.1.1.3	anticomm	14
5.1.1.4	channel	14
5.1.1.5	choi	15
5.1.1.6	choi2kraus	15
5.1.1.7	comm	16
5.1.1.8	conjugate	16
5.1.1.9	cosm	16
5.1.1.10	det	17
5.1.1.11	disp	17
5.1.1.12	disp	17
5.1.1.13	disp	17
5.1.1.14	disp	17
5.1.1.15	displn	17
5.1.1.16	displn	18
5.1.1.17	displn	18
5.1.1.18	displn	18

5.1.1.19	entanglement	19
5.1.1.20	evals	19
5.1.1.21	evects	20
5.1.1.22	expandout	20
5.1.1.23	expm	21
5.1.1.24	fun	21
5.1.1.25	funm	21
5.1.1.26	gconcurrency	22
5.1.1.27	grams	23
5.1.1.28	grams	23
5.1.1.29	hevals	24
5.1.1.30	hevects	24
5.1.1.31	kron	24
5.1.1.32	kronlist	25
5.1.1.33	kronpow	25
5.1.1.34	load	25
5.1.1.35	loadMATLABmatrix	25
5.1.1.36	loadMATLABmatrix	25
5.1.1.37	loadMATLABmatrix	25
5.1.1.38	logm	26
5.1.1.39	mket	26
5.1.1.40	mket	26
5.1.1.41	mket	27
5.1.1.42	multiidx2n	27
5.1.1.43	mutualinfo	28
5.1.1.44	n2multiidx	28
5.1.1.45	norm	29
5.1.1.46	powm	29
5.1.1.47	proj	30
5.1.1.48	ptrace	30
5.1.1.49	ptrace2	31
5.1.1.50	ptranspose	31
5.1.1.51	rand	32
5.1.1.52	rand	32
5.1.1.53	rand	32
5.1.1.54	rand	32
5.1.1.55	randH	32
5.1.1.56	randket	32
5.1.1.57	randkraus	33
5.1.1.58	randn	33

5.1.1.59	randn	33
5.1.1.60	randn	33
5.1.1.61	randn	33
5.1.1.62	randrho	34
5.1.1.63	randU	34
5.1.1.64	randV	34
5.1.1.65	renyi	34
5.1.1.66	renyi_inf	35
5.1.1.67	reshape	35
5.1.1.68	save	35
5.1.1.69	saveMATLABmatrix	35
5.1.1.70	saveMATLABmatrix	36
5.1.1.71	saveMATLABmatrix	36
5.1.1.72	schmidtcoeff	36
5.1.1.73	schmidtprob	37
5.1.1.74	schmidtU	37
5.1.1.75	schmidtV	38
5.1.1.76	shannon	38
5.1.1.77	sinm	39
5.1.1.78	spectralpowm	39
5.1.1.79	sqrtm	39
5.1.1.80	sum	40
5.1.1.81	super	40
5.1.1.82	syspermute	41
5.1.1.83	trace	41
5.1.1.84	transpose	42
5.1.1.85	tsallis	42
5.1.2	Variable Documentation	42
5.1.2.1	gt	42
5.1.2.2	rdevs	42
5.2	qpp::ct Namespace Reference	42
5.2.1	Function Documentation	43
5.2.1.1	omega	43
5.2.2	Variable Documentation	43
5.2.2.1	chop	43
5.2.2.2	ee	43
5.2.2.3	eps	43
5.2.2.4	ii	43
5.2.2.5	pi	43
5.3	qpp::internal Namespace Reference	43

5.3.1	Function Documentation	44
5.3.1.1	<code>_check_col_vector</code>	44
5.3.1.2	<code>_check_dims</code>	44
5.3.1.3	<code>_check_dims_match_cvect</code>	44
5.3.1.4	<code>_check_dims_match_mat</code>	44
5.3.1.5	<code>_check_dims_match_rvect</code>	44
5.3.1.6	<code>_check_eq_dims</code>	44
5.3.1.7	<code>_check_nonzero_size</code>	44
5.3.1.8	<code>_check_perm</code>	44
5.3.1.9	<code>_check_row_vector</code>	44
5.3.1.10	<code>_check_square_mat</code>	44
5.3.1.11	<code>_check_subsys</code>	44
5.3.1.12	<code>_check_vector</code>	44
5.3.1.13	<code>_multiidx2n</code>	44
5.3.1.14	<code>_n2multiidx</code>	44
5.3.1.15	<code>_ptranspose_worker</code>	44
5.3.1.16	<code>_syspermute_worker</code>	45
5.4	<code>qpp::types</code> Namespace Reference	45
5.4.1	Typedef Documentation	45
5.4.1.1	<code>bra</code>	45
5.4.1.2	<code>cmat</code>	45
5.4.1.3	<code>cplx</code>	45
5.4.1.4	<code>dmat</code>	45
5.4.1.5	<code>DynMat</code>	45
5.4.1.6	<code>fmat</code>	45
5.4.1.7	<code>imat</code>	45
5.4.1.8	<code>ket</code>	45
6	Class Documentation	47
6.1	<code>qpp::DiscreteDistribution</code> Class Reference	47
6.1.1	Constructor & Destructor Documentation	47
6.1.1.1	<code>DiscreteDistribution</code>	47
6.1.1.2	<code>DiscreteDistribution</code>	47
6.1.1.3	<code>DiscreteDistribution</code>	47
6.1.2	Member Function Documentation	47
6.1.2.1	<code>probabilities</code>	47
6.1.2.2	<code>sample</code>	48
6.1.3	Member Data Documentation	48
6.1.3.1	<code>_d</code>	48
6.2	<code>qpp::DiscreteDistributionAbsSquare</code> Class Reference	48

6.2.1	Constructor & Destructor Documentation	48
6.2.1.1	DiscreteDistributionAbsSquare	49
6.2.1.2	DiscreteDistributionAbsSquare	49
6.2.1.3	DiscreteDistributionAbsSquare	49
6.2.1.4	DiscreteDistributionAbsSquare	50
6.2.2	Member Function Documentation	50
6.2.2.1	cplx2weights	50
6.2.2.2	probabilities	50
6.2.2.3	sample	50
6.2.3	Member Data Documentation	50
6.2.3.1	_d	50
6.3	qpp::Exception Class Reference	50
6.3.1	Member Enumeration Documentation	52
6.3.1.1	Type	52
6.3.2	Constructor & Destructor Documentation	53
6.3.2.1	Exception	53
6.3.2.2	Exception	53
6.3.2.3	~Exception	53
6.3.3	Member Function Documentation	53
6.3.3.1	_construct_exception_msg	53
6.3.3.2	what	53
6.3.4	Member Data Documentation	53
6.3.4.1	_custom	53
6.3.4.2	_msg	53
6.3.4.3	_type	53
6.3.4.4	_where	53
6.4	qpp::Gates Class Reference	54
6.4.1	Constructor & Destructor Documentation	55
6.4.1.1	Gates	55
6.4.1.2	Gates	55
6.4.1.3	~Gates	55
6.4.2	Member Function Documentation	55
6.4.2.1	CTRL	55
6.4.2.2	Fd	56
6.4.2.3	getInstance	56
6.4.2.4	Id	56
6.4.2.5	operator=	56
6.4.2.6	Rtheta	56
6.4.2.7	Xd	56
6.4.2.8	Zd	56

6.4.3	Member Data Documentation	57
6.4.3.1	b00	57
6.4.3.2	b01	57
6.4.3.3	b10	57
6.4.3.4	b11	57
6.4.3.5	CNOTab	57
6.4.3.6	CNOTba	57
6.4.3.7	CS	57
6.4.3.8	CZ	57
6.4.3.9	FRED	57
6.4.3.10	GHZ	57
6.4.3.11	H	57
6.4.3.12	Id2	57
6.4.3.13	pb00	57
6.4.3.14	pb01	57
6.4.3.15	pb10	57
6.4.3.16	pb11	57
6.4.3.17	pGHZ	57
6.4.3.18	pW	57
6.4.3.19	px0	57
6.4.3.20	px1	57
6.4.3.21	py0	57
6.4.3.22	py1	57
6.4.3.23	pz0	57
6.4.3.24	pz1	57
6.4.3.25	S	57
6.4.3.26	SWAP	57
6.4.3.27	T	57
6.4.3.28	TOF	58
6.4.3.29	W	58
6.4.3.30	X	58
6.4.3.31	x0	58
6.4.3.32	x1	58
6.4.3.33	Y	58
6.4.3.34	y0	58
6.4.3.35	y1	58
6.4.3.36	Z	58
6.4.3.37	z0	58
6.4.3.38	z1	58
6.5	qpp::NormalDistribution Class Reference	58

6.5.1	Constructor & Destructor Documentation	58
6.5.1.1	NormalDistribution	58
6.5.2	Member Function Documentation	58
6.5.2.1	sample	59
6.5.3	Member Data Documentation	59
6.5.3.1	_d	59
6.6	qpp::Qudit Class Reference	59
6.6.1	Constructor & Destructor Documentation	59
6.6.1.1	Qudit	60
6.6.1.2	~Qudit	60
6.6.2	Member Function Documentation	60
6.6.2.1	getD	60
6.6.2.2	getRho	60
6.6.2.3	measure	60
6.6.2.4	measure	61
6.6.3	Member Data Documentation	61
6.6.3.1	_D	61
6.6.3.2	_rho	61
6.7	qpp::RandomDevices Class Reference	61
6.7.1	Constructor & Destructor Documentation	62
6.7.1.1	RandomDevices	62
6.7.1.2	RandomDevices	62
6.7.1.3	~RandomDevices	62
6.7.2	Member Function Documentation	62
6.7.2.1	getInstance	62
6.7.2.2	operator=	62
6.7.3	Member Data Documentation	62
6.7.3.1	_rd	62
6.7.3.2	_rng	62
6.8	qpp::Timer Class Reference	62
6.8.1	Constructor & Destructor Documentation	62
6.8.1.1	Timer	62
6.8.1.2	~Timer	62
6.8.2	Member Function Documentation	63
6.8.2.1	seconds	63
6.8.2.2	tic	63
6.8.2.3	toc	63
6.8.3	Friends And Related Function Documentation	63
6.8.3.1	operator<<	63
6.8.4	Member Data Documentation	63

6.8.4.1	<code>_end</code>	63
6.8.4.2	<code>_start</code>	63
6.9	<code>qpp::UniformRealDistribution</code> Class Reference	63
6.9.1	Constructor & Destructor Documentation	63
6.9.1.1	<code>UniformRealDistribution</code>	63
6.9.2	Member Function Documentation	63
6.9.2.1	<code>sample</code>	64
6.9.3	Member Data Documentation	64
6.9.3.1	<code>_d</code>	64
7	File Documentation	65
7.1	<code>include/channels.h</code> File Reference	65
7.2	<code>include/classes/exception.h</code> File Reference	66
7.3	<code>include/classes/gates.h</code> File Reference	67
7.4	<code>include/classes/qudit.h</code> File Reference	68
7.5	<code>include/classes/randevs.h</code> File Reference	69
7.6	<code>include/classes/stat.h</code> File Reference	70
7.7	<code>include/classes/timer.h</code> File Reference	71
7.8	<code>include/constants.h</code> File Reference	72
7.9	<code>include/entanglement.h</code> File Reference	74
7.10	<code>include/entropies.h</code> File Reference	75
7.11	<code>include/functions.h</code> File Reference	76
7.12	<code>include/internal.h</code> File Reference	79
7.13	<code>include/io.h</code> File Reference	80
7.14	<code>include/matlab.h</code> File Reference	82
7.15	<code>include/qpp.h</code> File Reference	83
7.16	<code>include/random.h</code> File Reference	83
7.17	<code>include/types.h</code> File Reference	85

Chapter 1

Namespace Index

1.1 Namespace List

Here is a list of all namespaces with brief descriptions:

qpp	9
qpp::ct	42
qpp::internal	43
qpp::types	45

Chapter 2

Hierarchical Index

2.1 Class Hierarchy

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

qpp::DiscreteDistribution	47
qpp::DiscreteDistributionAbsSquare	48
exception	
qpp::Exception	50
qpp::Gates	54
qpp::NormalDistribution	58
qpp::Qudit	59
qpp::RandomDevices	61
qpp::Timer	62
qpp::UniformRealDistribution	63

Chapter 3

Class Index

3.1 Class List

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

qpp::DiscreteDistribution	47
qpp::DiscreteDistributionAbsSquare	48
qpp::Exception	50
qpp::Gates	54
qpp::NormalDistribution	58
qpp::Qudit	59
qpp::RandomDevices	61
qpp::Timer	62
qpp::UniformRealDistribution	63

