

qpp
0.1

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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	14
5.1.1.3	anticomm	14
5.1.1.4	channel	14
5.1.1.5	channel	15
5.1.1.6	choi	15
5.1.1.7	choi2kraus	16
5.1.1.8	comm	16
5.1.1.9	compperm	17
5.1.1.10	conjugate	17
5.1.1.11	cosm	17
5.1.1.12	cwise	18
5.1.1.13	det	18
5.1.1.14	disp	18
5.1.1.15	disp	18
5.1.1.16	disp	18
5.1.1.17	disp	18
5.1.1.18	displn	19

5.1.1.19	displn	19
5.1.1.20	displn	19
5.1.1.21	displn	20
5.1.1.22	entanglement	20
5.1.1.23	evals	21
5.1.1.24	evects	21
5.1.1.25	expandout	22
5.1.1.26	expm	22
5.1.1.27	funm	22
5.1.1.28	gconcurrency	23
5.1.1.29	grams	24
5.1.1.30	grams	24
5.1.1.31	grams	24
5.1.1.32	hevals	25
5.1.1.33	hevects	25
5.1.1.34	inverse	25
5.1.1.35	invperm	26
5.1.1.36	kron	26
5.1.1.37	kron	26
5.1.1.38	kron	26
5.1.1.39	kron	27
5.1.1.40	kronpow	27
5.1.1.41	load	27
5.1.1.42	loadMATLABmatrix	27
5.1.1.43	loadMATLABmatrix	27
5.1.1.44	loadMATLABmatrix	27
5.1.1.45	logdet	28
5.1.1.46	logm	28
5.1.1.47	mket	28
5.1.1.48	mket	29
5.1.1.49	mket	29
5.1.1.50	multiidx2n	29
5.1.1.51	n2multiidx	30
5.1.1.52	norm	30
5.1.1.53	powm	30
5.1.1.54	prj	31
5.1.1.55	ptrace	32
5.1.1.56	ptrace1	33
5.1.1.57	ptrace2	33
5.1.1.58	ptranspose	34

5.1.1.59	qmutualinfo	35
5.1.1.60	rand	35
5.1.1.61	rand	35
5.1.1.62	rand	36
5.1.1.63	rand	36
5.1.1.64	randH	36
5.1.1.65	randint	37
5.1.1.66	randket	37
5.1.1.67	randkraus	37
5.1.1.68	randn	37
5.1.1.69	randn	38
5.1.1.70	randn	38
5.1.1.71	randn	38
5.1.1.72	randperm	39
5.1.1.73	randrho	39
5.1.1.74	randU	39
5.1.1.75	randV	39
5.1.1.76	renyi	40
5.1.1.77	renyi_inf	40
5.1.1.78	reshape	40
5.1.1.79	save	41
5.1.1.80	saveMATLABmatrix	41
5.1.1.81	saveMATLABmatrix	41
5.1.1.82	saveMATLABmatrix	41
5.1.1.83	schmidtcoeff	42
5.1.1.84	schmidtprob	42
5.1.1.85	schmidtU	43
5.1.1.86	schmidtV	43
5.1.1.87	shannon	44
5.1.1.88	sinm	44
5.1.1.89	spectralpowm	44
5.1.1.90	sqrtm	45
5.1.1.91	sum	45
5.1.1.92	super	45
5.1.1.93	syspermute	46
5.1.1.94	trace	46
5.1.1.95	transpose	47
5.1.1.96	tsallis	47
5.1.2	Variable Documentation	47
5.1.2.1	gt	47

5.1.2.2	rdevs	47
5.1.2.3	st	47
5.2	qpp::ct Namespace Reference	47
5.2.1	Function Documentation	48
5.2.1.1	omega	48
5.2.2	Variable Documentation	48
5.2.2.1	chop	48
5.2.2.2	ee	48
5.2.2.3	eps	48
5.2.2.4	ii	48
5.2.2.5	maxn	48
5.2.2.6	pi	48
5.3	qpp::internal Namespace Reference	48
5.3.1	Function Documentation	49
5.3.1.1	_check_col_vector	49
5.3.1.2	_check_dims	49
5.3.1.3	_check_dims_match_cvect	49
5.3.1.4	_check_dims_match_mat	49
5.3.1.5	_check_dims_match_rvect	49
5.3.1.6	_check_eq_dims	49
5.3.1.7	_check_nonzero_size	49
5.3.1.8	_check_perm	49
5.3.1.9	_check_row_vector	49
5.3.1.10	_check_square_mat	49
5.3.1.11	_check_subsys_match_dims	49
5.3.1.12	_check_vector	49
5.3.1.13	_kron2	49
5.3.1.14	_multiidx2n	50
5.3.1.15	_n2multiidx	50
5.3.1.16	variadic_vector_emplace	50
5.3.1.17	variadic_vector_emplace	50
5.4	qpp::types Namespace Reference	50
5.4.1	Typedef Documentation	50
5.4.1.1	bra	50
5.4.1.2	cmat	50
5.4.1.3	cplx	50
5.4.1.4	dmat	50
5.4.1.5	DynMat	50
5.4.1.6	ket	50

6	Class Documentation	51
6.1	qpp::DiscreteDistribution Class Reference	51
6.1.1	Constructor & Destructor Documentation	51
6.1.1.1	DiscreteDistribution	51
6.1.1.2	DiscreteDistribution	51
6.1.1.3	DiscreteDistribution	51
6.1.2	Member Function Documentation	51
6.1.2.1	probabilities	51
6.1.2.2	sample	52
6.1.3	Member Data Documentation	52
6.1.3.1	_d	52
6.2	qpp::DiscreteDistributionAbsSquare Class Reference	52
6.2.1	Constructor & Destructor Documentation	52
6.2.1.1	DiscreteDistributionAbsSquare	53
6.2.1.2	DiscreteDistributionAbsSquare	53
6.2.1.3	DiscreteDistributionAbsSquare	53
6.2.1.4	DiscreteDistributionAbsSquare	54
6.2.2	Member Function Documentation	54
6.2.2.1	cplx2weights	54
6.2.2.2	probabilities	54
6.2.2.3	sample	54
6.2.3	Member Data Documentation	54
6.2.3.1	_d	54
6.3	qpp::Exception Class Reference	54
6.3.1	Member Enumeration Documentation	56
6.3.1.1	Type	56
6.3.2	Constructor & Destructor Documentation	57
6.3.2.1	Exception	57
6.3.2.2	Exception	57
6.3.3	Member Function Documentation	57
6.3.3.1	_construct_exception_msg	57
6.3.3.2	what	57
6.3.4	Member Data Documentation	57
6.3.4.1	_custom	57
6.3.4.2	_msg	57
6.3.4.3	_type	57
6.3.4.4	_where	57
6.4	qpp::Gates Class Reference	58
6.4.1	Constructor & Destructor Documentation	59
6.4.1.1	Gates	59

6.4.2	Member Function Documentation	59
6.4.2.1	apply	60
6.4.2.2	CTRL	61
6.4.2.3	Fd	61
6.4.2.4	Id	61
6.4.2.5	Rn	61
6.4.2.6	Xd	62
6.4.2.7	Zd	62
6.4.3	Friends And Related Function Documentation	62
6.4.3.1	Singleton< const Gates >	62
6.4.4	Member Data Documentation	62
6.4.4.1	CNOTab	62
6.4.4.2	CNOTba	62
6.4.4.3	CZ	62
6.4.4.4	FRED	62
6.4.4.5	H	62
6.4.4.6	Id2	62
6.4.4.7	S	62
6.4.4.8	SWAP	62
6.4.4.9	T	62
6.4.4.10	TOF	63
6.4.4.11	X	63
6.4.4.12	Y	63
6.4.4.13	Z	63
6.5	qpp::NormalDistribution Class Reference	63
6.5.1	Constructor & Destructor Documentation	63
6.5.1.1	NormalDistribution	63
6.5.2	Member Function Documentation	63
6.5.2.1	sample	63
6.5.3	Member Data Documentation	63
6.5.3.1	_d	63
6.6	qpp::Qudit Class Reference	64
6.6.1	Constructor & Destructor Documentation	64
6.6.1.1	Qudit	64
6.6.2	Member Function Documentation	64
6.6.2.1	getD	64
6.6.2.2	getRho	64
6.6.2.3	measure	65
6.6.2.4	measure	65
6.6.3	Member Data Documentation	65

6.6.3.1	_D	65
6.6.3.2	_rho	65
6.7	qpp::RandomDevices Class Reference	66
6.7.1	Constructor & Destructor Documentation	67
6.7.1.1	RandomDevices	67
6.7.2	Friends And Related Function Documentation	67
6.7.2.1	Singleton< const RandomDevices >	67
6.7.3	Member Data Documentation	67
6.7.3.1	_rd	67
6.7.3.2	_rng	67
6.8	qpp::Singleton< T > Class Template Reference	67
6.8.1	Constructor & Destructor Documentation	68
6.8.1.1	Singleton	68
6.8.1.2	~Singleton	68
6.8.1.3	Singleton	68
6.8.2	Member Function Documentation	68
6.8.2.1	get_instance	68
6.8.2.2	operator=	68
6.9	qpp::States Class Reference	68
6.9.1	Constructor & Destructor Documentation	70
6.9.1.1	States	70
6.9.2	Friends And Related Function Documentation	70
6.9.2.1	Singleton< const States >	70
6.9.3	Member Data Documentation	70
6.9.3.1	b00	70
6.9.3.2	b01	70
6.9.3.3	b10	70
6.9.3.4	b11	70
6.9.3.5	GHZ	70
6.9.3.6	pb00	70
6.9.3.7	pb01	70
6.9.3.8	pb10	70
6.9.3.9	pb11	70
6.9.3.10	pGHZ	70
6.9.3.11	pW	70
6.9.3.12	px0	70
6.9.3.13	px1	70
6.9.3.14	py0	70
6.9.3.15	py1	70
6.9.3.16	pz0	70

6.9.3.17	pz1	70
6.9.3.18	W	70
6.9.3.19	x0	70
6.9.3.20	x1	70
6.9.3.21	y0	70
6.9.3.22	y1	70
6.9.3.23	z0	71
6.9.3.24	z1	71
6.10	qpp::Timer Class Reference	71
6.10.1	Constructor & Destructor Documentation	71
6.10.1.1	Timer	71
6.10.2	Member Function Documentation	71
6.10.2.1	seconds	71
6.10.2.2	tic	71
6.10.2.3	toc	71
6.10.3	Friends And Related Function Documentation	71
6.10.3.1	operator<<	71
6.10.4	Member Data Documentation	71
6.10.4.1	_end	71
6.10.4.2	_start	71
6.11	qpp::UniformRealDistribution Class Reference	72
6.11.1	Constructor & Destructor Documentation	72
6.11.1.1	UniformRealDistribution	72
6.11.2	Member Function Documentation	72
6.11.2.1	sample	72
6.11.3	Member Data Documentation	72
6.11.3.1	_d	72
7	File Documentation	73
7.1	include/channels.h File Reference	73
7.2	include/classes/exception.h File Reference	74
7.3	include/classes/gates.h File Reference	74
7.4	include/classes/qudit.h File Reference	75
7.5	include/classes/randevs.h File Reference	75
7.6	include/classes/singleton.h File Reference	76
7.6.1	Macro Definition Documentation	76
7.6.1.1	CLASS_CONST_SINGLETON	76
7.6.1.2	CLASS_SINGLETON	76
7.7	include/classes/stat.h File Reference	77
7.8	include/classes/states.h File Reference	77

7.9	include/classes/timer.h File Reference	78
7.10	include/constants.h File Reference	78
7.11	include/entanglement.h File Reference	79
7.12	include/entropies.h File Reference	80
7.13	include/functions.h File Reference	80
7.14	include/internal.h File Reference	83
7.15	include/io.h File Reference	84
7.16	include/matlab.h File Reference	85
7.17	include/qpp.h File Reference	86
7.18	include/random.h File Reference	87
7.19	include/types.h File Reference	88
	Index	89

Chapter 1

Namespace Index

1.1 Namespace List

Here is a list of all namespaces with brief descriptions:

qpp	9
qpp::ct	47
qpp::internal	48
qpp::types	50

Chapter 2

Hierarchical Index

2.1 Class Hierarchy

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

qpp::DiscreteDistribution	51
qpp::DiscreteDistributionAbsSquare	52
exception	
qpp::Exception	54
qpp::NormalDistribution	63
qpp::Qudit	64
qpp::Singleton< T >	67
qpp::Gates	58
qpp::RandomDevices	66
qpp::Singleton< const Gates >	67
qpp::Singleton< const RandomDevices >	67
qpp::Singleton< const States >	67
qpp::States	68
qpp::Timer	71
qpp::UniformRealDistribution	72

Chapter 3

Class Index

3.1 Class List

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

qpp::DiscreteDistribution	51
qpp::DiscreteDistributionAbsSquare	52
qpp::Exception	54
qpp::Gates	58
qpp::NormalDistribution	63
qpp::Qudit	64
qpp::RandomDevices	66
qpp::Singleton< T >	67
qpp::States	68
qpp::Timer	71
qpp::UniformRealDistribution	72

Chapter 4

File Index

4.1 File List

Here is a list of all files with brief descriptions:

include/channels.h	73
include/constants.h	78
include/entanglement.h	79
include/entropies.h	80
include/functions.h	80
include/internal.h	83
include/io.h	84
include/matlab.h	85
include/qpp.h	86
include/random.h	87
include/types.h	88
include/classes/exception.h	74
include/classes/gates.h	74
include/classes/qudit.h	75
include/classes/randevs.h	75
include/classes/singleton.h	76
include/classes/stat.h	77
include/classes/states.h	77
include/classes/timer.h	78

Chapter 5

Namespace Documentation

5.1 qpp Namespace Reference

Namespaces

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

Classes

- class [DiscreteDistribution](#)
- class [DiscreteDistributionAbsSquare](#)
- class [Exception](#)
- class [Gates](#)
- class [NormalDistribution](#)
- class [Qudit](#)
- class [RandomDevices](#)
- class [Singleton](#)
- class [States](#)
- class [Timer](#)
- class [UniformRealDistribution](#)

Functions

- [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 channel](#) (const Eigen::MatrixBase< Derived > &rho, const std::vector< [types::cmat](#) > &Ks)
- template<typename Derived >
[types::cmat channel](#) (const Eigen::MatrixBase< Derived > &rho, const std::vector< [types::cmat](#) > &Ks,
const std::vector< std::size_t > &subsys, const std::vector< std::size_t > &dims)
- template<typename Derived >
[types::cmat schmidtcoeff](#) (const Eigen::MatrixBase< Derived > &A, const std::vector< std::size_t > &dims)
- template<typename Derived >
[types::cmat schmidtU](#) (const Eigen::MatrixBase< Derived > &A, const std::vector< std::size_t > &dims)
- template<typename Derived >
[types::cmat schmidtV](#) (const Eigen::MatrixBase< Derived > &A, const std::vector< std::size_t > &dims)