Chapter 4

File Index

4.1 File List

Here is a list of all files with brief descriptions:

include/channels.h	65
include/constants.h	72
include/entanglement.h	74
include/entropies.h	75
include/functions.h	76
include/internal.h	79
include/io.h	80
include/matlab.h	82
include/qpp.h	83
include/random.h	83
include/types.h	85
include/classes/exception.h	66
include/classes/gates.h	67
include/classes/qudit.h	68
include/classes/randevs.h	69
include/classes/stat.h	70
include/classes/timer.h	71

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 >
[types::cmat schmidtcoeff](#) (const Eigen::MatrixBase< Derived > &A, const std::vector< size_t > &dims)
- template<typename Derived >
[types::cmat schmidtU](#) (const Eigen::MatrixBase< Derived > &A, const std::vector< size_t > &dims)
- template<typename Derived >
[types::cmat schmidtV](#) (const Eigen::MatrixBase< Derived > &A, const std::vector< size_t > &dims)
- template<typename Derived >
[types::cmat schmidtprob](#) (const Eigen::MatrixBase< Derived > &A, const std::vector< size_t > &dims)
- template<typename Derived >
double [entanglement](#) (const Eigen::MatrixBase< Derived > &A, const std::vector< size_t > &dims)
- template<typename Derived >
double [gconcurrency](#) (const Eigen::MatrixBase< Derived > &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 >`
`double tsallis (const double alpha, const Eigen::MatrixBase< Derived > &A)`
- `template<typename Derived >`
`double mutualinfo (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 > 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 evecs (const Eigen::MatrixBase< Derived > &A)`
- `template<typename Derived >`
`types::cmat hevals (const Eigen::MatrixBase< Derived > &A)`
- `template<typename Derived >`
`types::cmat hevecs (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 type-`
`name 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 > &sub-`
`sys, 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< De-`
`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)`
- `types::ket mket (const std::vector< size_t > &mask)`
- `types::ket mket (const std::vector< size_t > &mask, const std::vector< size_t > &dims)`
- `types::ket mket (const std::vector< size_t > &mask, size_t d)`

- `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)`

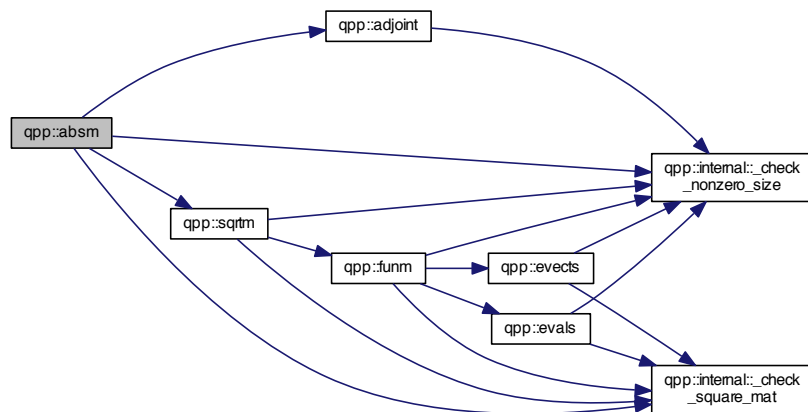
Variables

- [RandomDevices](#) & `rdevs` = `RandomDevices::getInstance()`
- `const` [Gates](#) & `gt` = `Gates::getInstance()`

5.1.1 Function Documentation

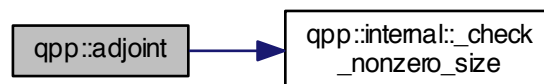
5.1.1.1 `template<typename Derived > types::cmat qpp::absm (const Eigen::MatrixBase< Derived > & A)`

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:



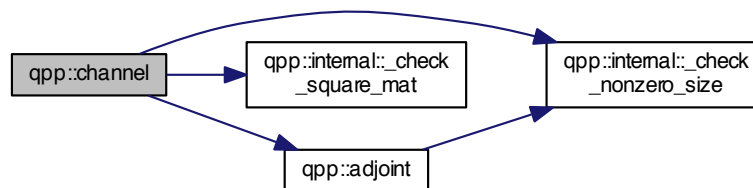
5.1.1.3 `template<typename Derived1 , typename Derived2 > types::DynMat<typename Derived1::Scalar> qpp::anticomm (const Eigen::MatrixBase< Derived1 > & A, const Eigen::MatrixBase< Derived2 > & B)`

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:



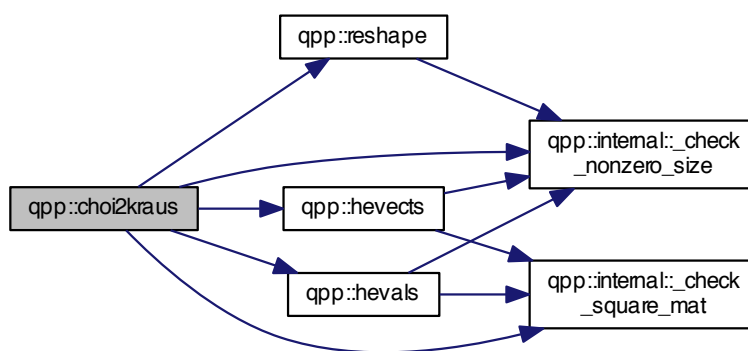
5.1.1.5 `types::cmat qpp::choi (const std::vector< types::cmat > & Ks)`

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:



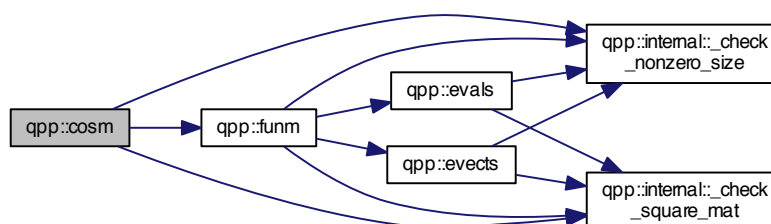
5.1.1.8 `template<typename Derived > types::DynMat<typename Derived::Scalar> qpp::conjugate (const Eigen::MatrixBase< Derived > & A)`

Here is the call graph for this function:



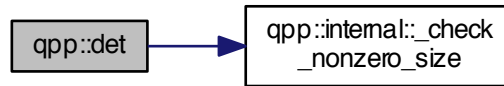
5.1.1.9 `template<typename Derived > types::cmat qpp::cosm (const Eigen::MatrixBase< Derived > & A)`

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:



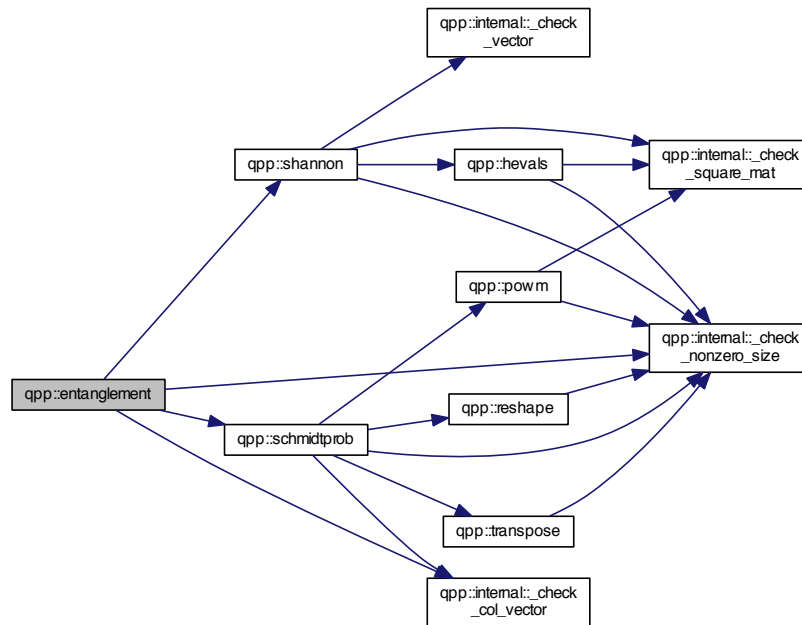
5.1.1.18 `void qpp::displn (const types::cplx c, double chop = ct::chop, std::ostream & os = std::cout)`

Here is the call graph for this function:



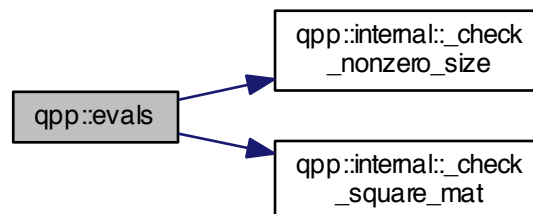
5.1.1.19 `template<typename Derived> double qpp::entanglement (const Eigen::MatrixBase< Derived> & A, const std::vector< size_t> & dims)`

Here is the call graph for this function:



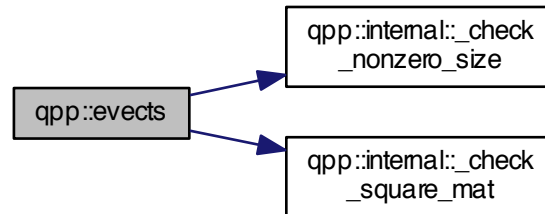
5.1.1.20 `template<typename Derived> types::cmat qpp::evals (const Eigen::MatrixBase< Derived> & A)`

Here is the call graph for this function:



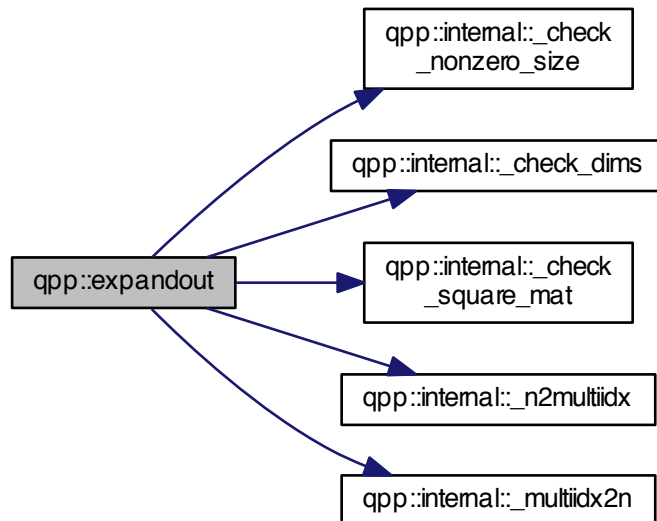
5.1.1.21 `template<typename Derived> types::cmat qpp::evecs (const Eigen::MatrixBase< Derived> & A)`

Here is the call graph for this function:



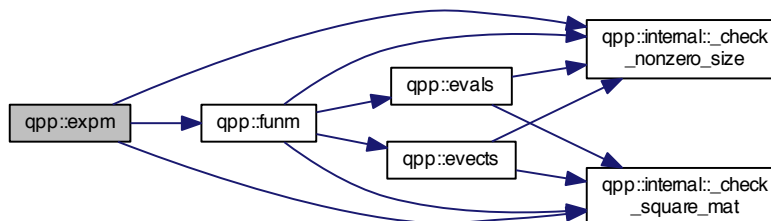
5.1.1.22 `template<typename Derived> types::DynMat<typename Derived::Scalar> qpp::expandout (const Eigen::MatrixBase< Derived> & A, size_t pos, const std::vector< size_t> & dims)`

Here is the call graph for this function:



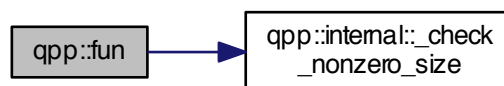
5.1.1.23 `template<typename Derived > types::cmat qpp::expm (const Eigen::MatrixBase< Derived > & A)`

Here is the call graph for this function:



5.1.1.24 `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:



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

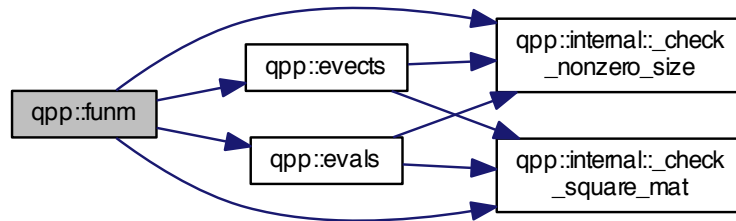
Parameters

<i>A</i>	input matrix
<i>f</i>	function pointer

Returns

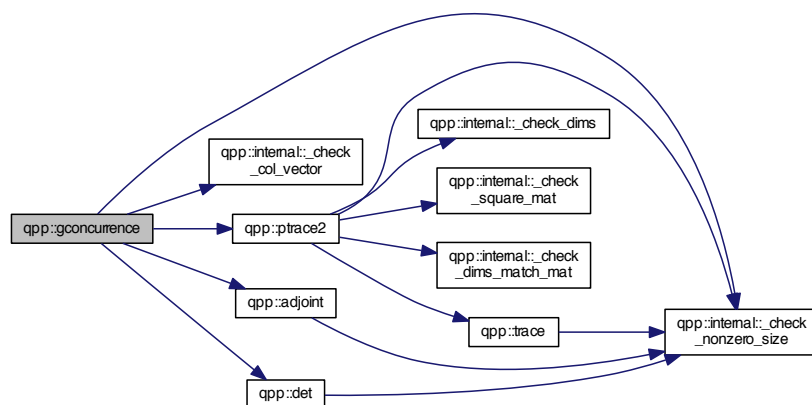
[types::cmat](#)