- `template<typename Derived >`
`types::cmat schmidtprob` (const Eigen::MatrixBase< Derived > &A, const std::vector< std::size_t > &dims)
- `template<typename Derived >`
`double entanglement` (const Eigen::MatrixBase< Derived > &A, const std::vector< std::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 qmutualinfo` (const Eigen::MatrixBase< Derived > &A, const std::vector< std::size_t > &subsys, const std::vector< std::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 >`
`types::DynMat< typename`
`Derived::Scalar > inverse` (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 logdet` (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::dmat 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, std::size_t n)
- `template<typename OutputScalar, typename Derived >`
`types::DynMat< OutputScalar > cwise` (const Eigen::MatrixBase< Derived > &A, OutputScalar (*)(const typename Derived::Scalar &))
- `template<typename T >`
`types::DynMat< typename T::Scalar > kron` (const T &head)
- `template<typename T, typename... Args>`
`types::DynMat< typename T::Scalar > kron` (const T &head, const Args &...tail)
- `template<typename Derived >`
`types::DynMat< typename`
Derived::Scalar > `kron` (const std::vector< Derived > &As)
- `template<typename Derived >`
`types::DynMat< typename`
Derived::Scalar > `kron` (const std::initializer_list< Derived > &As)
- `template<typename Derived >`
`types::DynMat< typename`
Derived::Scalar > `kronpow` (const Eigen::MatrixBase< Derived > &A, std::size_t n)
- `template<typename Derived >`
`types::DynMat< typename`
Derived::Scalar > `reshape` (const Eigen::MatrixBase< Derived > &A, std::size_t rows, std::size_t cols)
- `template<typename Derived >`
`types::DynMat< typename`
Derived::Scalar > `syspermute` (const Eigen::MatrixBase< Derived > &A, const std::vector< std::size_t > &perm, const std::vector< std::size_t > &dims)
- `template<typename Derived >`
`types::DynMat< typename`
Derived::Scalar > `ptrace1` (const Eigen::MatrixBase< Derived > &A, const std::vector< std::size_t > &dims)
- `template<typename Derived >`
`types::DynMat< typename`
Derived::Scalar > `ptrace2` (const Eigen::MatrixBase< Derived > &A, const std::vector< std::size_t > &dims)
- `template<typename Derived >`
`types::DynMat< typename`
Derived::Scalar > `ptrace` (const Eigen::MatrixBase< Derived > &A, const std::vector< std::size_t > &subsys, const std::vector< std::size_t > &dims)
- `template<typename Derived >`
`types::DynMat< typename`
Derived::Scalar > `ptranspose` (const Eigen::MatrixBase< Derived > &A, const std::vector< std::size_t > &subsys, const std::vector< std::size_t > &dims)
- `template<typename Derived1, typename Derived2 >`
`types::DynMat< typename`
Derived1::Scalar > `comm` (const Eigen::MatrixBase< Derived1 > &A, const Eigen::MatrixBase< Derived2 > &B)
- `template<typename Derived1, typename Derived2 >`
`types::DynMat< typename`
Derived1::Scalar > `anticomm` (const Eigen::MatrixBase< Derived1 > &A, const Eigen::MatrixBase< Derived2 > &B)
- `template<typename Derived >`
`types::DynMat< typename`
Derived::Scalar > `prj` (const Eigen::MatrixBase< Derived > &V)

- `template<typename Derived >`
`types::DynMat< typename`
`Derived::Scalar > expandout` (const Eigen::MatrixBase< Derived > &A, std::size_t pos, const std::vector< std::size_t > &dims)
- `template<typename Derived >`
`types::DynMat< typename`
`Derived::Scalar > grams` (const std::vector< Derived > &Vs)
- `template<typename Derived >`
`types::DynMat< typename`
`Derived::Scalar > grams` (const std::initializer_list< Derived > &Vs)
- `template<typename Derived >`
`types::DynMat< typename`
`Derived::Scalar > grams` (const Eigen::MatrixBase< Derived > &A)
- `std::vector< std::size_t > n2multiidx` (std::size_t n, const std::vector< std::size_t > &dims)
- `std::size_t multiidx2n` (const std::vector< std::size_t > &midx, const std::vector< std::size_t > &dims)
- `types::ket mket` (const std::vector< std::size_t > &mask)
- `types::ket mket` (const std::vector< std::size_t > &mask, const std::vector< std::size_t > &dims)
- `types::ket mket` (const std::vector< std::size_t > &mask, std::size_t d)
- `std::vector< std::size_t > invperm` (const std::vector< std::size_t > &perm)
- `std::vector< std::size_t > compperm` (const std::vector< std::size_t > &perm, const std::vector< std::size_t > &sigma)
- `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 std::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 std::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` (std::size_t rows, std::size_t cols, double a=0, double b=1)
- `template<>`
`types::dmat` `rand` (std::size_t rows, std::size_t cols, double a, double b)
- `template<>`
`types::cmat` `rand` (std::size_t rows, std::size_t cols, double a, double b)
- double `rand` (double a=0, double b=1)
- long long `randint` (long long a, long long b)
- `template<typename Derived >`
Derived `randn` (std::size_t rows, std::size_t cols, double mean=0, double sigma=1)
- `template<>`
`types::dmat` `randn` (std::size_t rows, std::size_t cols, double mean, double sigma)
- `template<>`
`types::cmat` `randn` (std::size_t rows, std::size_t cols, double mean, double sigma)
- double `randn` (double mean=0, double sigma=1)
- `types::cmat` `randU` (std::size_t D)
- `types::cmat` `randV` (std::size_t Din, std::size_t Dout)
- std::vector< `types::cmat` > `randkraus` (std::size_t n, std::size_t D)
- `types::cmat` `randH` (std::size_t D)
- `types::ket` `randket` (std::size_t D)
- `types::cmat` `randrho` (std::size_t D)
- std::vector< std::size_t > `randperm` (std::size_t n)

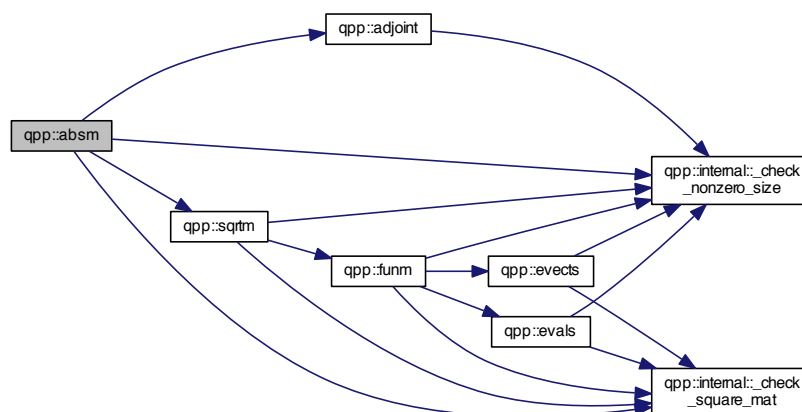
Variables

- const `RandomDevices` & `rdevs` = `RandomDevices::get_instance()`
- const `Gates` & `gt` = `Gates::get_instance()`
- const `States` & `st` = `States::get_instance()`

5.1.1 Function Documentation

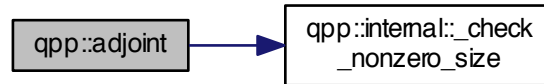
5.1.1.1 `template<typename Derived > types::cmat qpp::absm (const Eigen::MatrixBase< Derived > &A)`

Here is the call graph for this function:



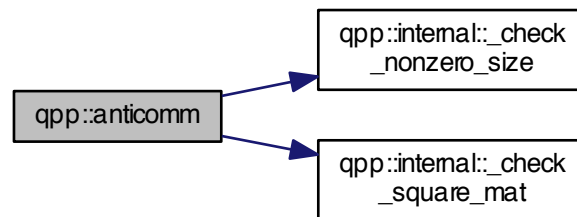
5.1.1.2 `template<typename Derived > types::DynMat<typename Derived::Scalar> qpp::adjoint (const Eigen::MatrixBase< Derived > & A)`

Here is the call graph for this function:



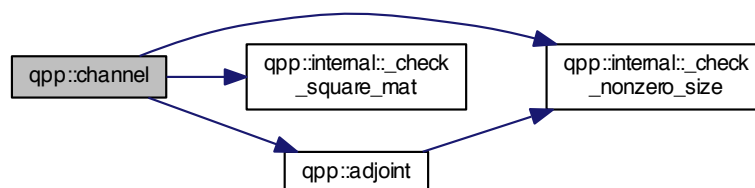
5.1.1.3 `template<typename Derived1 , typename Derived2 > types::DynMat<typename Derived1::Scalar> qpp::anticomm (const Eigen::MatrixBase< Derived1 > & A, const Eigen::MatrixBase< Derived2 > & B)`

Here is the call graph for this function:



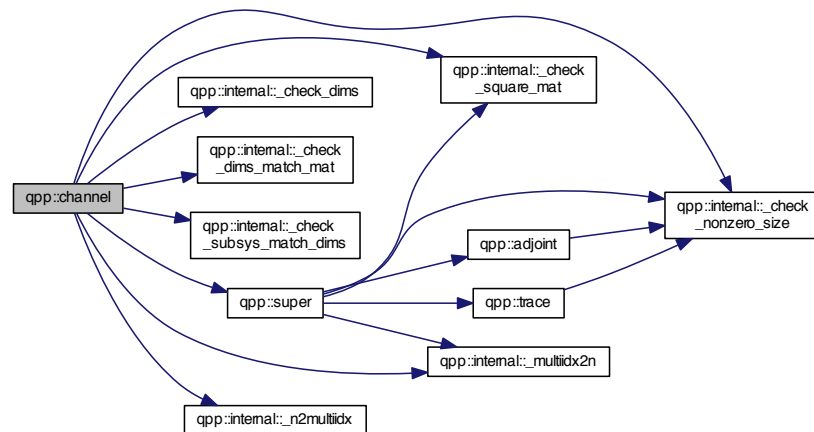
5.1.1.4 `template<typename Derived > types::cmat qpp::channel (const Eigen::MatrixBase< Derived > & rho, const std::vector< types::cmat > & Ks)`

Here is the call graph for this function:



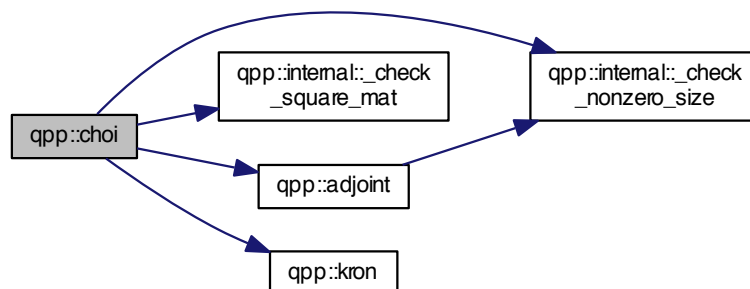
5.1.1.5 `template<typename Derived > types::cmat qpp::channel (const Eigen::MatrixBase< Derived > & rho, const std::vector< types::cmat > & Ks, const std::vector< std::size_t > & subsys, const std::vector< std::size_t > & dims)`

Here is the call graph for this function:



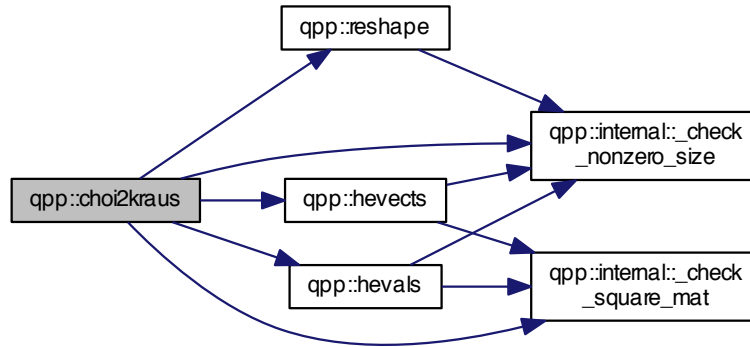
5.1.1.6 `types::cmat qpp::choi (const std::vector< types::cmat > & Ks)`

Here is the call graph for this function:



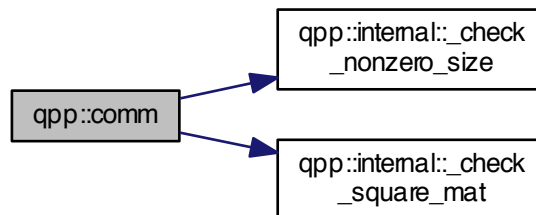
5.1.1.7 `std::vector<types::cmat> qpp::choi2kraus (const types::cmat & A)`

Here is the call graph for this function:



5.1.1.8 `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:



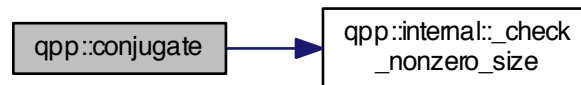
5.1.1.9 `std::vector<std::size_t> qpp::compperm (const std::vector< std::size_t > & perm, const std::vector< std::size_t > & sigma)`

Here is the call graph for this function:



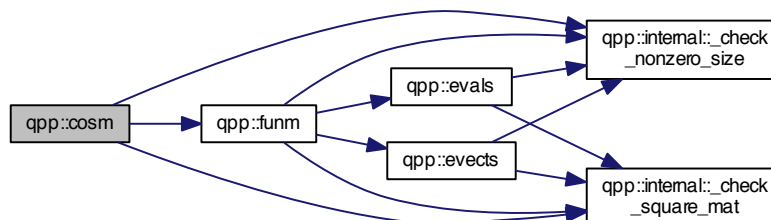
5.1.1.10 `template<typename Derived> types::DynMat<typename Derived::Scalar> qpp::conjugate (const Eigen::MatrixBase< Derived > & A)`

Here is the call graph for this function:



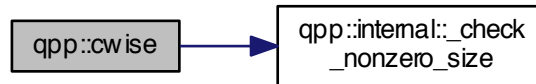
5.1.1.11 `template<typename Derived> types::cmat qpp::cosm (const Eigen::MatrixBase< Derived > & A)`

Here is the call graph for this function:



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

Here is the call graph for this function:



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

Here is the call graph for this function:



5.1.1.14 `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)`

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

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

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

Here is the call graph for this function:



5.1.1.18 `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:



5.1.1.19 `template<typename T> void qpp::displn (const T * x, const std::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:



5.1.1.20 `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:



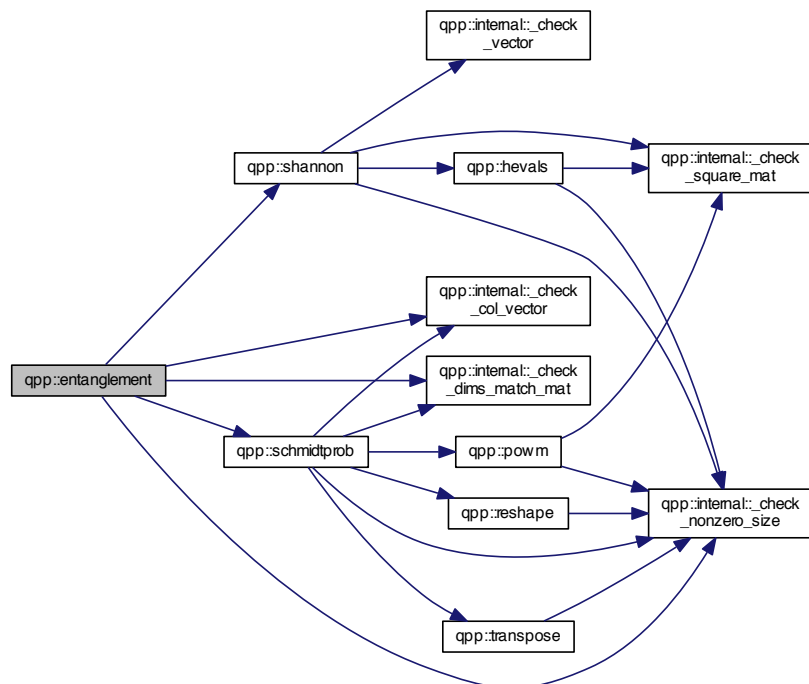
5.1.1.21 `void qpp::displn (const types::cplx c, double chop = ct : : chop, std::ostream & os = std : : cout)`

Here is the call graph for this function:



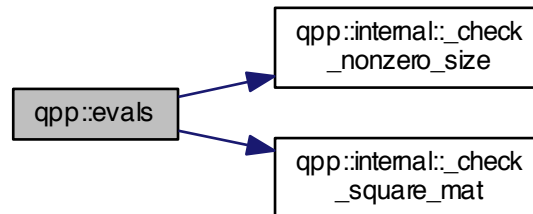
5.1.1.22 `template<typename Derived> double qpp::entanglement (const Eigen::MatrixBase< Derived> & A, const std::vector< std::size_t> & dims)`

Here is the call graph for this function:



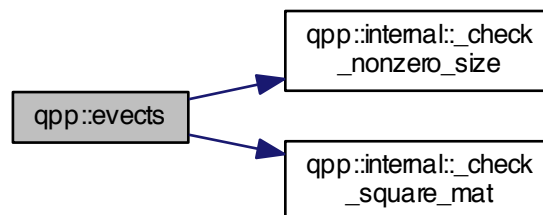
5.1.1.23 `template<typename Derived > types::cmat qpp::evals (const Eigen::MatrixBase< Derived > & A)`

Here is the call graph for this function:



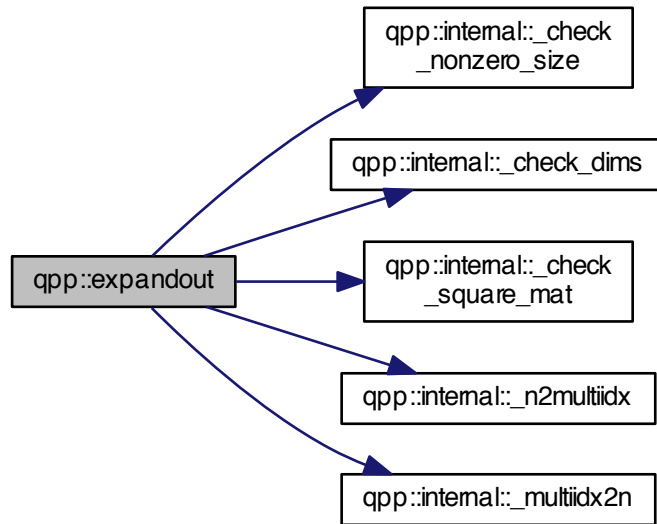
5.1.1.24 `template<typename Derived > types::cmat qpp::evecs (const Eigen::MatrixBase< Derived > & A)`

Here is the call graph for this function:



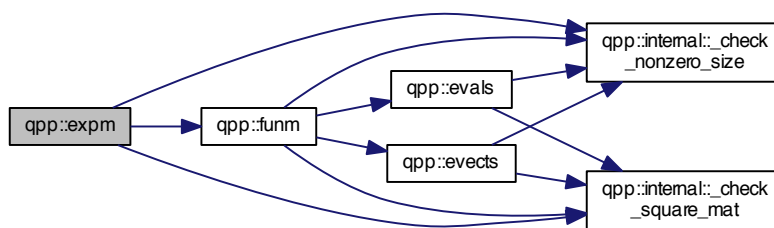
5.1.1.25 `template<typename Derived > types::DynMat<typename Derived::Scalar> qpp::expandout (const Eigen::MatrixBase< Derived > & A, std::size_t pos, const std::vector< std::size_t > & dims)`

Here is the call graph for this function:



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

Here is the call graph for this function:



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

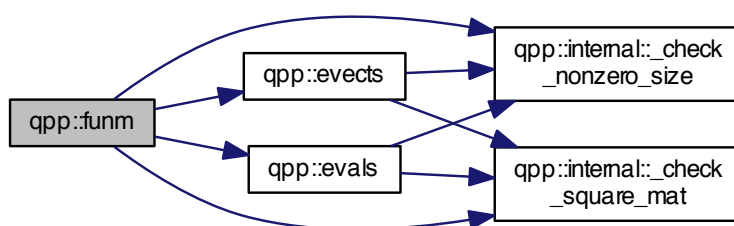
Parameters

A	input matrix
f	function pointer

Returns

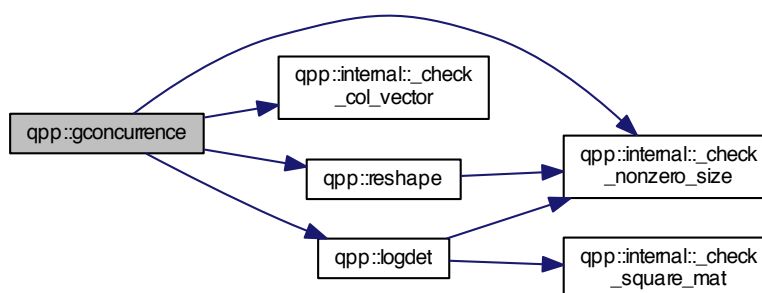
[types::cmat](#)

Here is the call graph for this function:



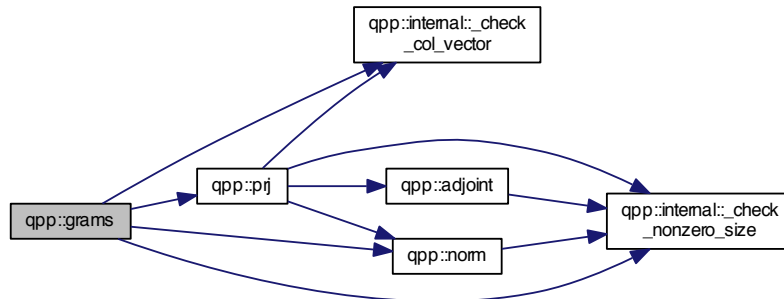
5.1.1.28 `template<typename Derived> double qpp::gconcurrency (const Eigen::MatrixBase< Derived> & A)`

Here is the call graph for this function:



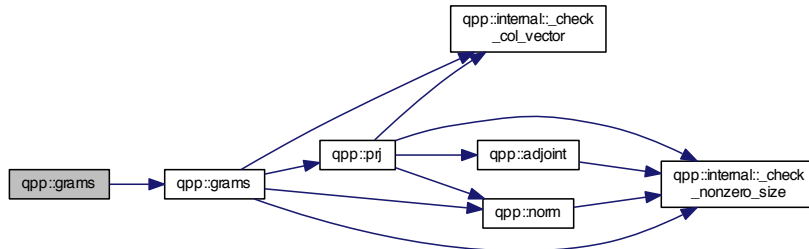
5.1.1.29 `template<typename Derived > types::DynMat<typename Derived::Scalar> qpp::grams (const std::vector< Derived > & Vs)`

Here is the call graph for this function:



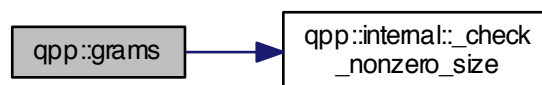
5.1.1.30 `template<typename Derived > types::DynMat<typename Derived::Scalar> qpp::grams (const std::initializer_list< Derived > & Vs)`

Here is the call graph for this function:



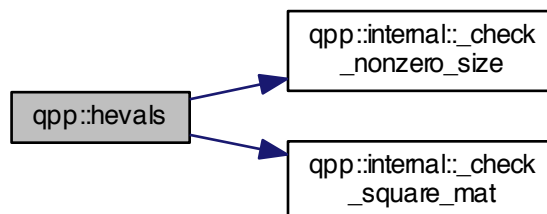
5.1.1.31 `template<typename Derived > types::DynMat<typename Derived::Scalar> qpp::grams (const Eigen::MatrixBase< Derived > & A)`

Here is the call graph for this function:



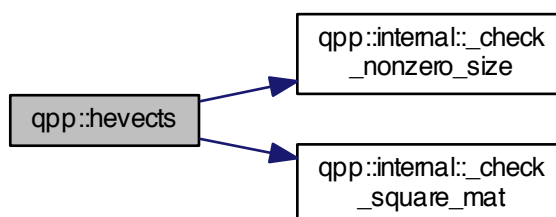
5.1.1.32 `template<typename Derived> types::dmat qpp::hevals (const Eigen::MatrixBase< Derived > & A)`

Here is the call graph for this function:



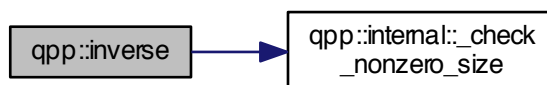
5.1.1.33 `template<typename Derived> types::cmat qpp::hevects (const Eigen::MatrixBase< Derived > & A)`

Here is the call graph for this function:



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

Here is the call graph for this function:



5.1.1.35 `std::vector<std::size_t> qpp::invperm (const std::vector< std::size_t > & perm)`

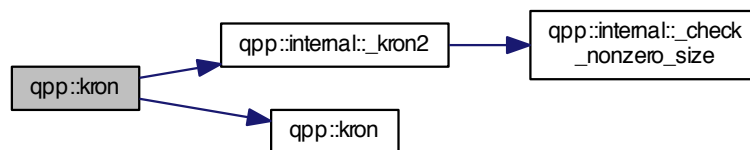
Here is the call graph for this function:



5.1.1.36 `template<typename T> types::DynMat<typename T::Scalar> qpp::kron (const T & head)`

5.1.1.37 `template<typename T, typename... Args> types::DynMat<typename T::Scalar> qpp::kron (const T & head, const Args &... tail)`

Here is the call graph for this function:



5.1.1.38 `template<typename Derived> types::DynMat<typename Derived::Scalar> qpp::kron (const std::vector< Derived > & As)`

Here is the call graph for this function:



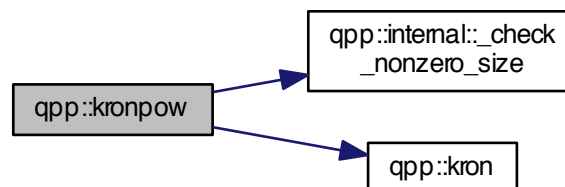
5.1.1.39 `template<typename Derived> types::DynMat<typename Derived::Scalar> qpp::kron (const std::initializer_list<Derived> & As)`

Here is the call graph for this function:



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

Here is the call graph for this function:



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

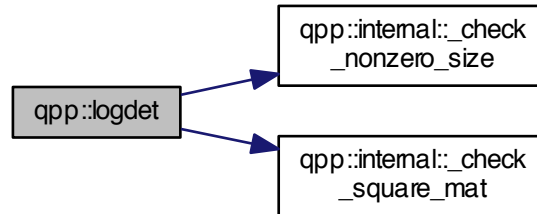
5.1.1.42 `template<typename Derived> Derived qpp::loadMATLABmatrix (const std::string & mat_file, const std::string & var_name)`

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

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

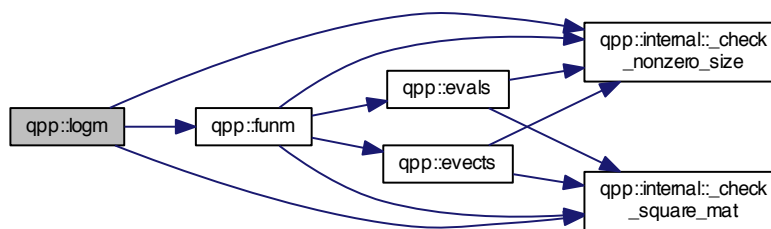
5.1.1.45 `template<typename Derived> Derived::Scalar qpp::logdet (const Eigen::MatrixBase< Derived> & A)`

Here is the call graph for this function:



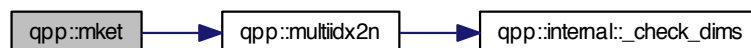
5.1.1.46 `template<typename Derived> types::cmat qpp::logm (const Eigen::MatrixBase< Derived> & A)`

Here is the call graph for this function:



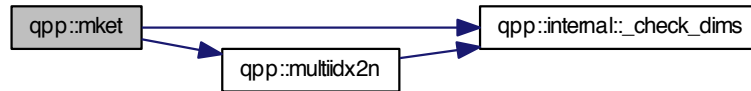
5.1.1.47 `types::ket qpp::mket (const std::vector< std::size_t> & mask)`

Here is the call graph for this function:



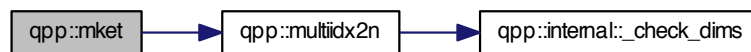
5.1.1.48 `types::ket qpp::mket (const std::vector< std::size_t > & mask, const std::vector< std::size_t > & dims)`

Here is the call graph for this function:



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

Here is the call graph for this function:



5.1.1.50 `std::size_t qpp::multidx2n (const std::vector< std::size_t > & midx, const std::vector< std::size_t > & dims)`

Here is the call graph for this function:



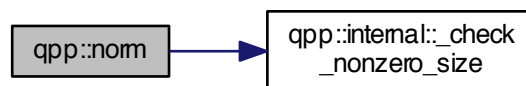
5.1.1.51 `std::vector<std::size_t> qpp::n2multiidx (std::size_t n, const std::vector< std::size_t > & dims)`

Here is the call graph for this function:



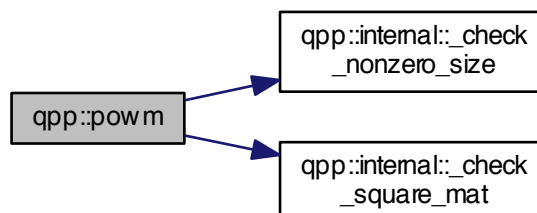
5.1.1.52 `template<typename Derived > double qpp::norm (const Eigen::MatrixBase< Derived > & A)`

Here is the call graph for this function:



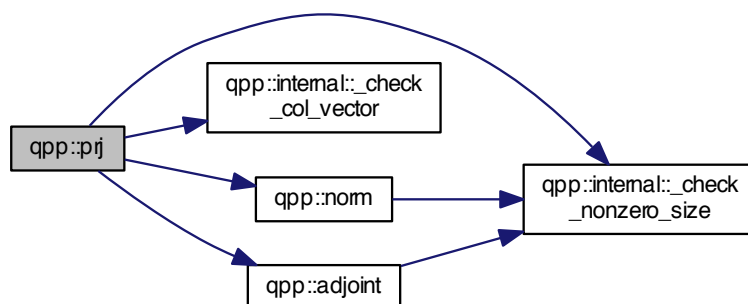
5.1.1.53 `template<typename Derived > types::DynMat<typename Derived::Scalar> qpp::powm (const Eigen::MatrixBase< Derived > & A, std::size_t n)`

Here is the call graph for this function:



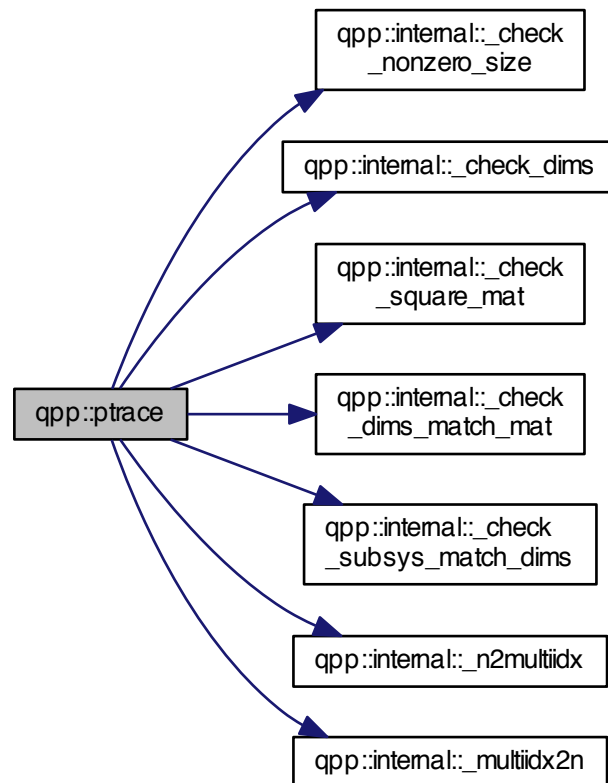
5.1.1.54 `template<typename Derived> types::DynMat<typename Derived::Scalar> qpp::prj (const Eigen::MatrixBase<Derived> & V)`

Here is the call graph for this function:



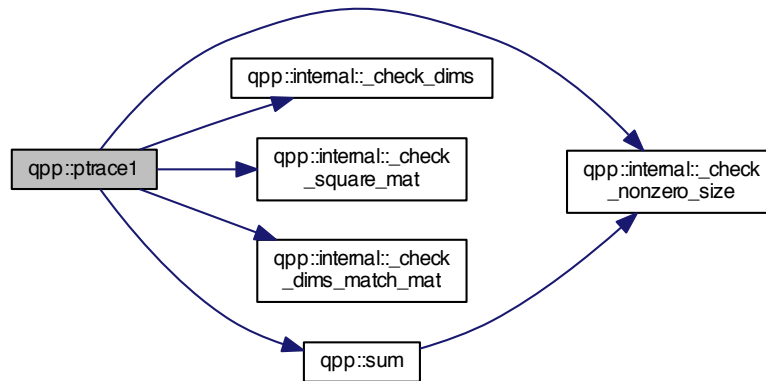
5.1.1.55 `template<typename Derived> types::DynMat<typename Derived::Scalar> qpp::ptrace (const Eigen::MatrixBase< Derived> & A, const std::vector< std::size_t> & subsys, const std::vector< std::size_t> & dims)`

Here is the call graph for this function:



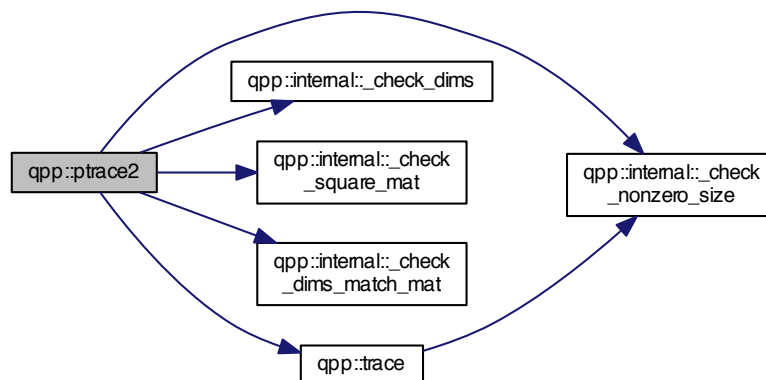
5.1.1.56 `template<typename Derived> types::DynMat<typename Derived::Scalar> qpp::ptrace1 (const Eigen::MatrixBase< Derived> & A, const std::vector< std::size_t> & dims)`

Here is the call graph for this function:



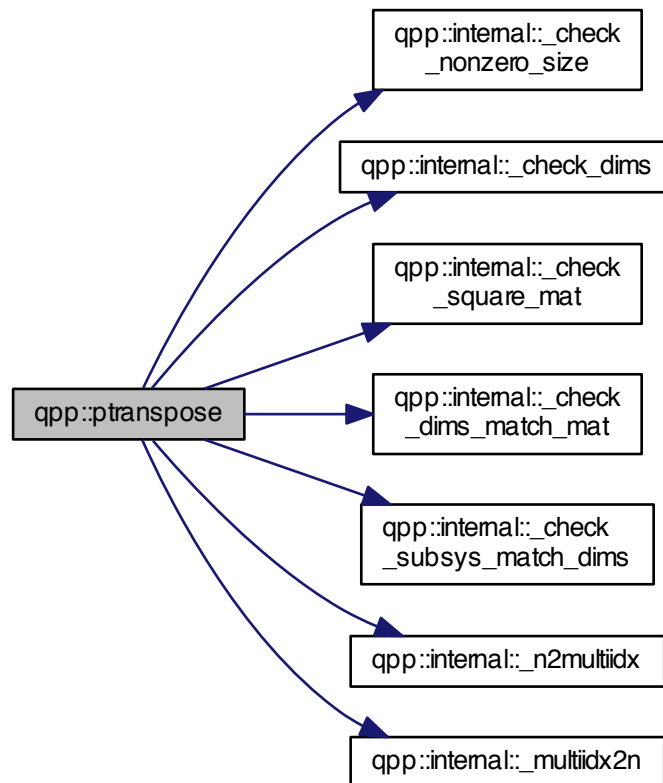
5.1.1.57 `template<typename Derived> types::DynMat<typename Derived::Scalar> qpp::ptrace2 (const Eigen::MatrixBase< Derived> & A, const std::vector< std::size_t> & dims)`

Here is the call graph for this function:



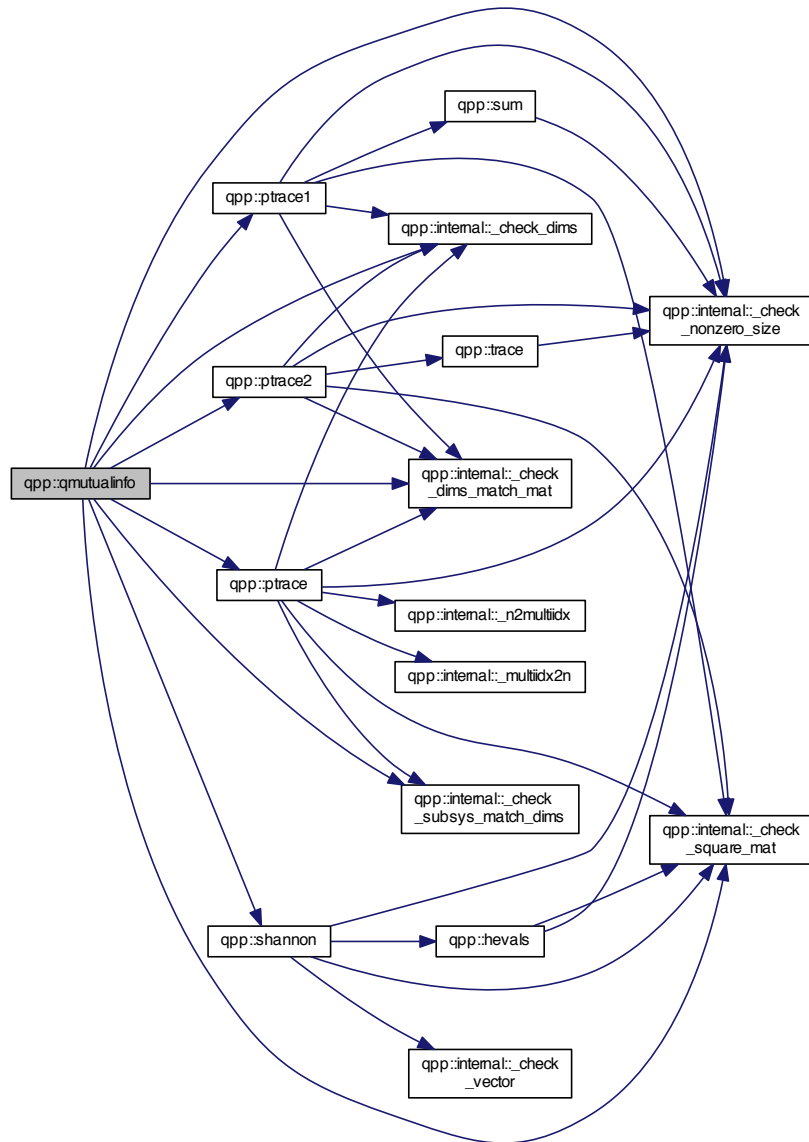
5.1.1.58 `template<typename Derived> types::DynMat<typename Derived::Scalar> qpp::ptranspose (const Eigen::MatrixBase< Derived> & A, const std::vector< std::size_t> & subsys, const std::vector< std::size_t> & dims)`

Here is the call graph for this function:



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

Here is the call graph for this function:



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

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

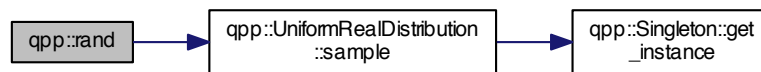
5.1.1.62 `template<> types::cmat qpp::rand (std::size_t rows, std::size_t cols, double a, double b)`

Here is the call graph for this function:



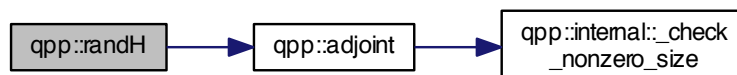
5.1.1.63 `double qpp::rand (double a = 0, double b = 1)`

Here is the call graph for this function:



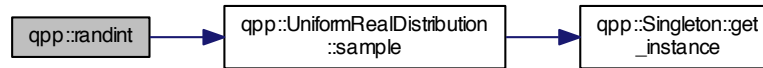
5.1.1.64 `types::cmat qpp::randH (std::size_t D)`

Here is the call graph for this function:

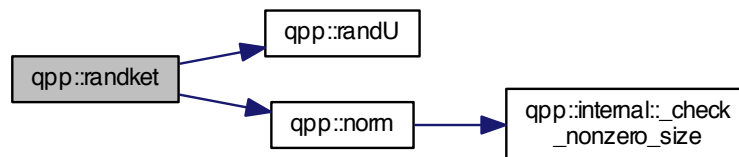


5.1.1.65 `long long qpp::randint (long long a, long long b)`

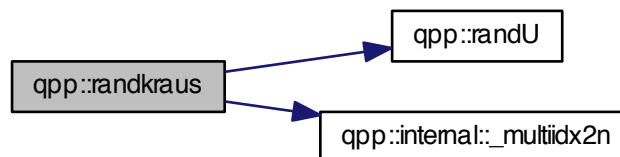
Here is the call graph for this function:

5.1.1.66 `types::ket qpp::randket (std::size_t D)`

Here is the call graph for this function:

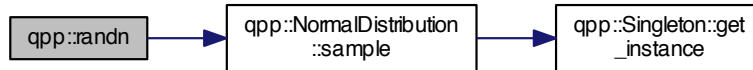
5.1.1.67 `std::vector<types::cmat> qpp::randkraus (std::size_t n, std::size_t D)`

Here is the call graph for this function:

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

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

Here is the call graph for this function:



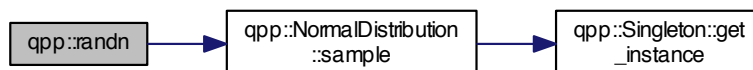
5.1.1.70 `template<> types::cmat qpp::randn (std::size_t rows, std::size_t cols, double mean, double sigma)`

Here is the call graph for this function:



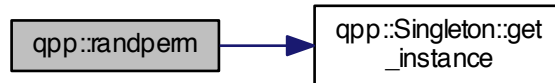
5.1.1.71 `double qpp::randn (double mean = 0, double sigma = 1)`

Here is the call graph for this function:

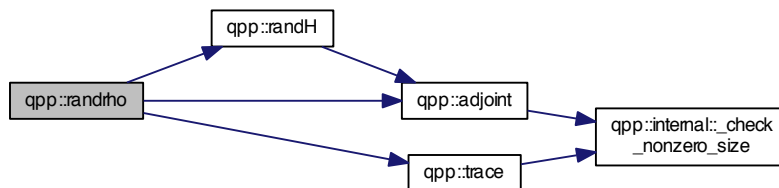


5.1.1.72 `std::vector<std::size_t> qpp::randperm (std::size_t n)`

Here is the call graph for this function:

**5.1.1.73** `types::cmat qpp::randrho (std::size_t D)`

Here is the call graph for this function:

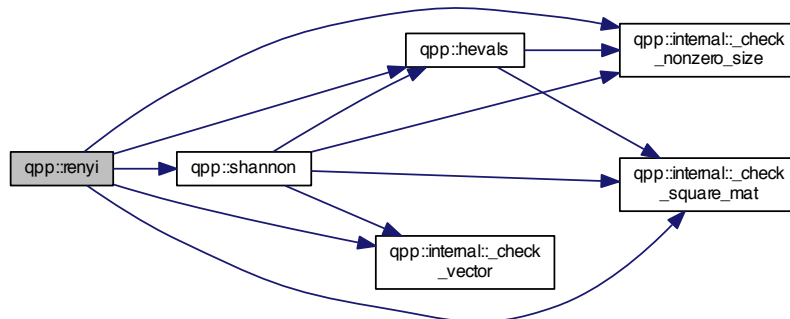
**5.1.1.74** `types::cmat qpp::randU (std::size_t D)`**5.1.1.75** `types::cmat qpp::randV (std::size_t Din, std::size_t Dout)`

Here is the call graph for this function:



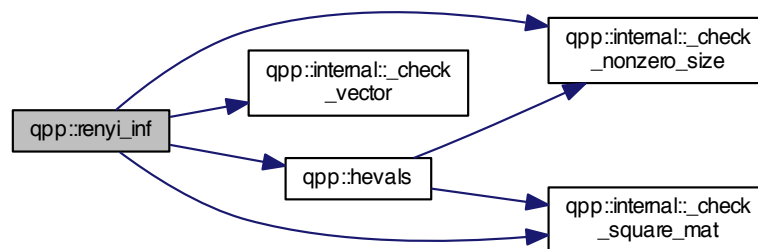
5.1.1.76 `template<typename Derived> double qpp::renyi (const double alpha, const Eigen::MatrixBase< Derived > & A)`

Here is the call graph for this function:



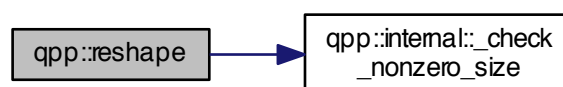
5.1.1.77 `template<typename Derived> double qpp::renyi_inf (const Eigen::MatrixBase< Derived > & A)`

Here is the call graph for this function:



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

Here is the call graph for this function:

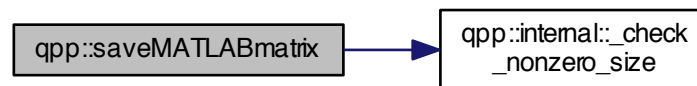


5.1.1.79 `template<typename Derived > void qpp::save (const Eigen::MatrixBase< Derived > & A, const std::string & fname)`

5.1.1.80 `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)`

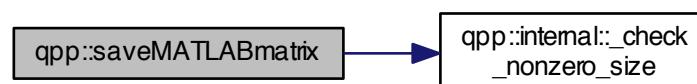
5.1.1.81 `template<> void qpp::saveMATLABmatrix (const Eigen::MatrixBase< typename types::dmat > & A, const std::string & mat_file, const std::string & var_name, const std::string & mode)`

Here is the call graph for this function:



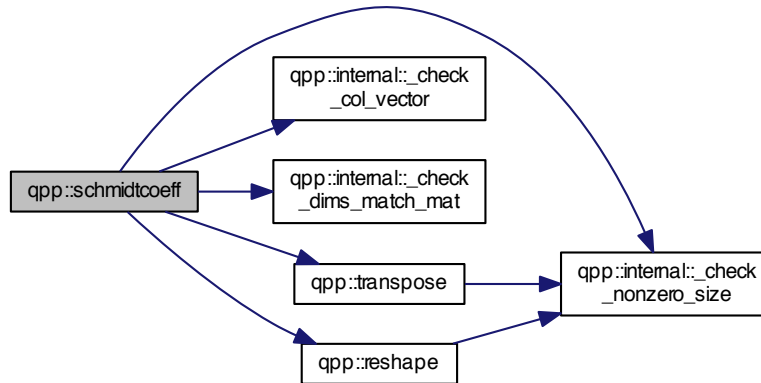
5.1.1.82 `template<> void qpp::saveMATLABmatrix (const Eigen::MatrixBase< typename types::cmat > & A, const std::string & mat_file, const std::string & var_name, const std::string & mode)`

Here is the call graph for this function:



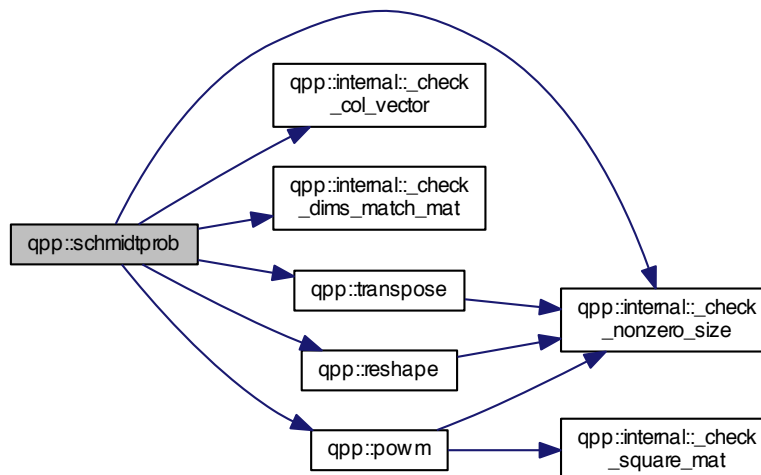
5.1.1.83 `template<typename Derived> types::cmat qpp::schmidtcoeff (const Eigen::MatrixBase< Derived> & A, const std::vector< std::size_t> & dims)`

Here is the call graph for this function:



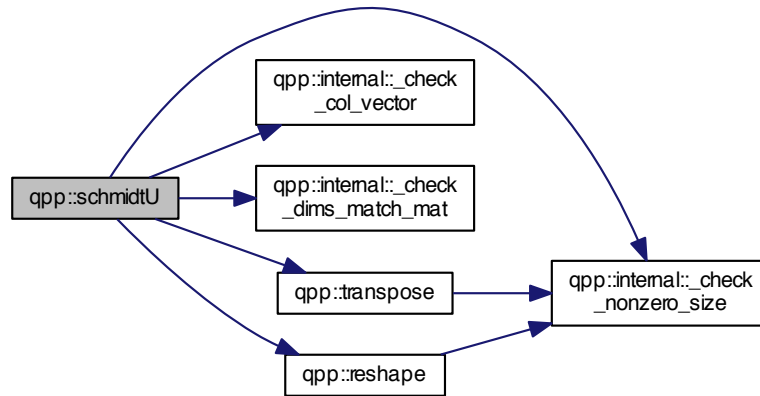
5.1.1.84 `template<typename Derived> types::cmat qpp::schmidtprob (const Eigen::MatrixBase< Derived> & A, const std::vector< std::size_t> & dims)`

Here is the call graph for this function:



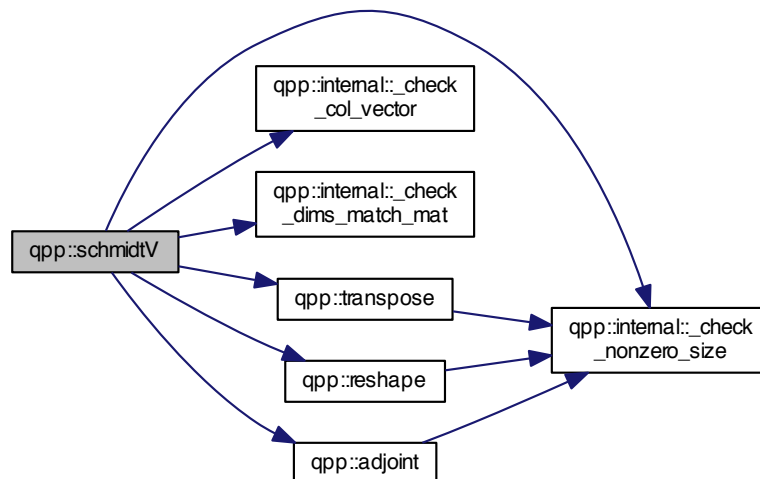
5.1.1.85 `template<typename Derived> types::cmat qpp::schmidtU (const Eigen::MatrixBase< Derived> & A, const std::vector< std::size_t> & dims)`

Here is the call graph for this function:



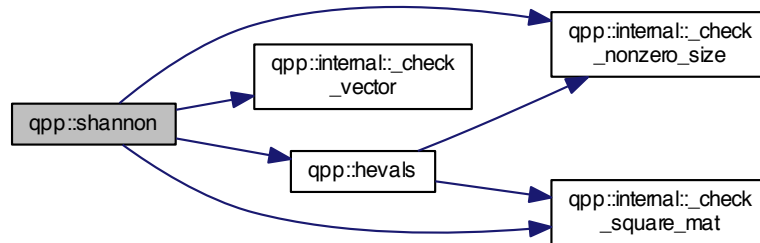
5.1.1.86 `template<typename Derived> types::cmat qpp::schmidtV (const Eigen::MatrixBase< Derived> & A, const std::vector< std::size_t> & dims)`

Here is the call graph for this function:



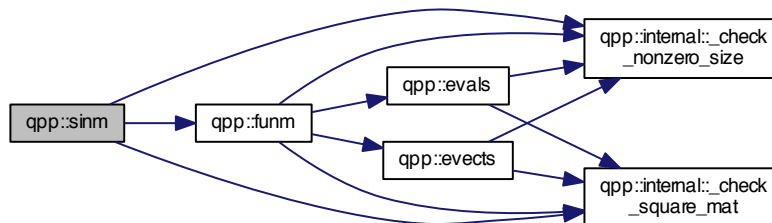
5.1.1.87 `template<typename Derived> double qpp::shannon (const Eigen::MatrixBase< Derived > & A)`

Here is the call graph for this function:



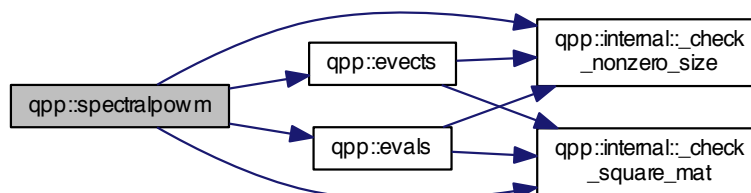
5.1.1.88 `template<typename Derived> types::cmat qpp::sinm (const Eigen::MatrixBase< Derived > & A)`

Here is the call graph for this function:



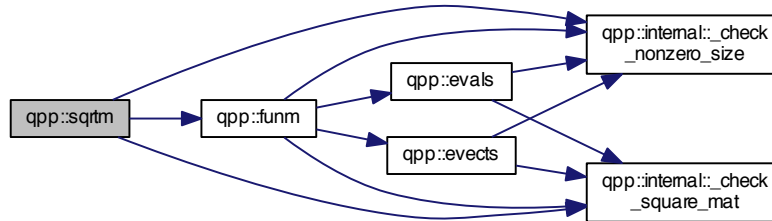
5.1.1.89 `template<typename Derived> types::cmat qpp::spectralpowm (const Eigen::MatrixBase< Derived > & A, const types::cplx z)`

Here is the call graph for this function:



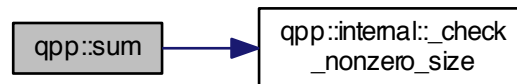
5.1.1.90 `template<typename Derived> types::cmat qpp::sqrtm (const Eigen::MatrixBase< Derived > & A)`

Here is the call graph for this function:



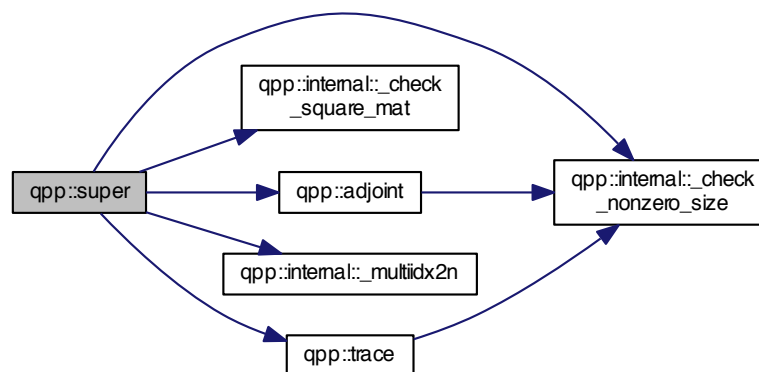
5.1.1.91 `template<typename Derived> Derived::Scalar qpp::sum (const Eigen::MatrixBase< Derived > & A)`

Here is the call graph for this function:



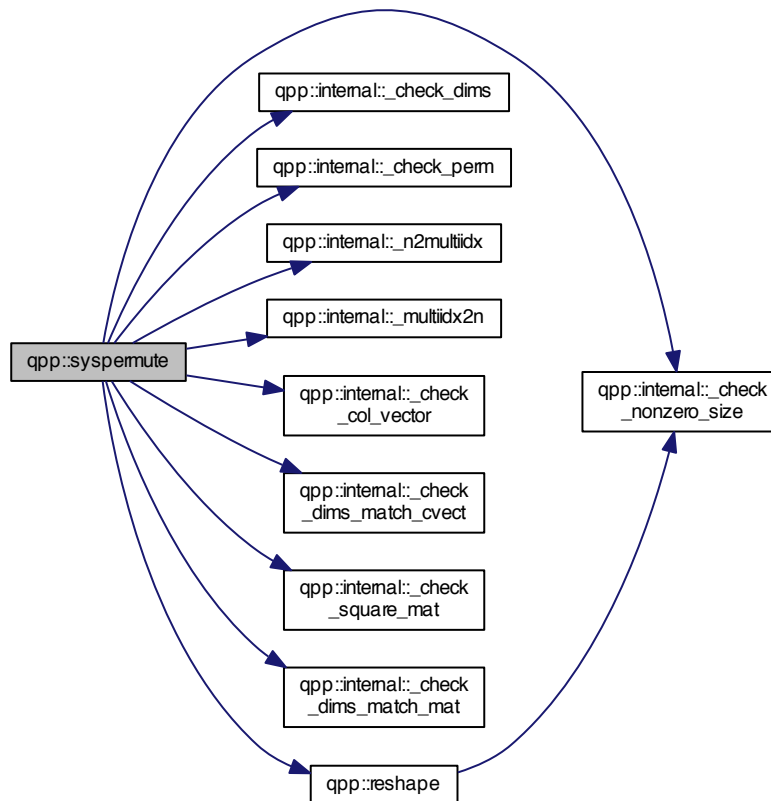
5.1.1.92 `types::cmat qpp::super (const std::vector< types::cmat > & Ks)`

Here is the call graph for this function:



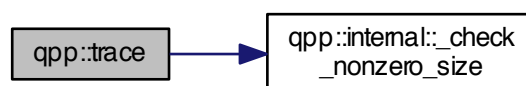
5.1.1.93 `template<typename Derived> types::DynMat<typename Derived::Scalar> qpp::syspermute (const Eigen::MatrixBase< Derived> & A, const std::vector< std::size_t> & perm, const std::vector< std::size_t> & dims)`

Here is the call graph for this function:



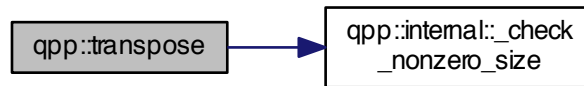
5.1.1.94 `template<typename Derived> Derived::Scalar qpp::trace (const Eigen::MatrixBase< Derived> & A)`

Here is the call graph for this function:



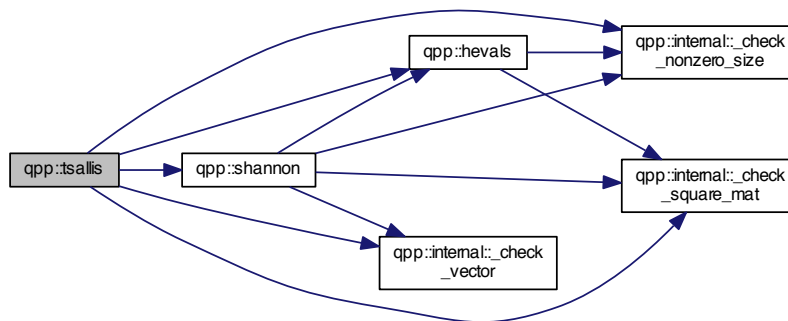
5.1.1.95 `template<typename Derived> types::DynMat<typename Derived::Scalar> qpp::transpose (const Eigen::MatrixBase< Derived> & A)`

Here is the call graph for this function:



5.1.1.96 `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::get_instance()`

5.1.2.2 `const RandomDevices& qpp::rdevs = RandomDevices::get_instance()`

5.1.2.3 `const States& qpp::st = States::get_instance()`

5.2 qpp::ct Namespace Reference

Functions

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

Variables

- `const double chop = 1e-10`

- const double `eps` = 1e-12
- const std::size_t `maxn` = 64
- 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 (std::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 std::size_t qpp::ct::maxn = 64`

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

5.3 qpp::internal Namespace Reference

Functions

- void `_n2multiidx` (std::size_t n, std::size_t numdims, const std::size_t *dims, std::size_t *result)
- std::size_t `_multiidx2n` (const std::size_t *midx, std::size_t numdims, const std::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< std::size_t > &dims)
- template<typename Derived >
bool `_check_dims_match_mat` (const std::vector< std::size_t > &dims, const Eigen::MatrixBase< Derived > &A)
- template<typename Derived >
bool `_check_dims_match_cvect` (const std::vector< std::size_t > &dims, const Eigen::MatrixBase< Derived > &V)
- template<typename Derived >
bool `_check_dims_match_rvect` (const std::vector< std::size_t > &dims, const Eigen::MatrixBase< Derived > &V)
- bool `_check_eq_dims` (const std::vector< std::size_t > &dims, std::size_t dim)
- bool `_check_subsys_match_dims` (const std::vector< std::size_t > &subsys, const std::vector< std::size_t > &dims)
- bool `_check_perm` (const std::vector< std::size_t > &perm)

- `template<typename Derived1 , typename Derived2 >`
`types::DynMat< typename`
`Derived1::Scalar > _kron2 (const Eigen::MatrixBase< Derived1 > &A, const Eigen::MatrixBase< Derived2`
`> &B)`
- `template<typename T >`
`void variadic_vector_emplace (std::vector< T > &)`
- `template<typename T , typename First , typename... Args>`
`void variadic_vector_emplace (std::vector< T > &v, First &&first, Args &&...args)`

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< std::size_t > & dims)`

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

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

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

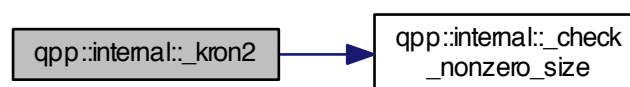
5.3.1.10 `template<typename Derived > bool qpp::internal::_check_square_mat (const Eigen::MatrixBase< Derived > & A)`

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

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

5.3.1.13 `template<typename Derived1 , typename Derived2 > types::DynMat<typename Derived1::Scalar>`
`qpp::internal::_kron2 (const Eigen::MatrixBase< Derived1 > & A, const Eigen::MatrixBase< Derived2 > & B)`

Here is the call graph for this function:



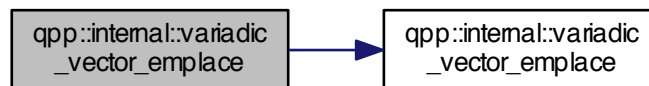
5.3.1.14 `std::size_t qpp::internal::_multiidx2n (const std::size_t * midx, std::size_t numdims, const std::size_t * dims)`

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

5.3.1.16 `template<typename T> void qpp::internal::variadic_vector_emplace (std::vector< T > &)`

5.3.1.17 `template<typename T, typename First, typename... Args> void qpp::internal::variadic_vector_emplace (std::vector< T > & v, First && first, Args &&... args)`

Here is the call graph for this function:



5.4 qpp::types Namespace Reference

Typedefs

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

5.4.1 Typedef Documentation

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

5.4.1.2 using `qpp::types::cmat` = typedef `Eigen::MatrixXcd`

5.4.1.3 using `qpp::types::cplx` = typedef `std::complex<double>`

5.4.1.4 using `qpp::types::dmat` = typedef `Eigen::MatrixXd`

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

5.4.1.6 using `qpp::types::ket` = typedef `Eigen::Matrix<cplx, Eigen::Dynamic, 1>`

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)
- `std::size_t sample` ()
- `std::vector< double > probabilities` () const

Protected Attributes

- `std::discrete_distribution`
< std::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]

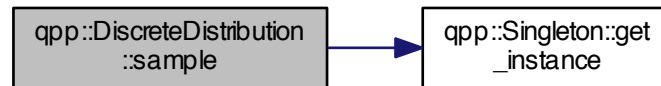
6.1.1.3 `qpp::DiscreteDistribution::DiscreteDistribution (std::vector< double > weights)` [inline]

6.1.2 Member Function Documentation

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

6.1.2.2 `std::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<std::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)
- `std::size_t sample` ()
- `std::vector< double > probabilities` () const

Protected Member Functions

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

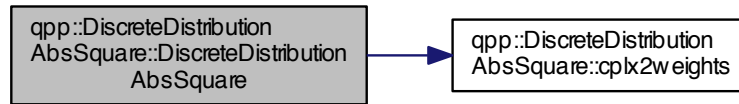
Protected Attributes

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

6.2.1 Constructor & Destructor Documentation

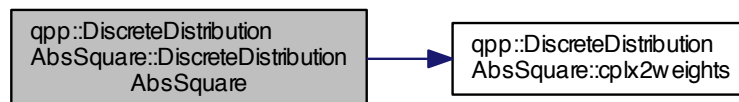
6.2.1.1 `template<typename InputIterator> qpp::DiscreteDistributionAbsSquare::DiscreteDistributionAbsSquare (InputIterator first, InputIterator last) [inline]`

Here is the call graph for this function:



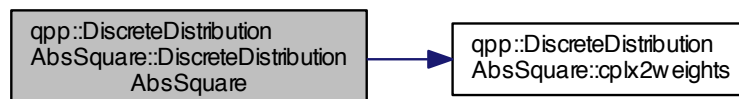
6.2.1.2 `qpp::DiscreteDistributionAbsSquare::DiscreteDistributionAbsSquare (std::initializer_list< types::cplx > amplitudes) [inline]`

Here is the call graph for this function:



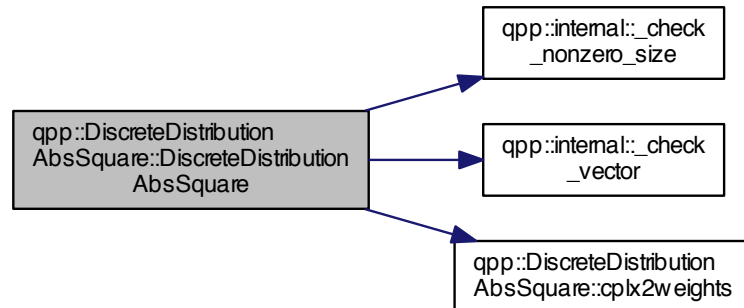
6.2.1.3 `qpp::DiscreteDistributionAbsSquare::DiscreteDistributionAbsSquare (std::vector< types::cplx > amplitudes) [inline]`

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:



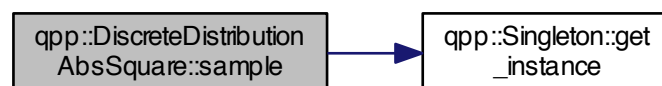
6.2.2 Member Function Documentation

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

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

6.2.2.3 `std::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<std::size_t> qpp::DiscreteDistributionAbsSquare::_d [protected]`

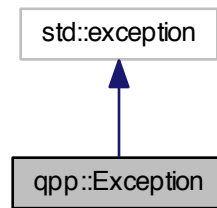
The documentation for this class was generated from the following file:

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

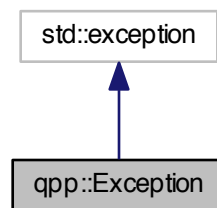
6.3 qpp::Exception Class Reference

```
#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_INVALID`, `Type::NOT_QUBIT_GATE`, `Type::NOT_QUBIT_SUBSYS`, `Type::NOT_BIPARTITE`,
`Type::OUT_OF_RANGE`, `Type::TYPE_MISMATCH`, `Type::UNDEFINED_TYPE`, `Type::CUSTOM_EXCEPTION` }

Public Member Functions

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

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]

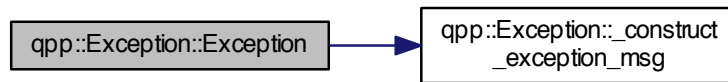
Enumerator

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_INVALID
NOT_QUBIT_GATE
NOT_QUBIT_SUBSYS
NOT_BIPARTITE
OUT_OF_RANGE
TYPE_MISMATCH
UNDEFINED_TYPE
CUSTOM_EXCEPTION

6.3.2 Constructor & Destructor Documentation

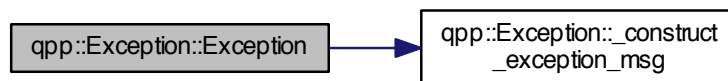
6.3.2.1 `qpp::Exception::Exception (const std::string & where, const Type & type)` `[inline]`

Here is the call graph for this function:



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

Here is the call graph for this function:



6.3.3 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]`

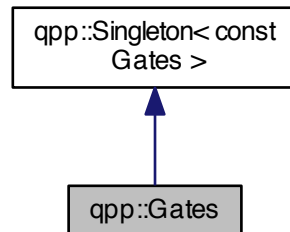
The documentation for this class was generated from the following file:

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

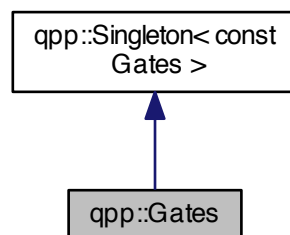
6.4 qpp::Gates Class Reference

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

Inheritance diagram for qpp::Gates:



Collaboration diagram for qpp::Gates:



Public Member Functions

- `types::cmat Rn` (double theta, `std::vector< double > n`) const
- `types::cmat Zd` (`std::size_t D`) const
- `types::cmat Fd` (`std::size_t D`) const
- `types::cmat Xd` (`std::size_t D`) const
- `template<typename Derived = Eigen::MatrixXcd>`
`Derived ld` (`std::size_t D`) const
- `template<typename Derived1 , typename Derived2 >`
`types::DynMat< typename`
`Derived1::Scalar > apply` (const `Eigen::MatrixBase< Derived1 >` &state, const `Eigen::MatrixBase< Derived2 >` &A, const `std::vector< std::size_t >` &subsys, const `std::vector< std::size_t >` &dims) const
- `template<typename Derived >`
`types::DynMat< typename`
`Derived::Scalar > CTRL` (const `Eigen::MatrixBase< Derived >` &A, const `std::vector< std::size_t >` &ctrl, const `std::vector< std::size_t >` &subsys, `std::size_t n`, `std::size_t d=2`) const

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 CNOTba](#)
- [types::cmat SWAP](#)
- [types::cmat TOF](#)
- [types::cmat FRED](#)

Private Member Functions

- [Gates \(\)](#)

Friends

- class [Singleton< const Gates >](#)

Additional Inherited Members

6.4.1 Constructor & Destructor Documentation

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

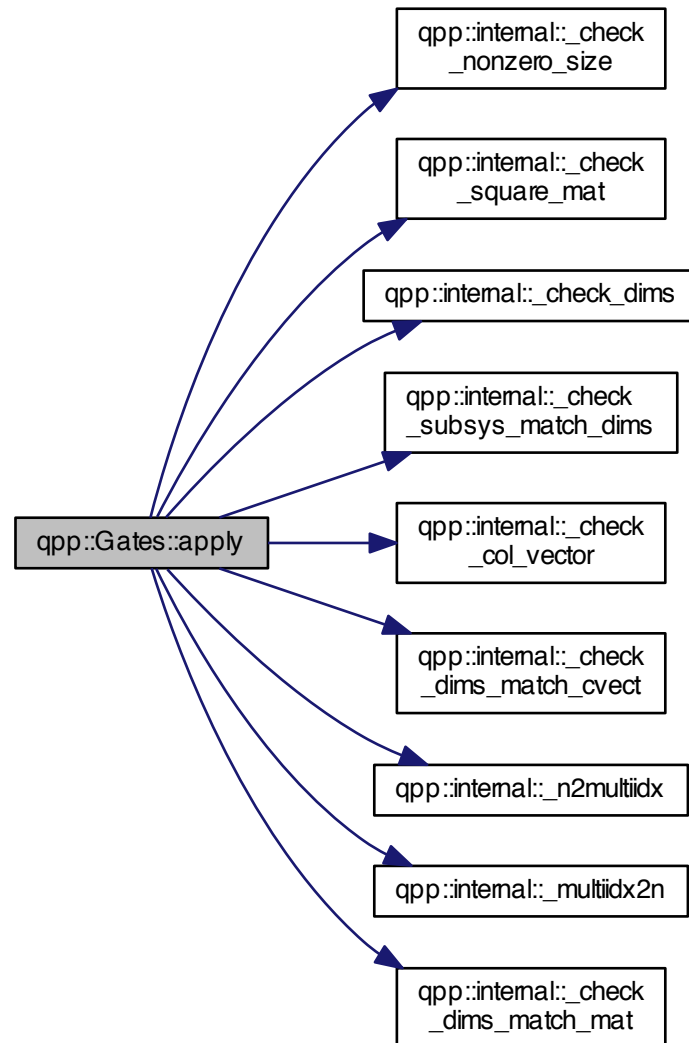
6.4.2 Member Function Documentation