Here is the call graph for this function:



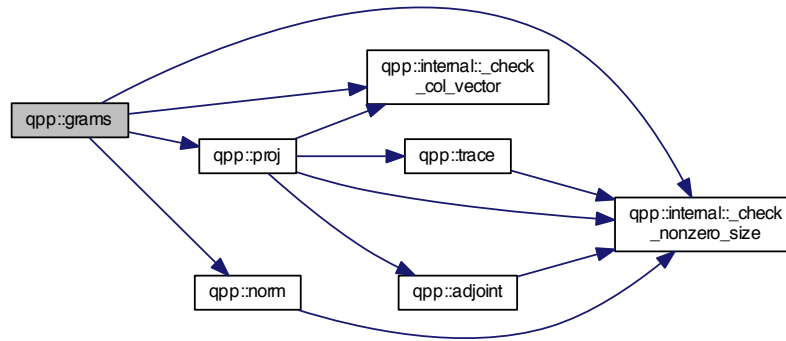
5.1.1.26 `template<typename Derived> double qpp::gconcurrency (const Eigen::MatrixBase< Derived> & A)`

Here is the call graph for this function:



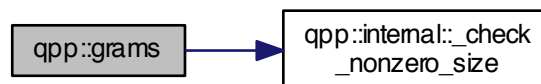
5.1.1.27 `template<typename Derived> types::DynMat<typename Derived::Scalar> qpp::grams (const std::vector<types::DynMat<typename Derived::Scalar>> & Vs)`

Here is the call graph for this function:



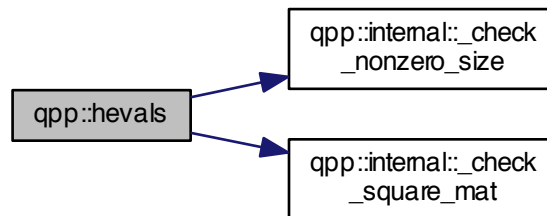
5.1.1.28 `template<typename Derived> types::DynMat<typename Derived::Scalar> qpp::grams (const Eigen::MatrixBase<Derived> & A)`

Here is the call graph for this function:



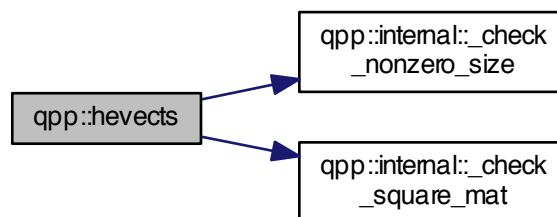
5.1.1.29 `template<typename Derived> types::cmat qpp::hevals (const Eigen::MatrixBase< Derived> & A)`

Here is the call graph for this function:



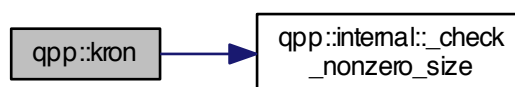
5.1.1.30 `template<typename Derived> types::cmat qpp::hevects (const Eigen::MatrixBase< Derived> & A)`

Here is the call graph for this function:



5.1.1.31 `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:



5.1.1.32 `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:



5.1.1.33 `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:



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

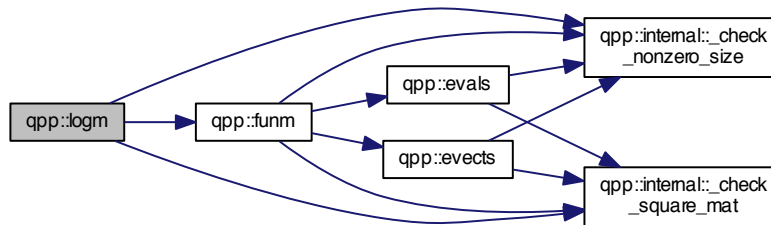
5.1.1.35 `template<typename Derived> Derived qpp::loadMATLABmatrix (const std::string & mat_file, const std::string & var_name)`

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

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

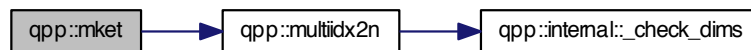
5.1.1.38 `template<typename Derived> types::cmat qpp::logm (const Eigen::MatrixBase< Derived > & A)`

Here is the call graph for this function:



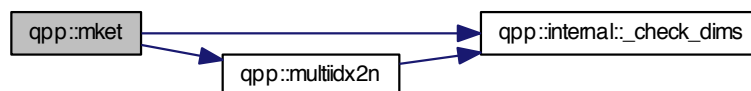
5.1.1.39 `types::ket qpp::mket (const std::vector< size_t > & mask)`

Here is the call graph for this function:



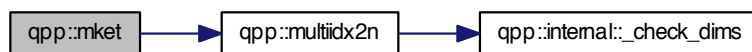
5.1.1.40 `types::ket qpp::mket (const std::vector< size_t > & mask, const std::vector< size_t > & dims)`

Here is the call graph for this function:



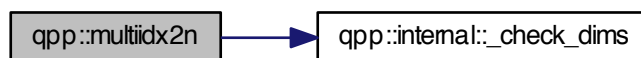
5.1.1.41 `types::ket qpp::mket (const std::vector< size_t > & mask, size_t d)`

Here is the call graph for this function:



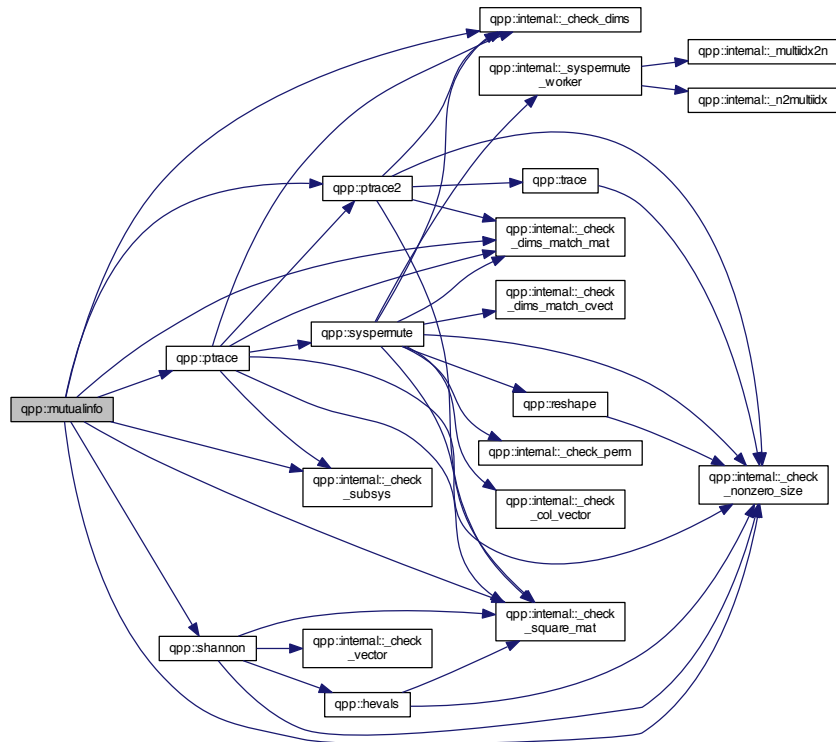
5.1.1.42 `size_t qpp::multiidx2n (const std::vector< size_t > & midx, const std::vector< size_t > & dims)`

Here is the call graph for this function:



5.1.1.43 `template<typename Derived> double qpp::mutualinfo (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:



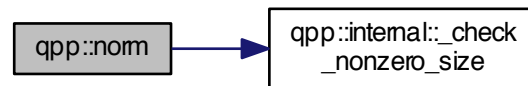
5.1.1.44 `std::vector<size_t> qpp::n2multidx (size_t n, const std::vector< size_t> & dims)`

Here is the call graph for this function:



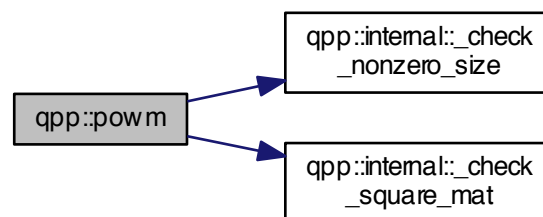
5.1.1.45 `template<typename Derived > double qpp::norm (const Eigen::MatrixBase< Derived > & A)`

Here is the call graph for this function:



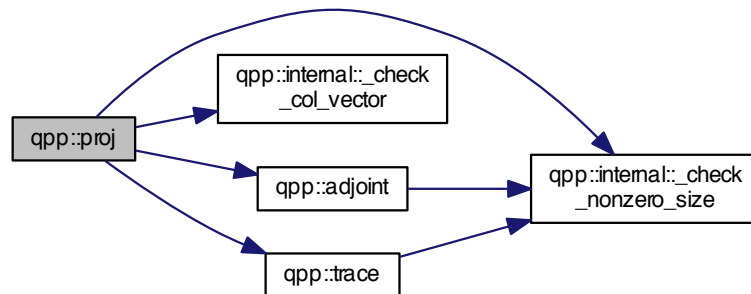
5.1.1.46 `template<typename Derived > types::DynMat<typename Derived::Scalar> qpp::powm (const Eigen::MatrixBase< Derived > & A, size_t n)`

Here is the call graph for this function:



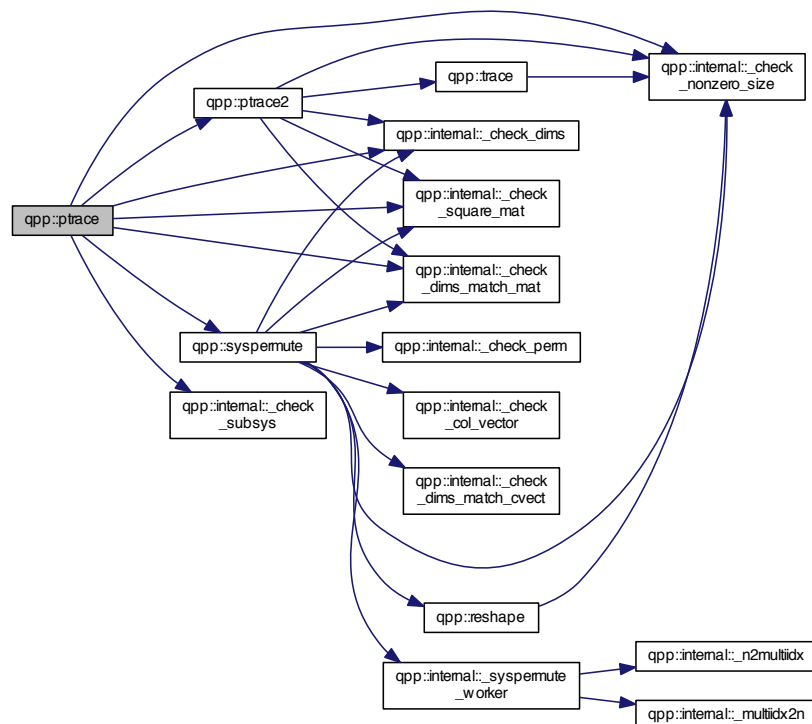
5.1.1.47 `template<typename Derived> types::DynMat<typename Derived::Scalar> qpp::proj (const Eigen::MatrixBase<Derived> & V)`

Here is the call graph for this function:



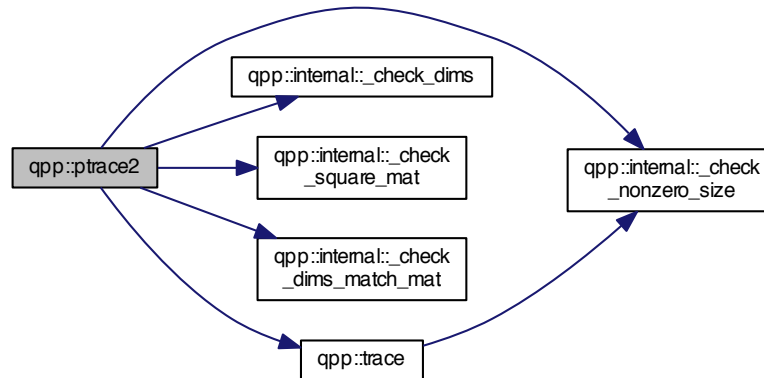
5.1.1.48 `template<typename Derived> types::DynMat<typename Derived::Scalar> qpp::ptrace (const Eigen::MatrixBase<Derived> & A, const std::vector<size_t> & subsys, const std::vector<size_t> & dims)`

Here is the call graph for this function:



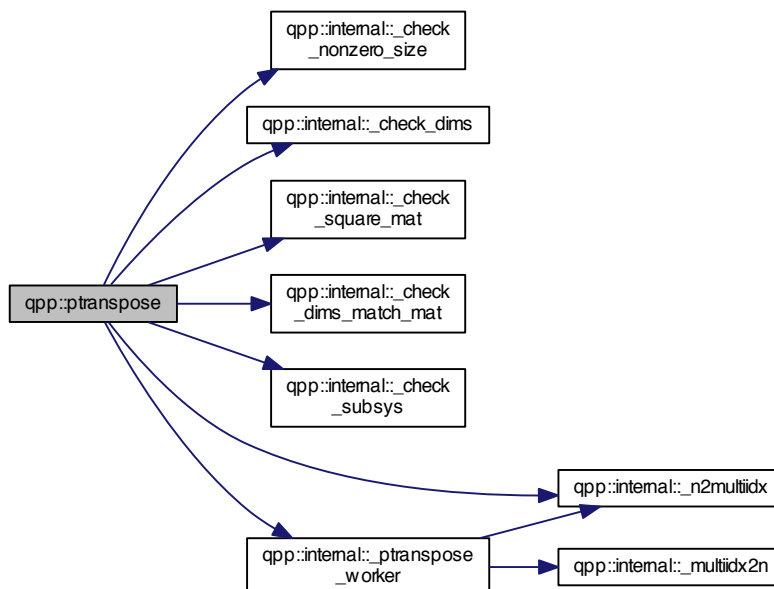
5.1.1.49 `template<typename Derived> types::DynMat<typename Derived::Scalar> qpp::ptrace2 (const Eigen::MatrixBase< Derived> & A, const std::vector< size_t> & dims)`

Here is the call graph for this function:



5.1.1.50 `template<typename Derived> types::DynMat<typename Derived::Scalar> qpp::ptrtranspose (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:



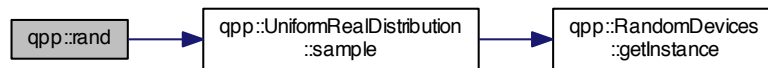
5.1.1.51 `template<typename Derived> Derived qpp::rand (size_t rows, size_t cols, double a = 0, double b = 1)`

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

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

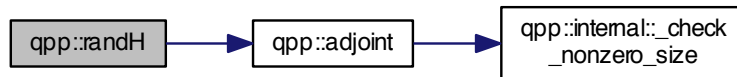
5.1.1.54 `double qpp::rand (double a = 0, double b = 1)`

Here is the call graph for this function:



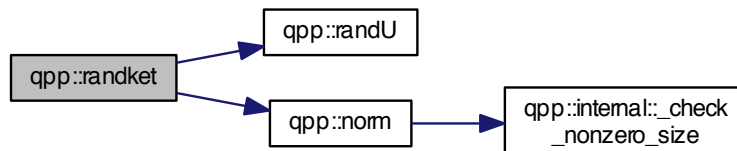
5.1.1.55 `types::cmat qpp::randH (size_t D)`

Here is the call graph for this function:



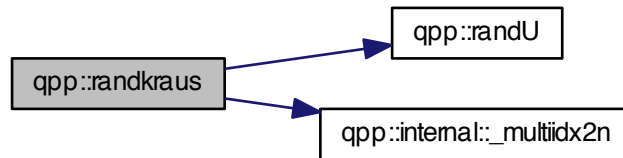
5.1.1.56 `types::ket qpp::randket (size_t D)`

Here is the call graph for this function:



5.1.1.57 `std::vector<types::cmat> qpp::randkraus (size_t n, size_t D)`

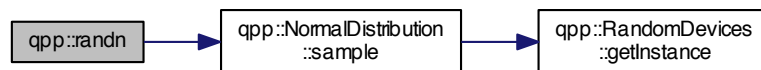
Here is the call graph for this function:



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

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

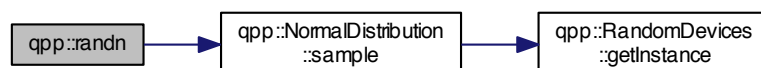
Here is the call graph for this function:



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

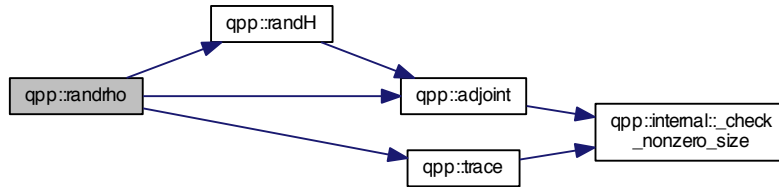
5.1.1.61 `double qpp::randn (double mean = 0, double sigma = 1)`

Here is the call graph for this function:



5.1.1.62 `types::cmat qpp::randrho (size_t D)`

Here is the call graph for this function:



5.1.1.63 `types::cmat qpp::randU (size_t D)`

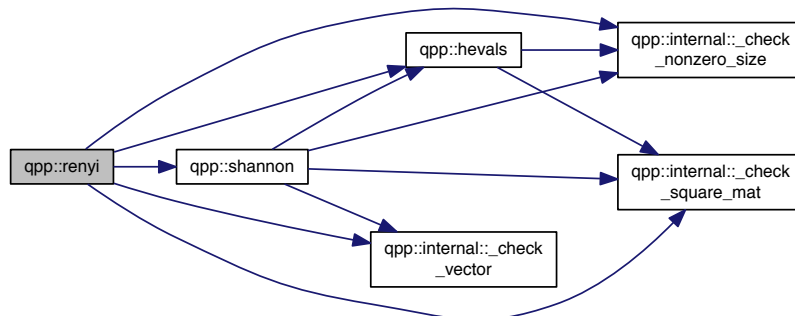
5.1.1.64 `types::cmat qpp::randV (size_t Din, size_t Dout)`

Here is the call graph for this function:



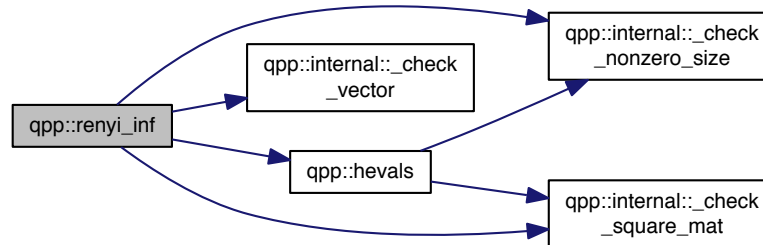
5.1.1.65 `template<typename Derived> double qpp::renyi (const double alpha, const Eigen::MatrixBase< Derived > & A)`

Here is the call graph for this function:



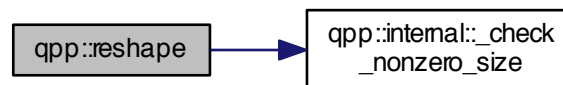
5.1.1.66 `template<typename Derived> double qpp::renyi_inf (const Eigen::MatrixBase< Derived> & A)`

Here is the call graph for this function:



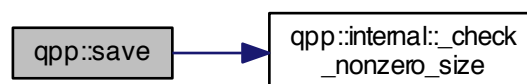
5.1.1.67 `template<typename Derived> types::DynMat<typename Derived::Scalar> qpp::reshape (const Eigen::MatrixBase< Derived> & A, size_t rows, size_t cols)`

Here is the call graph for this function:



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

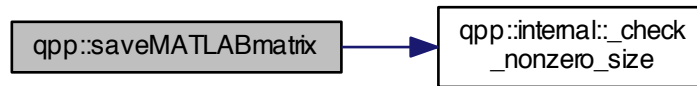
Here is the call graph for this function:



5.1.1.69 `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)`

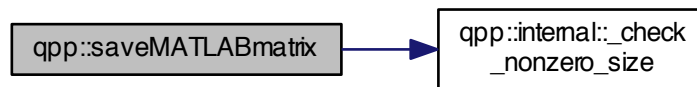
5.1.1.70 `template<> void qpp::saveMATLABmatrix (const Eigen::MatrixBase< typename types::dmat > & A, const std::string & mat_file, const std::string & var_name, const std::string & mode)`

Here is the call graph for this function:



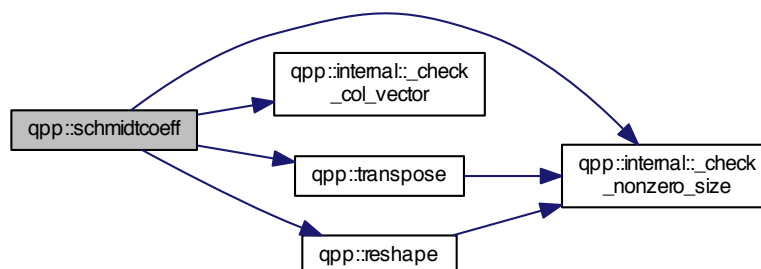
5.1.1.71 `template<> void qpp::saveMATLABmatrix (const Eigen::MatrixBase< typename types::cmat > & A, const std::string & mat_file, const std::string & var_name, const std::string & mode)`

Here is the call graph for this function:



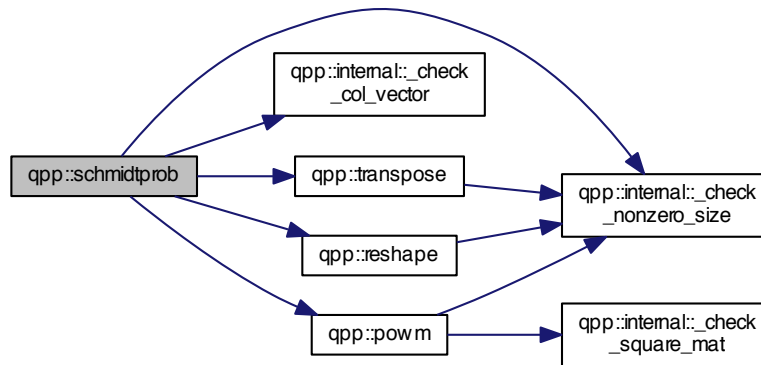
5.1.1.72 `template<typename Derived> types::cmat qpp::schmidtcoeff (const Eigen::MatrixBase< Derived > & A, const std::vector< size_t > & dims)`

Here is the call graph for this function:



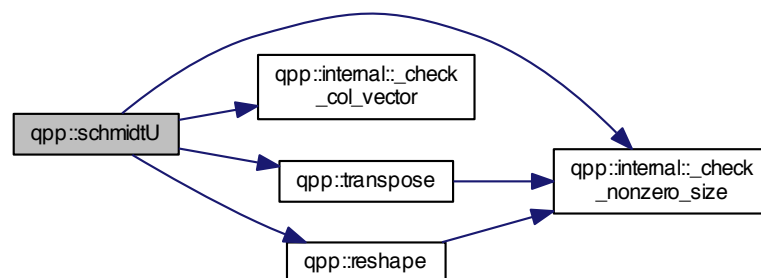
5.1.1.73 `template<typename Derived> types::cmat qpp::schmidtprob (const Eigen::MatrixBase< Derived> & A, const std::vector< size_t> & dims)`

Here is the call graph for this function:



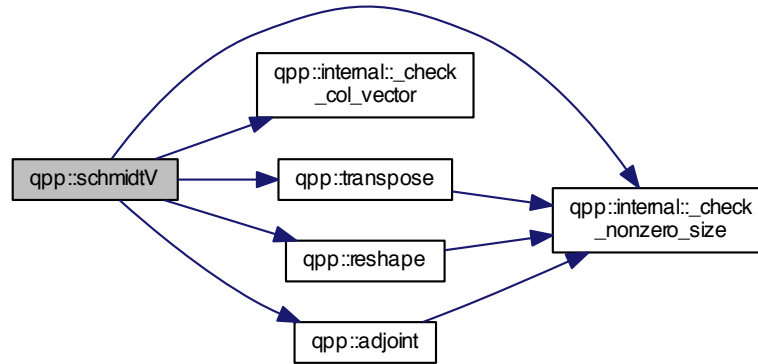
5.1.1.74 `template<typename Derived> types::cmat qpp::schmidtU (const Eigen::MatrixBase< Derived> & A, const std::vector< size_t> & dims)`

Here is the call graph for this function:



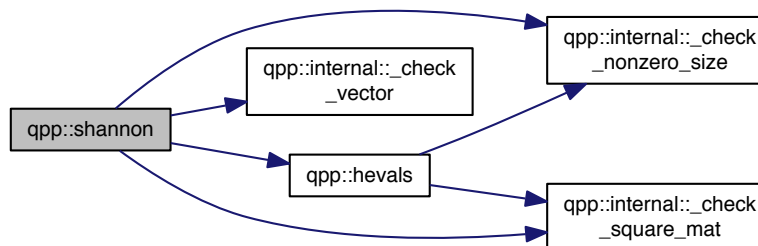
5.1.1.75 `template<typename Derived> types::cmat qpp::schmidtV (const Eigen::MatrixBase< Derived> & A, const std::vector< size_t> & dims)`

Here is the call graph for this function:



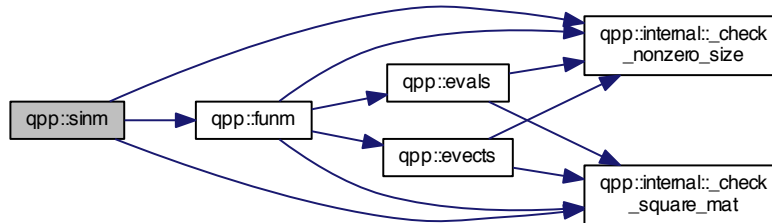
5.1.1.76 `template<typename Derived> double qpp::shannon (const Eigen::MatrixBase< Derived> & A)`

Here is the call graph for this function:



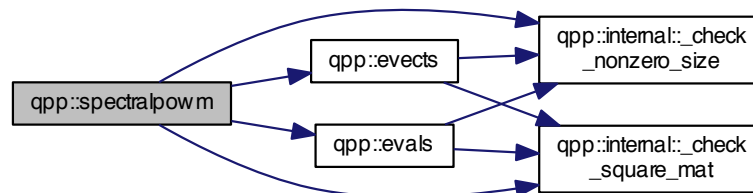
5.1.1.77 `template<typename Derived> types::cmat qpp::sinm (const Eigen::MatrixBase< Derived> & A)`

Here is the call graph for this function:



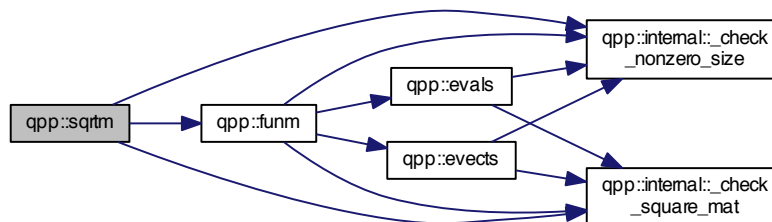
5.1.1.78 `template<typename Derived> types::cmat qpp::spectralpowm (const Eigen::MatrixBase< Derived> & A, const types::cplx z)`

Here is the call graph for this function:



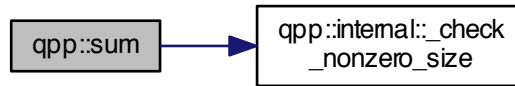
5.1.1.79 `template<typename Derived> types::cmat qpp::sqrtm (const Eigen::MatrixBase< Derived> & A)`

Here is the call graph for this function:



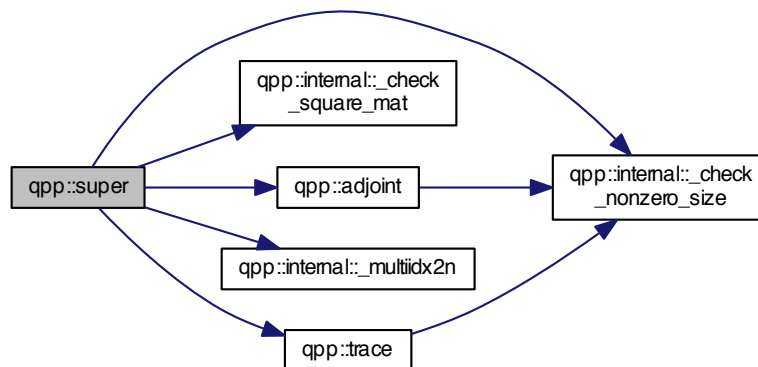
5.1.1.80 `template<typename Derived > Derived::Scalar qpp::sum (const Eigen::MatrixBase< Derived > & A)`

Here is the call graph for this function:



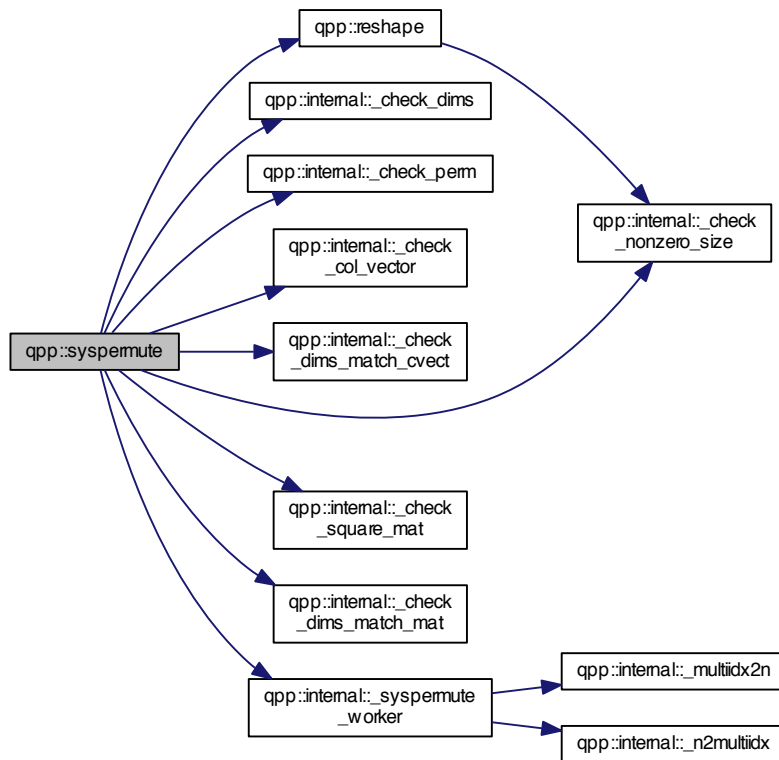
5.1.1.81 `types::cmat qpp::super (const std::vector< types::cmat > & Ks)`

Here is the call graph for this function:



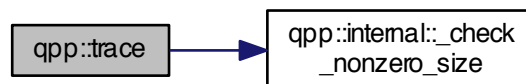
5.1.1.82 `template<typename Derived> types::DynMat<typename Derived::Scalar> qpp::syspermute (const Eigen::MatrixBase< Derived> & A, const std::vector< size_t> & perm, const std::vector< size_t> & dims)`

Here is the call graph for this function:



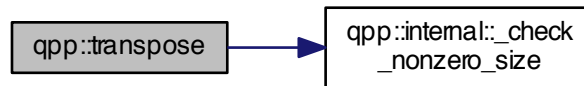
5.1.1.83 `template<typename Derived> Derived::Scalar qpp::trace (const Eigen::MatrixBase< Derived> & A)`

Here is the call graph for this function:



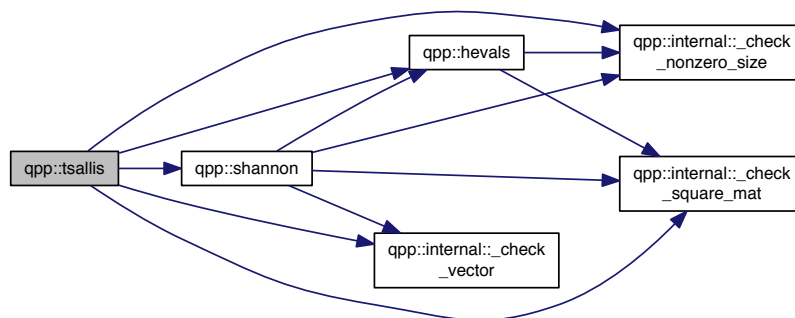
5.1.1.84 `template<typename Derived> types::DynMat<typename Derived::Scalar> qpp::transpose (const Eigen::MatrixBase< Derived> & A)`

Here is the call graph for this function:



5.1.1.85 `template<typename Derived> double qpp::tsallis (const double alpha, 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-12`
- `const std::complex< double> ii = { 0, 1 }`

- const double `pi` = 3.141592653589793238462643383279502884
- const double `ee` = 2.718281828459045235360287471352662497

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 = 2.718281828459045235360287471352662497`

5.2.2.3 `const double qpp::ct::eps = 1e-12`

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

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

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)
- template<typename Derived >
bool `_check_dims_match_cvect` (const std::vector< size_t > &dims, const Eigen::MatrixBase< Derived > &V)
- template<typename Derived >
bool `_check_dims_match_rvect` (const std::vector< size_t > &dims, const Eigen::MatrixBase< Derived > &V)
- 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_cvect (const std::vector< size_t > & dims, const Eigen::MatrixBase< Derived > & V)`

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

5.3.1.5 `template<typename Derived > bool qpp::internal::_check_dims_match_rvect (const std::vector< size_t > & dims, const Eigen::MatrixBase< Derived > & V)`

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

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

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

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

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

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

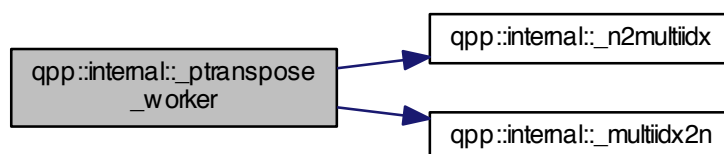
5.3.1.12 `template<typename Derived > bool qpp::internal::_check_vector (const Eigen::MatrixBase< Derived > & A)`

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

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

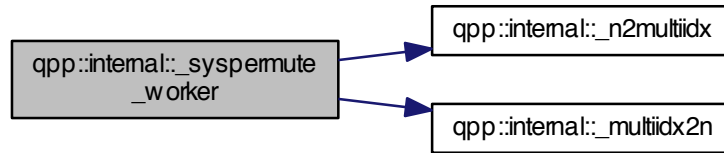
5.3.1.15 `template<typename Scalar > void qpp::internal::_ptranpose_worker (const size_t * midxcoll, size_t numdims, size_t numsubsys, const size_t * cdims, const size_t * csubsys, size_t i, size_t j, size_t iperm, size_t jperm, const types::DynMat< Scalar > & A, types::DynMat< Scalar > & result)`

Here is the call graph for this function:



5.3.1.16 `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]`

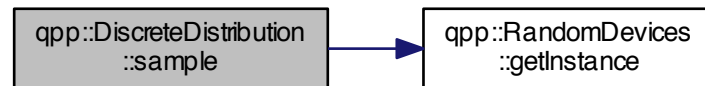
6.1.1.3 `qpp::DiscreteDistribution::DiscreteDistribution (std::vector< double > weights)` `[inline]`

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)

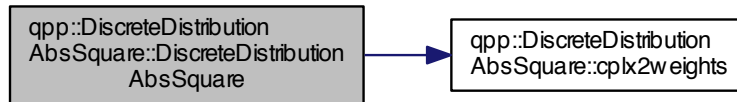
Protected Attributes

- `std::discrete_distribution`
`< size_t > _d`

6.2.1 Constructor & Destructor Documentation

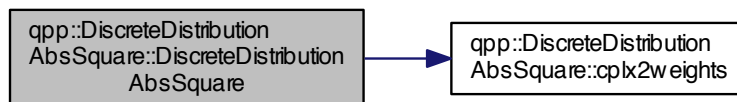
6.2.1.1 `template<typename InputIterator> qpp::DiscreteDistributionAbsSquare::DiscreteDistributionAbsSquare (InputIterator first, InputIterator last) [inline]`

Here is the call graph for this function:



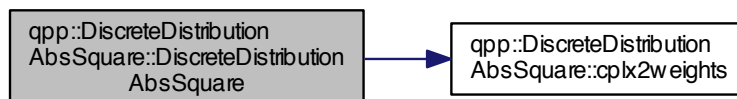
6.2.1.2 `qpp::DiscreteDistributionAbsSquare::DiscreteDistributionAbsSquare (std::initializer_list< types::cplx > amplitudes) [inline]`

Here is the call graph for this function:



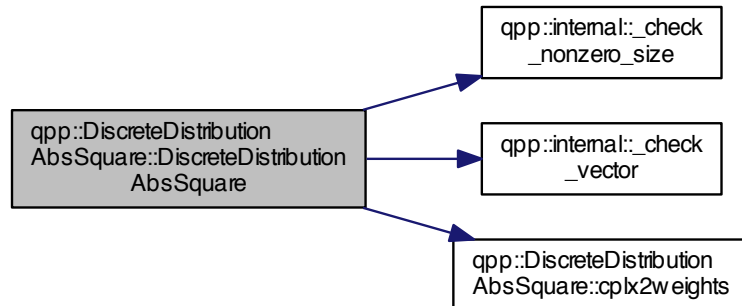
6.2.1.3 `qpp::DiscreteDistributionAbsSquare::DiscreteDistributionAbsSquare (std::vector< types::cplx > amplitudes) [inline]`