```

6.4.2.1 template<typename Derived1 , typename Derived2 > types::DynMat<typename Derived1::Scalar>
      qpp::Gates::apply ( const Eigen::MatrixBase< Derived1 > & state, const Eigen::MatrixBase< Derived2 > & A, const
      std::vector< std::size_t > & subsys, const std::vector< std::size_t > & dims ) const [inline]

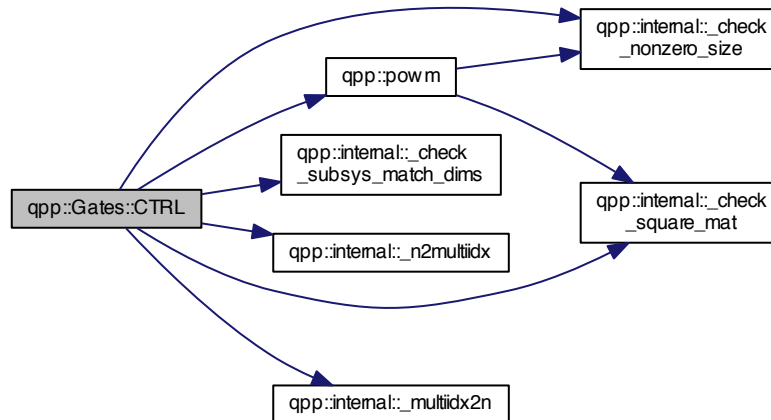
```

Here is the call graph for this function:



6.4.2.2 `template<typename Derived > types::DynMat<typename Derived::Scalar> qpp::Gates::CTRL (const Eigen::MatrixBase< Derived > & A, const std::vector< std::size_t > & ctrl, const std::vector< std::size_t > & subsys, std::size_t n, std::size_t d = 2) const [inline]`

Here is the call graph for this function:



6.4.2.3 `types::cmat qpp::Gates::Fd (std::size_t D) const [inline]`

Here is the call graph for this function:



6.4.2.4 `template<typename Derived = Eigen::MatrixXcd> Derived qpp::Gates::Id (std::size_t D) const [inline]`

6.4.2.5 `types::cmat qpp::Gates::Rn (double theta, std::vector< double > n) const [inline]`

6.4.2.6 `types::cmat qpp::Gates::Xd (std::size_t D) const` `[inline]`

Here is the call graph for this function:



6.4.2.7 `types::cmat qpp::Gates::Zd (std::size_t D) const` `[inline]`

Here is the call graph for this function:



6.4.3 Friends And Related Function Documentation

6.4.3.1 `friend class Singleton< const Gates >` `[friend]`

6.4.4 Member Data Documentation

6.4.4.1 `types::cmat qpp::Gates::CNOTab`

6.4.4.2 `types::cmat qpp::Gates::CNOTba`

6.4.4.3 `types::cmat qpp::Gates::CZ`

6.4.4.4 `types::cmat qpp::Gates::FRED`

6.4.4.5 `types::cmat qpp::Gates::H`

6.4.4.6 `types::cmat qpp::Gates::Id2`

6.4.4.7 `types::cmat qpp::Gates::S`

6.4.4.8 `types::cmat qpp::Gates::SWAP`

6.4.4.9 `types::cmat qpp::Gates::T`

6.4.4.10 `types::cmat qpp::Gates::TOF`

6.4.4.11 `types::cmat qpp::Gates::X`

6.4.4.12 `types::cmat qpp::Gates::Y`

6.4.4.13 `types::cmat qpp::Gates::Z`

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`

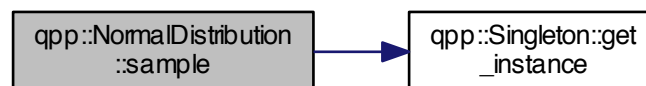
6.5.1 Constructor & Destructor Documentation

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=[States::get_instance\(\)](#).pz0)
- [std::size_t measure](#) (const [types::cmat](#) &U, bool destructive=false)
- [std::size_t measure](#) (bool destructive=false)
- [types::cmat getRho](#) () const
- [std::size_t getD](#) () const

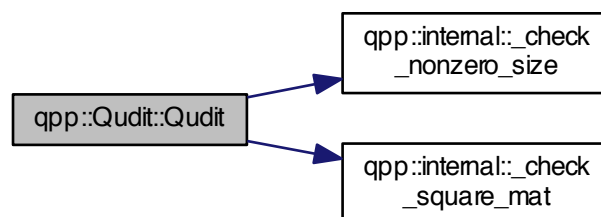
Private Attributes

- [types::cmat _rho](#)
- [std::size_t _D](#)

6.6.1 Constructor & Destructor Documentation

6.6.1.1 [qpp::Qudit::Qudit](#) (const [types::cmat](#) & rho = [States::get_instance\(\)](#).pz0) [inline]

Here is the call graph for this function:



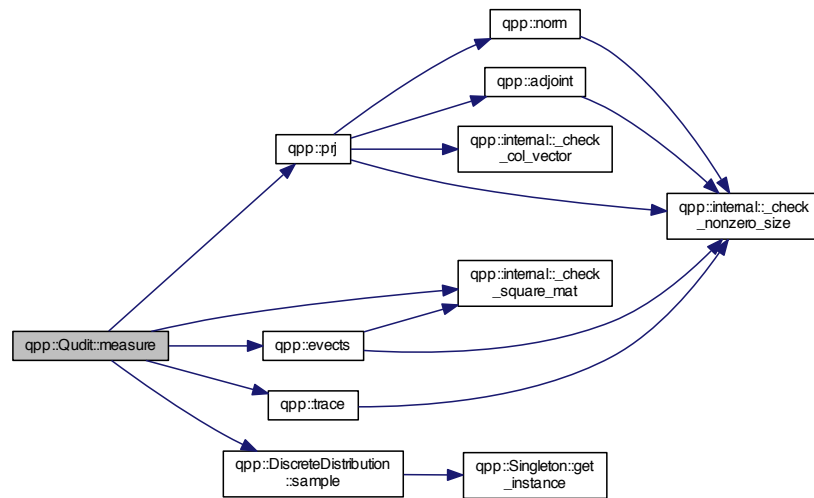
6.6.2 Member Function Documentation

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

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

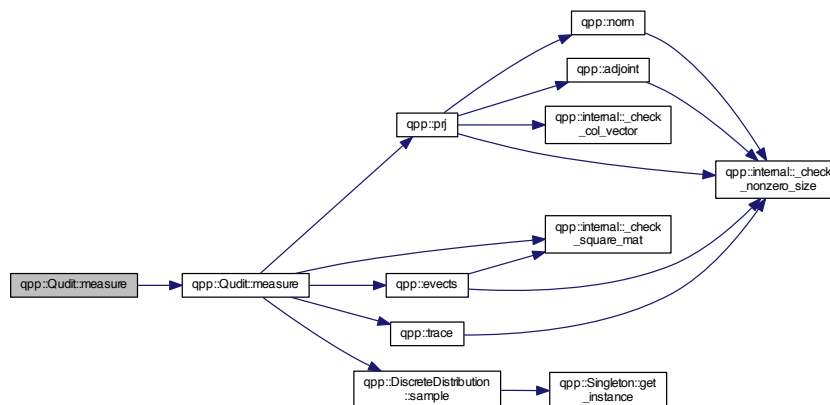
6.6.2.3 `std::size_t qpp::Qudit::measure (const types::cmat & U, bool destructive = false) [inline]`

Here is the call graph for this function:



6.6.2.4 `std::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 `std::size_t qpp::Qudit::_D [private]`

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

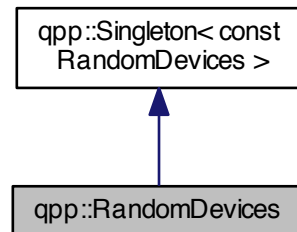
The documentation for this class was generated from the following file:

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

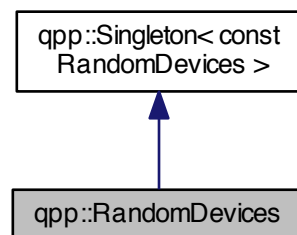
6.7 qpp::RandomDevices Class Reference

```
#include <randevs.h>
```

Inheritance diagram for qpp::RandomDevices:



Collaboration diagram for qpp::RandomDevices:



Public Attributes

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

Private Member Functions

- `RandomDevices ()`

Friends

- class `Singleton< const RandomDevices >`

Additional Inherited Members

6.7.1 Constructor & Destructor Documentation

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

6.7.2 Friends And Related Function Documentation

6.7.2.1 `friend class Singleton< const RandomDevices >` `[friend]`

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` `[mutable]`

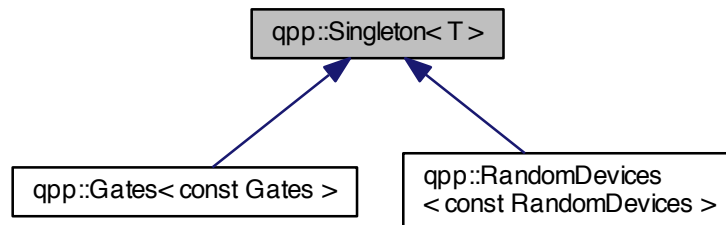
The documentation for this class was generated from the following file:

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

6.8 qpp::Singleton< T > Class Template Reference

```
#include <singleton.h>
```

Inheritance diagram for `qpp::Singleton< T >`:



Static Public Member Functions

- static `T & get_instance ()`

Protected Member Functions

- `Singleton ()`=default
- virtual `~Singleton ()`=default
- `Singleton (const Singleton &)=delete`
- `Singleton & operator= (const Singleton &)=delete`

6.8.1 Constructor & Destructor Documentation

6.8.1.1 `template<typename T> qpp::Singleton< T >::Singleton ()` [protected],[default]

6.8.1.2 `template<typename T> virtual qpp::Singleton< T >::~~Singleton ()` [protected],[virtual],[default]

6.8.1.3 `template<typename T> qpp::Singleton< T >::Singleton (const Singleton< T > &)` [protected],[delete]

6.8.2 Member Function Documentation

6.8.2.1 `template<typename T> static T& qpp::Singleton< T >::get_instance ()` [inline],[static]

6.8.2.2 `template<typename T> Singleton& qpp::Singleton< T >::operator= (const Singleton< T > &)` [protected],[delete]

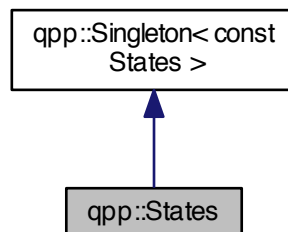
The documentation for this class was generated from the following file:

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

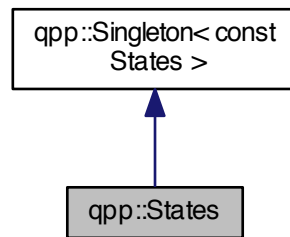
6.9 qpp::States Class Reference

```
#include <states.h>
```

Inheritance diagram for qpp::States:



Collaboration diagram for qpp::States:



Public Attributes

- [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

- [States \(\)](#)

Friends

- class [Singleton< const States >](#)

Additional Inherited Members

6.9.1 Constructor & Destructor Documentation

6.9.1.1 `qpp::States::States ()` `[inline],[private]`

6.9.2 Friends And Related Function Documentation

6.9.2.1 `friend class Singleton< const States >` `[friend]`

6.9.3 Member Data Documentation

6.9.3.1 `types::ket qpp::States::b00`

6.9.3.2 `types::ket qpp::States::b01`

6.9.3.3 `types::ket qpp::States::b10`

6.9.3.4 `types::ket qpp::States::b11`

6.9.3.5 `types::ket qpp::States::GHZ`

6.9.3.6 `types::cmat qpp::States::pb00`

6.9.3.7 `types::cmat qpp::States::pb01`

6.9.3.8 `types::cmat qpp::States::pb10`

6.9.3.9 `types::cmat qpp::States::pb11`

6.9.3.10 `types::cmat qpp::States::pGHZ`

6.9.3.11 `types::cmat qpp::States::pW`

6.9.3.12 `types::cmat qpp::States::px0`

6.9.3.13 `types::cmat qpp::States::px1`

6.9.3.14 `types::cmat qpp::States::py0`

6.9.3.15 `types::cmat qpp::States::py1`

6.9.3.16 `types::cmat qpp::States::pz0`

6.9.3.17 `types::cmat qpp::States::pz1`

6.9.3.18 `types::ket qpp::States::W`

6.9.3.19 `types::ket qpp::States::x0`

6.9.3.20 `types::ket qpp::States::x1`

6.9.3.21 `types::ket qpp::States::y0`

6.9.3.22 `types::ket qpp::States::y1`

6.9.3.23 `types::ket qpp::States::z0`

6.9.3.24 `types::ket qpp::States::z1`

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

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

6.10 qpp::Timer Class Reference