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:



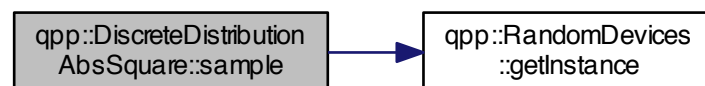
6.2.2 Member Function Documentation

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]`

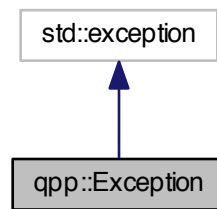
The documentation for this class was generated from the following file:

- [include/classes/stat.h](#)

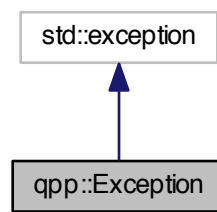
6.3 qpp::Exception Class Reference

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

Inheritance diagram for qpp::Exception:



Collaboration diagram for qpp::Exception:



Public Types

- enum `Type` {
`Type::UNKNOWN_EXCEPTION = 1`, `Type::ZERO_SIZE`, `Type::MATRIX_NOT_SQUARE`, `Type::MATRIX_NOT_CVECTOR`,
`Type::MATRIX_NOT_RVECTOR`, `Type::MATRIX_NOT_VECTOR`, `Type::MATRIX_NOT_SQUARE_OR_CVECTOR`, `Type::MATRIX_NOT_SQUARE_OR_RVECTOR`,
`Type::MATRIX_NOT_SQUARE_OR_VECTOR`, `Type::DIMS_INVALID`, `Type::DIMS_NOT_EQUAL`, `Type::DIMS_MISMATCH_MATRIX`,
`Type::DIMS_MISMATCH_CVECTOR`, `Type::DIMS_MISMATCH_RVECTOR`, `Type::DIMS_MISMATCH_VECTOR`, `Type::SUBSYS_MISMATCH_DIMS`,
`Type::PERM_MISMATCH_DIMS`, `Type::NOT_QUBIT_GATE`, `Type::NOT_QUBIT_SUBSYS`, `Type::NOT_BIPARTITE`,
`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 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]

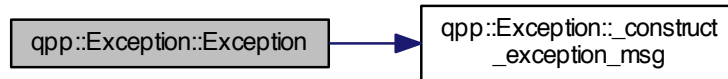
Enumerator

UNKNOWN_EXCEPTION
ZERO_SIZE
MATRIX_NOT_SQUARE
MATRIX_NOT_CVECTOR
MATRIX_NOT_RVECTOR
MATRIX_NOT_VECTOR
MATRIX_NOT_SQUARE_OR_CVECTOR
MATRIX_NOT_SQUARE_OR_RVECTOR
MATRIX_NOT_SQUARE_OR_VECTOR
DIMS_INVALID
DIMS_NOT_EQUAL
DIMS_MISMATCH_MATRIX
DIMS_MISMATCH_CVECTOR
DIMS_MISMATCH_RVECTOR
DIMS_MISMATCH_VECTOR
SUBSYS_MISMATCH_DIMS
PERM_MISMATCH_DIMS
NOT_QUBIT_GATE
NOT_QUBIT_SUBSYS
NOT_BIPARTITE
OUT_OF_RANGE
UNDEFINED_TYPE
TYPE_MISMATCH
CUSTOM_EXCEPTION

6.3.2 Constructor & Destructor Documentation

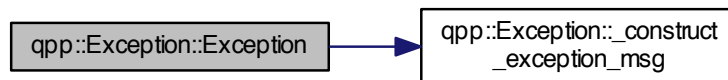
6.3.2.1 `qpp::Exception::Exception (const std::string & where, const Type & type)` `[inline]`

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](#)
- [types::ket GHZ](#)
- [types::ket W](#)
- [types::cmat pGHZ](#)
- [types::cmat pW](#)

Private Member Functions

- [Gates \(\)](#)

6.4.1 Constructor & Destructor Documentation

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

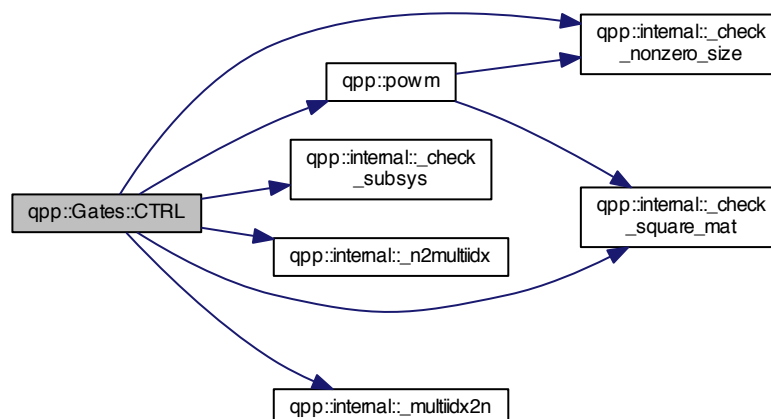
6.4.1.2 `qpp::Gates::Gates (const Gates &)` `[delete]`

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]`

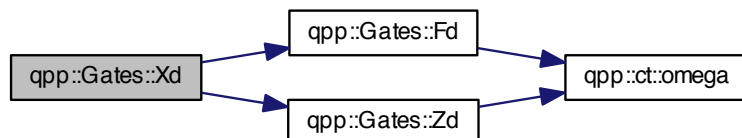
6.4.2.4 `types::cmat qpp::Gates::ld (size_t D) const` `[inline]`

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::ket qpp::Gates::GHZ`

6.4.3.11 `types::cmat qpp::Gates::H`

6.4.3.12 `types::cmat qpp::Gates::Id2`

6.4.3.13 `types::cmat qpp::Gates::pb00`

6.4.3.14 `types::cmat qpp::Gates::pb01`

6.4.3.15 `types::cmat qpp::Gates::pb10`

6.4.3.16 `types::cmat qpp::Gates::pb11`

6.4.3.17 `types::cmat qpp::Gates::pGHZ`

6.4.3.18 `types::cmat qpp::Gates::pW`

6.4.3.19 `types::cmat qpp::Gates::px0`

6.4.3.20 `types::cmat qpp::Gates::px1`

6.4.3.21 `types::cmat qpp::Gates::py0`

6.4.3.22 `types::cmat qpp::Gates::py1`

6.4.3.23 `types::cmat qpp::Gates::pz0`

6.4.3.24 `types::cmat qpp::Gates::pz1`

6.4.3.25 `types::cmat qpp::Gates::S`

6.4.3.26 `types::cmat qpp::Gates::SWAP`

6.4.3.27 `types::cmat qpp::Gates::T`

6.4.3.28 `types::cmat qpp::Gates::TOF`

6.4.3.29 `types::ket qpp::Gates::W`

6.4.3.30 `types::cmat qpp::Gates::X`

6.4.3.31 `types::ket qpp::Gates::x0`

6.4.3.32 `types::ket qpp::Gates::x1`

6.4.3.33 `types::cmat qpp::Gates::Y`

6.4.3.34 `types::ket qpp::Gates::y0`

6.4.3.35 `types::ket qpp::Gates::y1`

6.4.3.36 `types::cmat qpp::Gates::Z`

6.4.3.37 `types::ket qpp::Gates::z0`

6.4.3.38 `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`

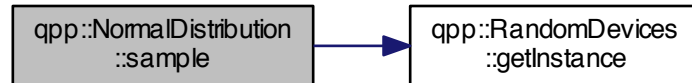
6.5.1 Constructor & Destructor Documentation

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

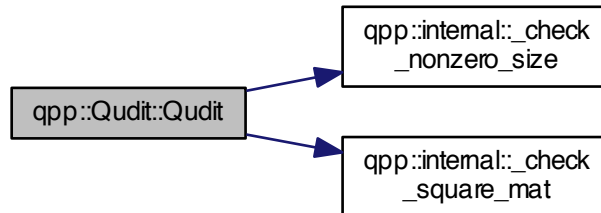
Private Attributes

- [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]`

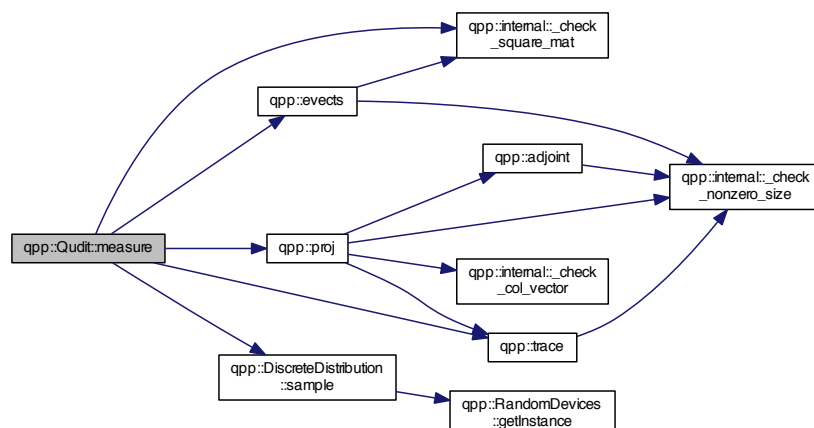
6.6.2 Member Function Documentation

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

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

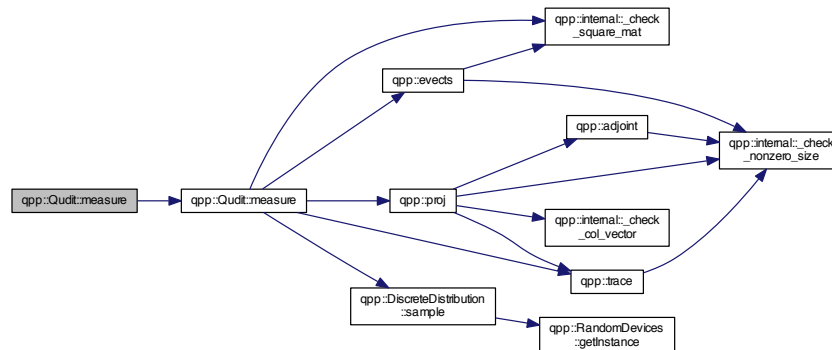
6.6.2.3 `size_t qpp::Qudit::measure (const types::cmat & U, bool destructive = false) [inline]`

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`

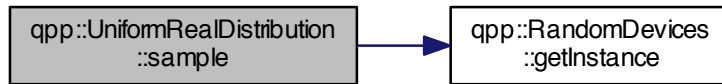
6.9.1 Constructor & Destructor Documentation

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`

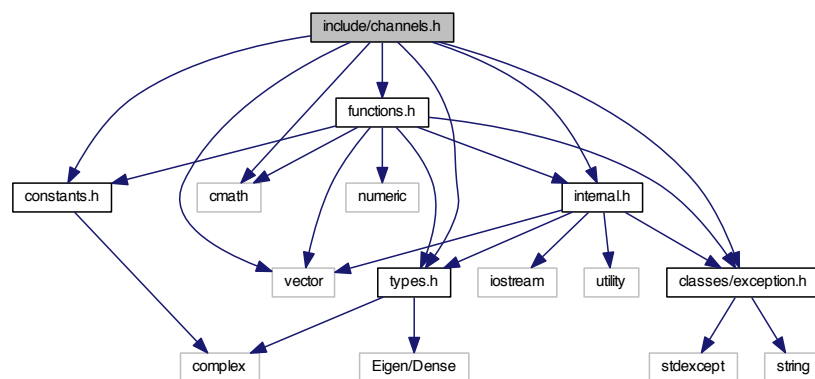
Chapter 7

File Documentation

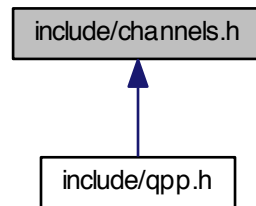
7.1 include/channels.h File Reference

```
#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

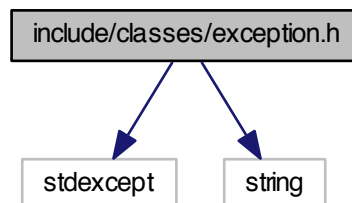
- `types::cmat` [qpp::channel](#) (`const types::cmat &rho`, `const std::vector< types::cmat > &Ks`)
- `types::cmat` [qpp::super](#) (`const std::vector< types::cmat > &Ks`)
- `types::cmat` [qpp::choi](#) (`const std::vector< types::cmat > &Ks`)
- `std::vector< types::cmat >` [qpp::choi2kraus](#) (`const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

7.2 include/classes/exception.h File Reference

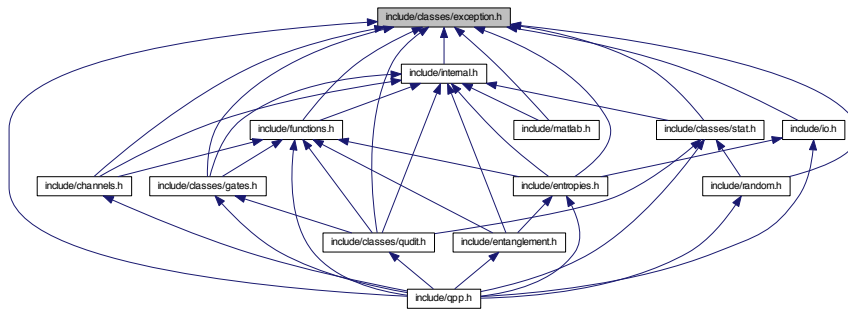
```
#include <stdexcept>
```

```
#include <string>
```

Include dependency graph for exception.h:



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



Classes

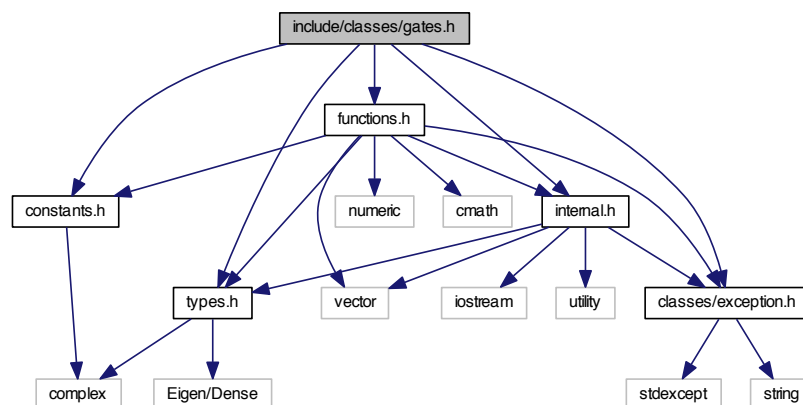
- class `qpp::Exception`

Namespaces

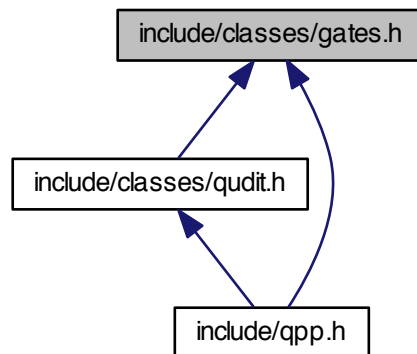
- `qpp`

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](#)

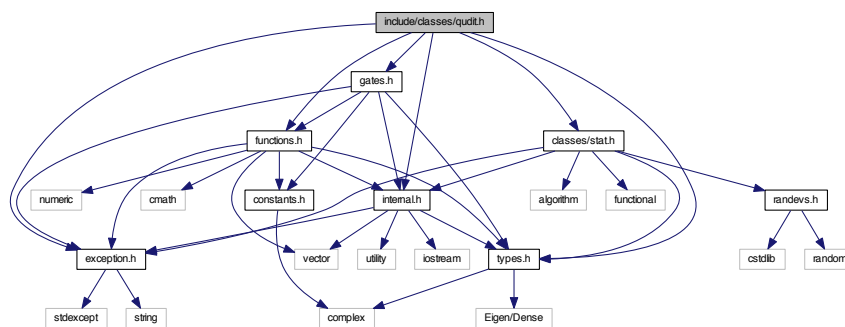
Namespaces

- [qpp](#)

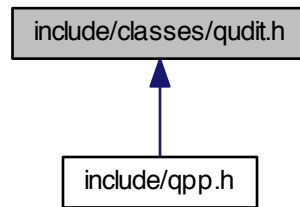
7.4 include/classes/qudit.h File Reference

```
#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

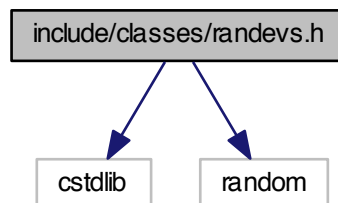
- [qpp](#)

7.5 include/classes/randevs.h File Reference

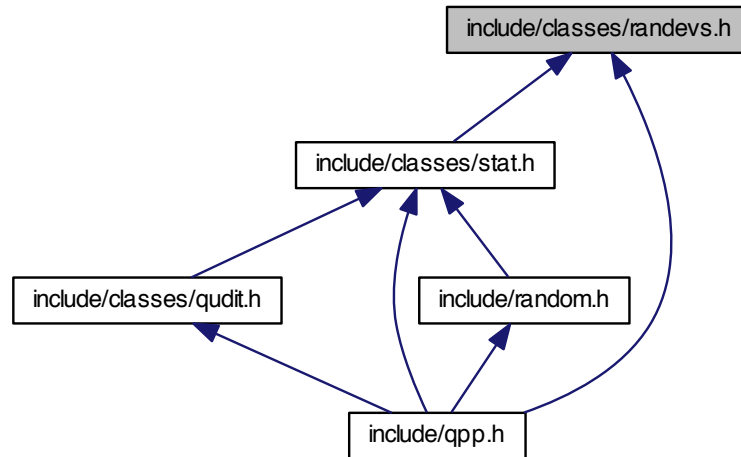
```
#include <cstdlib>
```

```
#include <random>
```

Include dependency graph for randevs.h:



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



Classes

- class [qpp::RandomDevices](#)

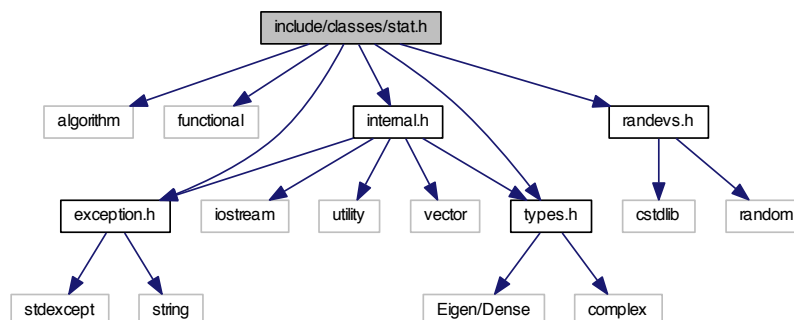
Namespaces

- [qpp](#)

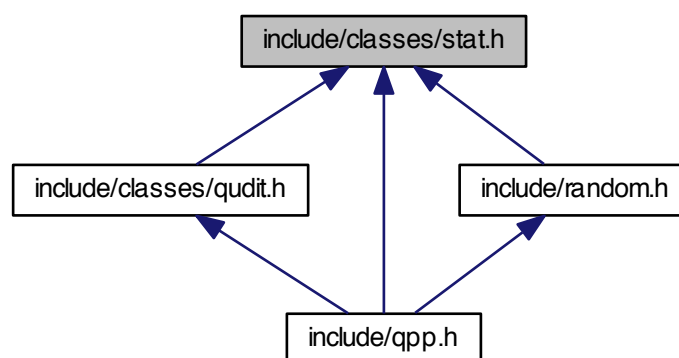
7.6 include/classes/stat.h File Reference

```
#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

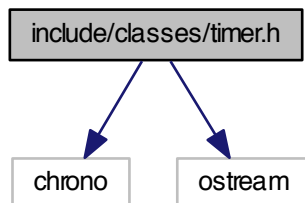
- `qpp`

7.7 include/classes/timer.h File Reference

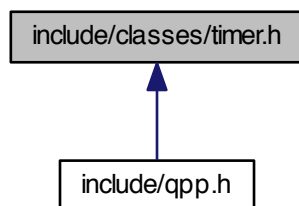
```
#include <chrono>
```

```
#include <ostream>
```

Include dependency graph for timer.h:



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



Classes

- class [qpp::Timer](#)

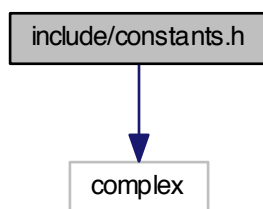
Namespaces

- [qpp](#)

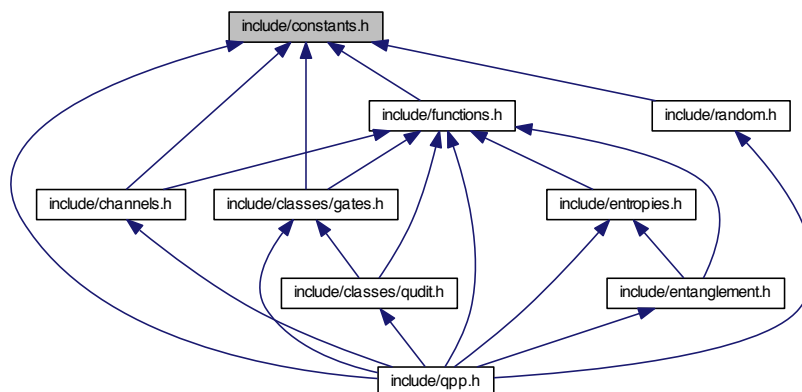
7.8 include/constants.h File Reference

```
#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)`

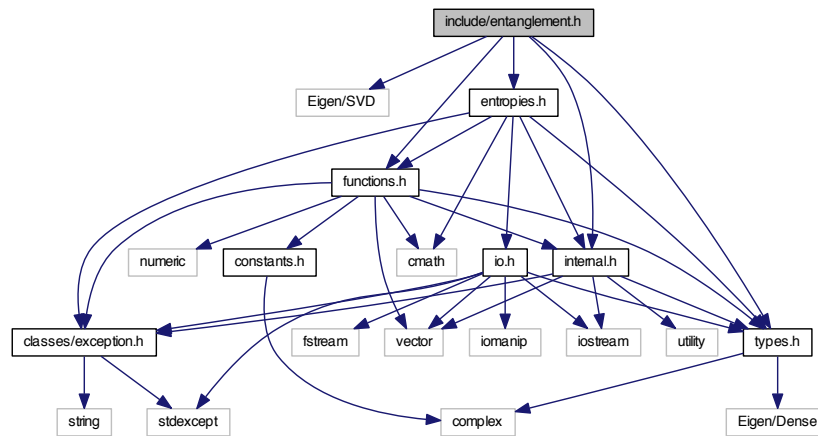
Variables

- `const double qpp::ct::chop = 1e-10`
- `const double qpp::ct::eps = 1e-12`
- `const std::complex< double > qpp::ct::ii = { 0, 1 }`
- `const double qpp::ct::pi = 3.141592653589793238462643383279502884`
- `const double qpp::ct::ee = 2.718281828459045235360287471352662497`

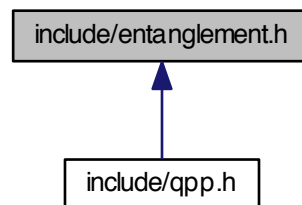
7.9 include/entanglement.h File Reference

```
#include <Eigen/SVD>
#include "entropies.h"
#include "functions.h"
#include "internal.h"
#include "types.h"
```

Include dependency graph for entanglement.h:



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



Namespaces

- [qpp](#)

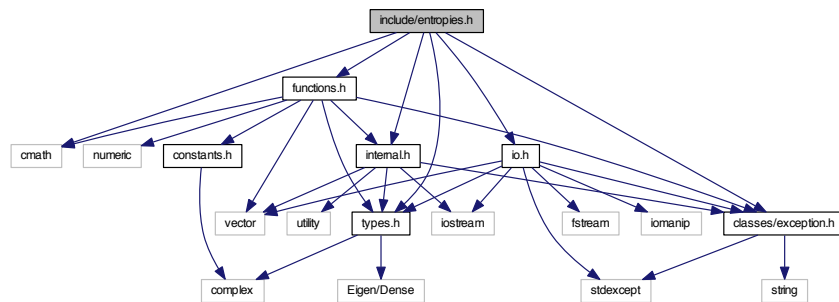
Functions

- `template<typename Derived >`
`types::cmat qpp::schmidtcoeff (const Eigen::MatrixBase< Derived > &A, const std::vector< size_t > &dims)`
- `template<typename Derived >`
`types::cmat qpp::schmidtU (const Eigen::MatrixBase< Derived > &A, const std::vector< size_t > &dims)`

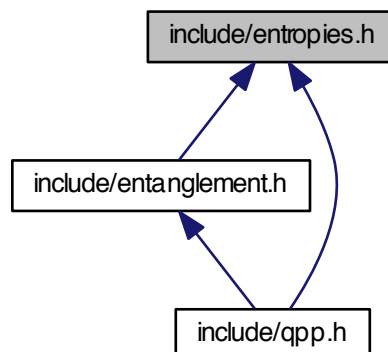
- `template<typename Derived >`
`types::cmat qpp::schmidtV (const Eigen::MatrixBase< Derived > &A, const std::vector< size_t > &dims)`
- `template<typename Derived >`
`types::cmat qpp::schmidtprob (const Eigen::MatrixBase< Derived > &A, const std::vector< size_t > &dims)`
- `template<typename Derived >`
`double qpp::entanglement (const Eigen::MatrixBase< Derived > &A, const std::vector< size_t > &dims)`
- `template<typename Derived >`
`double qpp::gconcurrence (const Eigen::MatrixBase< Derived > &A)`

7.10 include/entropies.h File Reference

```
#include <cmath>
#include "functions.h"
#include "internal.h"
#include "types.h"
#include "classes/exception.h"
#include "io.h"
Include dependency graph for entropies.h:
```



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



Namespaces

- [qpp](#)

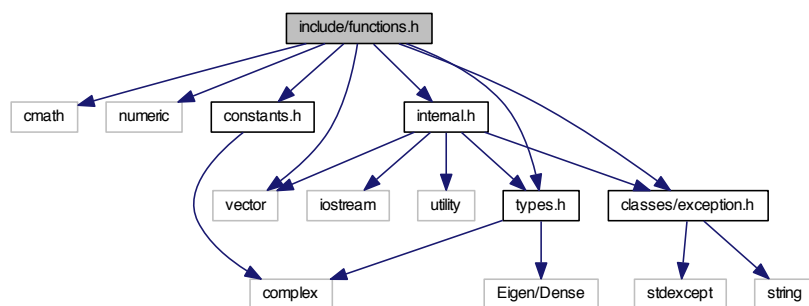
Functions

- `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)`
- `template<typename Derived >`
`double qpp::tsallis (const double alpha, const Eigen::MatrixBase< Derived > &A)`
- `template<typename Derived >`
`double qpp::mutualinfo (const Eigen::MatrixBase< Derived > &A, const std::vector< size_t > &subsys, const std::vector< size_t > &dims)`

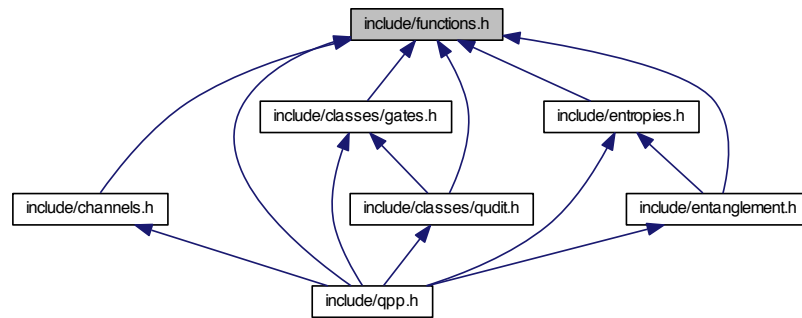
7.11 include/functions.h File Reference

```
#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

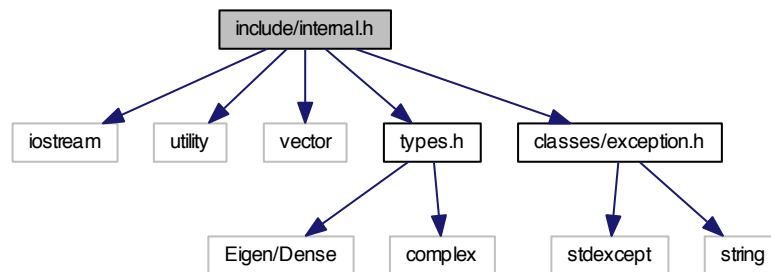
- `template<typename Derived >`
`types::DynMat< typename`
`Derived::Scalar > qpp::transpose (const Eigen::MatrixBase< Derived > &A)`
- `template<typename Derived >`
`types::DynMat< typename`
`Derived::Scalar > qpp::conjugate (const Eigen::MatrixBase< Derived > &A)`
- `template<typename Derived >`
`types::DynMat< 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::evecs (const Eigen::MatrixBase< Derived > &A)`
- `template<typename Derived >`
`types::cmat qpp::hevals (const Eigen::MatrixBase< Derived > &A)`
- `template<typename Derived >`
`types::cmat qpp::hevecs (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::spectralpwm (const Eigen::MatrixBase< Derived > &A, const types::cplx z)`
- `template<typename Derived >`
`types::DynMat< typename`
`Derived::Scalar > qpp::pwm (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< De-`
`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-`
`derived2 > &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)`

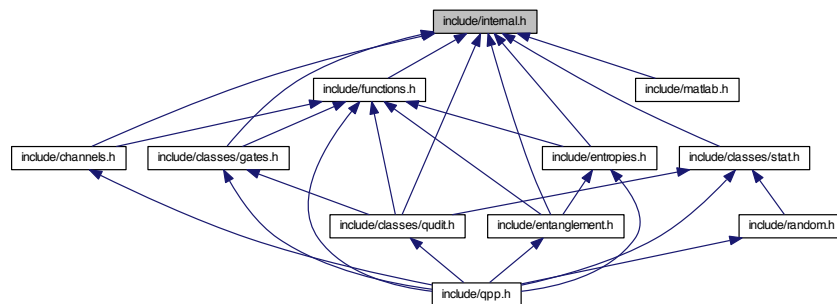
- `template<typename Derived >`
`types::DynMat< typename`
`Derived::Scalar > qpp::expandout (const Eigen::MatrixBase< Derived > &A, size_t pos, const std::vector<`
`size_t > &dims)`
- `template<typename Derived >`
`types::DynMat< typename`
`Derived::Scalar > qpp::grams (const std::vector< types::DynMat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

7.12 include/internal.h File Reference

```
#include <iostream>
#include <utility>
#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](#)

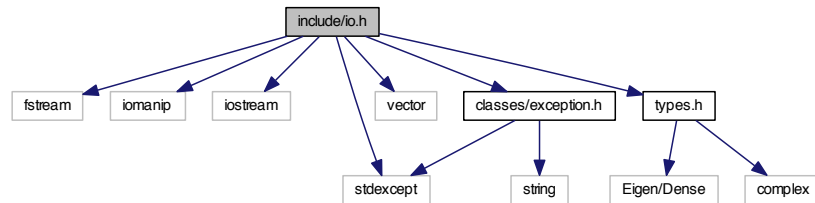
Functions

- 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)
- template<typename Derived >
bool [qpp::internal::_check_dims_match_cvect](#) (const std::vector< size_t > &dims, const Eigen::MatrixBase< Derived > &V)
- template<typename Derived >
bool [qpp::internal::_check_dims_match_rvect](#) (const std::vector< size_t > &dims, const Eigen::MatrixBase< Derived > &V)
- 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 *midxcoll, 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)

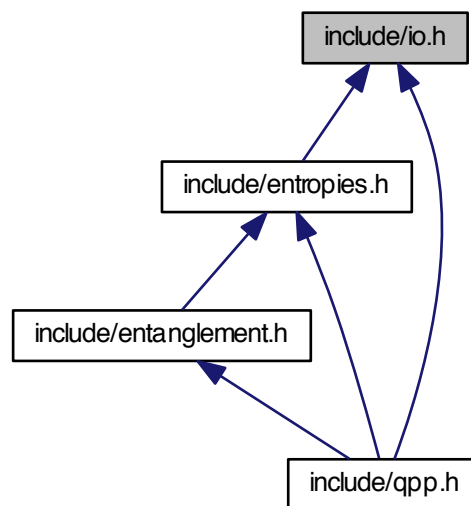
7.13 include/io.h File Reference

```
#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

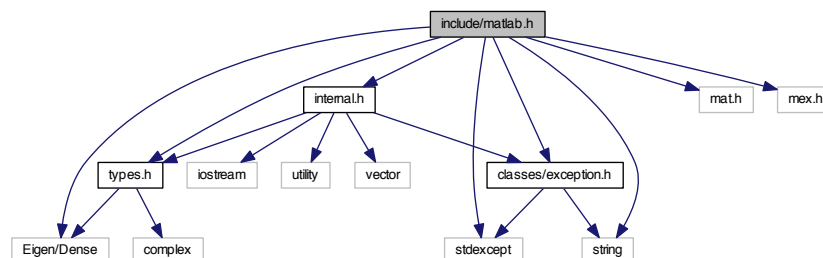
- `template<typename T >`
`void qpp::disp (const T &x, const std::string &separator, const std::string &start="[" , const std::string &end="]", std::ostream &os=std::cout)`
- `template<typename T >`
`void qpp::displn (const T &x, const std::string &separator, const std::string &start="[" , const std::string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

7.14 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

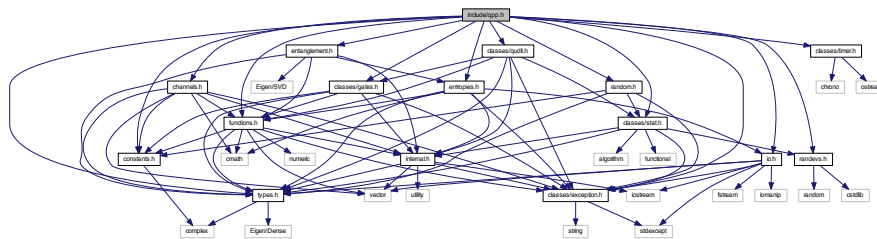
- `template<typename Derived >`
`Derived qpp::loadMATLABmatrix (const std::string &mat_file, const std::string &var_name)`
- `template<>`
`types::dmat qpp::loadMATLABmatrix (const std::string &mat_file, const std::string &var_name)`
- `template<>`
`types::cmat qpp::loadMATLABmatrix (const std::string &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)`

7.15 include/qpp.h File Reference

```
#include "channels.h"
#include "constants.h"
#include "entanglement.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:



Namespaces

- `qpp`

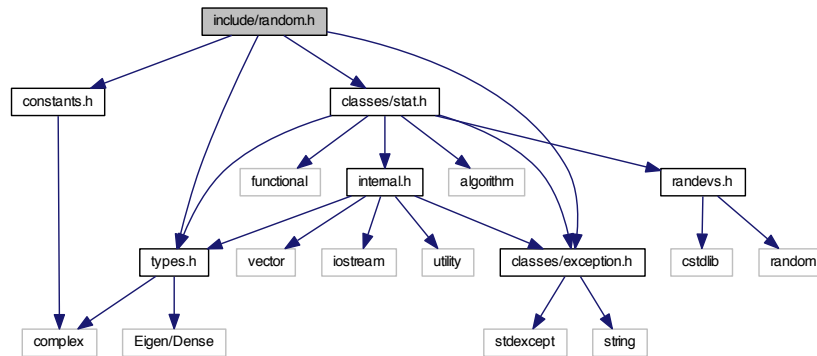
Variables

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

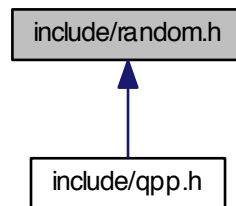
7.16 include/random.h File Reference

```
#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)

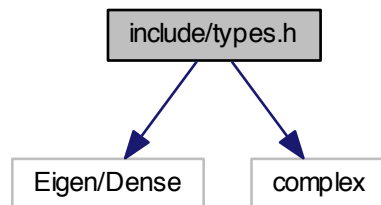
- `types::cmat` [qpp::randU](#) (size_t D)
- `types::cmat` [qpp::randV](#) (size_t Din, size_t Dout)
- `std::vector< types::cmat >` [qpp::randkraus](#) (size_t n, size_t D)
- `types::cmat` [qpp::randH](#) (size_t D)
- `types::ket` [qpp::randket](#) (size_t D)
- `types::cmat` [qpp::randrho](#) (size_t D)

7.17 include/types.h File Reference

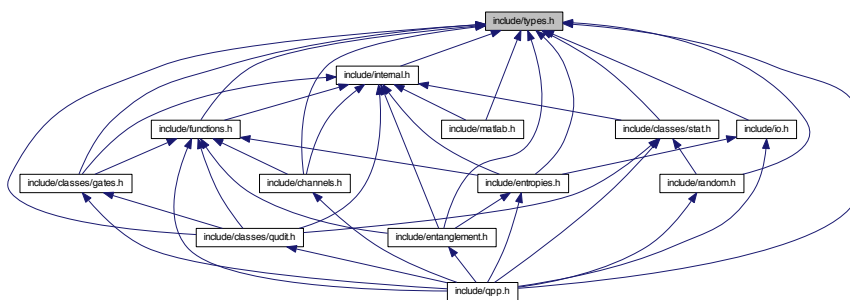
```
#include <Eigen/Dense>
```

```
#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 >