```
#include <timer.h>
```

Public Member Functions

- [Timer](#) ()
- void [tic](#) ()
- void [toc](#) ()
- double [seconds](#) () const

Protected Attributes

- `std::chrono::steady_clock::time_point` [_start](#)
- `std::chrono::steady_clock::time_point` [_end](#)

Friends

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

6.10.1 Constructor & Destructor Documentation

6.10.1.1 `qpp::Timer::Timer ()` [[inline](#)]

6.10.2 Member Function Documentation

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

6.10.2.2 `void qpp::Timer::tic ()` [[inline](#)]

6.10.2.3 `void qpp::Timer::toc ()` [[inline](#)]

6.10.3 Friends And Related Function Documentation

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

6.10.4 Member Data Documentation

6.10.4.1 `std::chrono::steady_clock::time_point` `qpp::Timer::_end` [[protected](#)]

6.10.4.2 `std::chrono::steady_clock::time_point` `qpp::Timer::_start` [[protected](#)]

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

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

6.11 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`

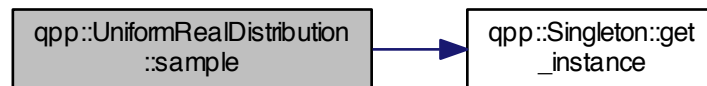
6.11.1 Constructor & Destructor Documentation

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

6.11.2 Member Function Documentation

6.11.2.1 `double qpp::UniformRealDistribution::sample ()` [`inline`]

Here is the call graph for this function:



6.11.3 Member Data Documentation

6.11.3.1 `std::uniform_real_distribution qpp::UniformRealDistribution::_d` [`protected`]

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

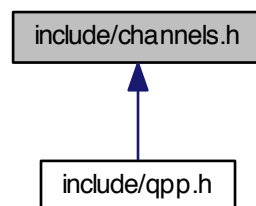
- `include/classes/stat.h`

Chapter 7

File Documentation

7.1 include/channels.h File Reference

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



Namespaces

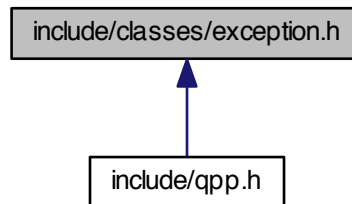
- [qpp](#)

Functions

- `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)`
- `template<typename Derived >
types::cmat qpp::channel (const Eigen::MatrixBase< Derived > &rho, const std::vector< types::cmat > &Ks)`
- `template<typename Derived >
types::cmat qpp::channel (const Eigen::MatrixBase< Derived > &rho, const std::vector< types::cmat > &Ks,
const std::vector< std::size_t > &subsys, const std::vector< std::size_t > &dims)`

7.2 include/classes/exception.h File Reference

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



Classes

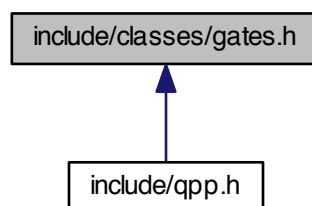
- class [qpp::Exception](#)

Namespaces

- [qpp](#)

7.3 include/classes/gates.h File Reference

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



Classes

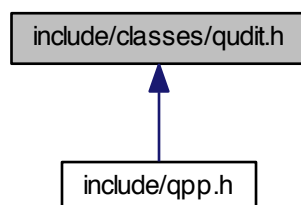
- class [qpp::Gates](#)

Namespaces

- [qpp](#)

7.4 include/classes/qudit.h File Reference

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



Classes

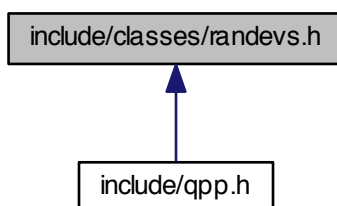
- class [qpp::Qudit](#)

Namespaces

- [qpp](#)

7.5 include/classes/randevs.h File Reference

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



Classes

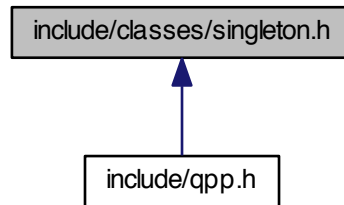
- class [qpp::RandomDevices](#)

Namespaces

- [qpp](#)

7.6 include/classes/singleton.h File Reference

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



Classes

- class [qpp::Singleton< T >](#)

Namespaces

- [qpp](#)

Macros

- `#define` [CLASS_SINGLETON\(Foo\)](#)
- `#define` [CLASS_CONST_SINGLETON\(Foo\)](#)

7.6.1 Macro Definition Documentation

7.6.1.1 `#define CLASS_CONST_SINGLETON(Foo)`

Value:

```
class Foo: public Singleton<const Foo>\n{\n    friend class Singleton<const Foo>;
```

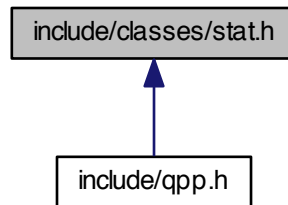
7.6.1.2 `#define CLASS_SINGLETON(Foo)`

Value:

```
class Foo: public Singleton<Foo>\n{\n    friend class Singleton<Foo>;
```


7.7 include/classes/stat.h File Reference

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



Classes

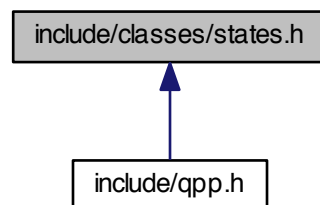
- class [qpp::NormalDistribution](#)
- class [qpp::UniformRealDistribution](#)
- class [qpp::DiscreteDistribution](#)
- class [qpp::DiscreteDistributionAbsSquare](#)

Namespaces

- [qpp](#)

7.8 include/classes/states.h File Reference

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



Classes

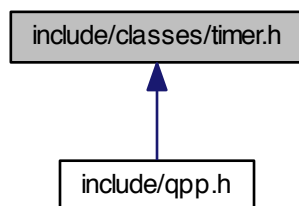
- class [qpp::States](#)

Namespaces

- [qpp](#)

7.9 include/classes/timer.h File Reference

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



Classes

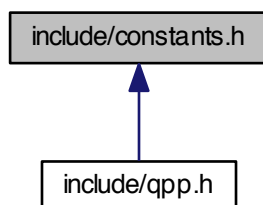
- class [qpp::Timer](#)

Namespaces

- [qpp](#)

7.10 include/constants.h File Reference

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



Namespaces

- [qpp](#)

- [qpp::ct](#)

Functions

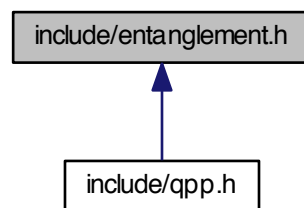
- `std::complex< double > qpp::ct::omega (std::size_t D)`

Variables

- `const double qpp::ct::chop = 1e-10`
- `const double qpp::ct::eps = 1e-12`
- `const std::size_t qpp::ct::maxn = 64`
- `const std::complex< double > qpp::ct::ii = { 0, 1 }`
- `const double qpp::ct::pi = 3.141592653589793238462643383279502884`
- `const double qpp::ct::ee = 2.718281828459045235360287471352662497`

7.11 include/entanglement.h File Reference

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



Namespaces

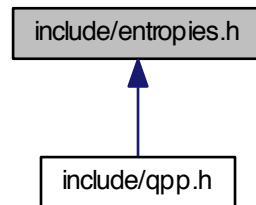
- [qpp](#)

Functions

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

7.12 include/entropies.h File Reference

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



Namespaces

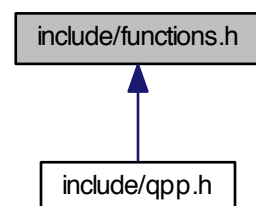
- [qpp](#)

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::qmutualinfo (const Eigen::MatrixBase< Derived > &A, const std::vector< std::size_t > &subsys, const std::vector< std::size_t > &dims)`

7.13 include/functions.h File Reference

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



Namespaces

- [qpp](#)

Functions

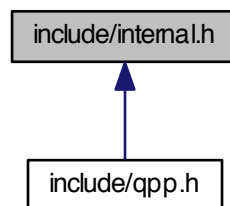
- `template<typename Derived >`
`types::DynMat< typename`
`Derived::Scalar > qpp::transpose (const Eigen::MatrixBase< Derived > &A)`
- `template<typename Derived >`
`types::DynMat< typename`
`Derived::Scalar > qpp::conjugate (const Eigen::MatrixBase< Derived > &A)`
- `template<typename Derived >`
`types::DynMat< typename`
`Derived::Scalar > qpp::adjoint (const Eigen::MatrixBase< Derived > &A)`
- `template<typename Derived >`
`types::DynMat< typename`
`Derived::Scalar > qpp::inverse (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::logdet (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::dmat 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, std::size_t n)`

- `template<typename OutputScalar , typename Derived >`
`types::DynMat< OutputScalar > qpp::cwise (const Eigen::MatrixBase< Derived > &A, Output←`
`Scalar(*)f)(const typename Derived::Scalar &))`
- `template<typename T >`
`types::DynMat< typename T::Scalar > qpp::kron (const T &head)`
- `template<typename T , typename... Args>`
`types::DynMat< typename T::Scalar > qpp::kron (const T &head, const Args &...tail)`
- `template<typename Derived >`
`types::DynMat< typename`
`Derived::Scalar > qpp::kron (const std::vector< Derived > &As)`
- `template<typename Derived >`
`types::DynMat< typename`
`Derived::Scalar > qpp::kron (const std::initializer_list< Derived > &As)`
- `template<typename Derived >`
`types::DynMat< typename`
`Derived::Scalar > qpp::kronpow (const Eigen::MatrixBase< Derived > &A, std::size_t n)`
- `template<typename Derived >`
`types::DynMat< typename`
`Derived::Scalar > qpp::reshape (const Eigen::MatrixBase< Derived > &A, std::size_t rows, std::size_t cols)`
- `template<typename Derived >`
`types::DynMat< typename`
`Derived::Scalar > qpp::syspermute (const Eigen::MatrixBase< Derived > &A, const std::vector< std::size_t`
`> &perm, const std::vector< std::size_t > &dims)`
- `template<typename Derived >`
`types::DynMat< typename`
`Derived::Scalar > qpp::ptrace1 (const Eigen::MatrixBase< Derived > &A, const std::vector< std::size_t >`
`&dims)`
- `template<typename Derived >`
`types::DynMat< typename`
`Derived::Scalar > qpp::ptrace2 (const Eigen::MatrixBase< Derived > &A, const std::vector< std::size_t >`
`&dims)`
- `template<typename Derived >`
`types::DynMat< typename`
`Derived::Scalar > qpp::ptrace (const Eigen::MatrixBase< Derived > &A, const std::vector< std::size_t >`
`&subsys, const std::vector< std::size_t > &dims)`
- `template<typename Derived >`
`types::DynMat< typename`
`Derived::Scalar > qpp::ptranspose (const Eigen::MatrixBase< Derived > &A, const std::vector< std::size_t`
`> &subsys, const std::vector< std::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::prj (const Eigen::MatrixBase< Derived > &V)`
- `template<typename Derived >`
`types::DynMat< typename`
`Derived::Scalar > qpp::expandout (const Eigen::MatrixBase< Derived > &A, std::size_t pos, const std←`
`::vector< std::size_t > &dims)`
- `template<typename Derived >`
`types::DynMat< typename`
`Derived::Scalar > qpp::grams (const std::vector< Derived > &Vs)`

- `template<typename Derived >`
`types::DynMat< typename`
`Derived::Scalar > qpp::grams (const std::initializer_list< Derived > &Vs)`
- `template<typename Derived >`
`types::DynMat< typename`
`Derived::Scalar > qpp::grams (const Eigen::MatrixBase< Derived > &A)`
- `std::vector< std::size_t > qpp::n2multiidx (std::size_t n, const std::vector< std::size_t > &dims)`
- `std::size_t qpp::multiidx2n (const std::vector< std::size_t > &midx, const std::vector< std::size_t > &dims)`
- `types::ket qpp::mket (const std::vector< std::size_t > &mask)`
- `types::ket qpp::mket (const std::vector< std::size_t > &mask, const std::vector< std::size_t > &dims)`
- `types::ket qpp::mket (const std::vector< std::size_t > &mask, std::size_t d)`
- `std::vector< std::size_t > qpp::invperm (const std::vector< std::size_t > &perm)`
- `std::vector< std::size_t > qpp::compperm (const std::vector< std::size_t > &perm, const std::vector< std::size_t > &sigma)`

7.14 include/internal.h File Reference

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



Namespaces

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

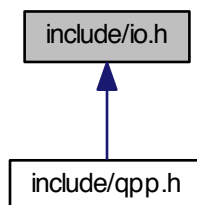
Functions

- `void qpp::internal::_n2multiidx (std::size_t n, std::size_t numdims, const std::size_t *dims, std::size_t *result)`
- `std::size_t qpp::internal::_multiidx2n (const std::size_t *midx, std::size_t numdims, const std::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< std::size_t > &dims)`

- `template<typename Derived >`
`bool qpp::internal::_check_dims_match_mat (const std::vector< std::size_t > &dims, const Eigen::Matrix<↵`
`Base< Derived > &A)`
- `template<typename Derived >`
`bool qpp::internal::_check_dims_match_cvect (const std::vector< std::size_t > &dims, const Eigen::Matrix<↵`
`Base< Derived > &V)`
- `template<typename Derived >`
`bool qpp::internal::_check_dims_match_rvect (const std::vector< std::size_t > &dims, const Eigen::Matrix<↵`
`Base< Derived > &V)`
- `bool qpp::internal::_check_eq_dims (const std::vector< std::size_t > &dims, std::size_t dim)`
- `bool qpp::internal::_check_subsys_match_dims (const std::vector< std::size_t > &subsys, const std::↵`
`::vector< std::size_t > &dims)`
- `bool qpp::internal::_check_perm (const std::vector< std::size_t > &perm)`
- `template<typename Derived1 , typename Derived2 >`
`types::DynMat< typename`
`Derived1::Scalar > qpp::internal::_kron2 (const Eigen::MatrixBase< Derived1 > &A, const Eigen::Matrix<↵`
`Base< Derived2 > &B)`
- `template<typename T >`
`void qpp::internal::variadic_vector_emplace (std::vector< T > &)`
- `template<typename T , typename First , typename... Args>`
`void qpp::internal::variadic_vector_emplace (std::vector< T > &v, First &&first, Args &&...args)`

7.15 include/io.h File Reference

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)`

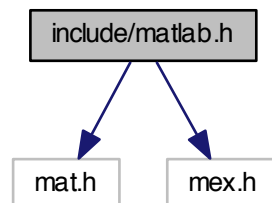
- `template<typename T >`
`void qpp::disp (const T *x, const std::size_t n, const std::string &separator, const std::string &start="[" , const std::string &end="]", std::ostream &os=std::cout)`
- `template<typename T >`
`void qpp::displn (const T *x, const std::size_t n, const std::string &separator,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

7.16 include/matlab.h File Reference

```
#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)`

7.17 include/qpp.h File Reference

```
#include <algorithm>
#include <chrono>
#include <cmath>
#include <complex>
#include <cstdlib>
#include <cstring>
#include <fstream>
#include <functional>
#include <iomanip>
#include <iostream>
#include <iterator>
#include <numeric>
#include <ostream>
#include <random>
#include <stdexcept>
#include <string>
#include <type_traits>
#include <utility>
#include <vector>
#include <Eigen/Dense>
#include <Eigen/SVD>
#include "constants.h"
#include "types.h"
#include "classes/exception.h"
#include "classes/singleton.h"
#include "classes/states.h"
#include "classes/randevs.h"
#include "internal.h"
#include "functions.h"
#include "classes/gates.h"
#include "classes/stat.h"
#include "entropies.h"
#include "entanglement.h"
#include "channels.h"
#include "io.h"
#include "random.h"
#include "classes/qudit.h"
#include "classes/timer.h"
Include dependency graph for qpp.h:
```



Namespaces

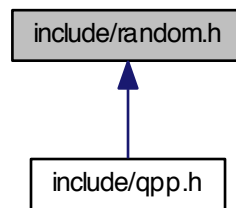
- `qpp`

Variables

- const RandomDevices & [qpp::rdevs](#) = RandomDevices::get_instance()
- const Gates & [qpp::gt](#) = Gates::get_instance()
- const States & [qpp::st](#) = States::get_instance()

7.18 include/random.h File Reference

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



Namespaces

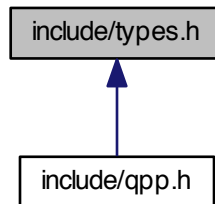
- [qpp](#)

Functions

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

7.19 include/types.h File Reference

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



Namespaces

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

Typedefs

- using [qpp::types::cplx](#) = `std::complex< double >`
- using [qpp::types::cmat](#) = `Eigen::MatrixXcd`
- using [qpp::types::dmat](#) = `Eigen::MatrixXd`
- using [qpp::types::ket](#) = `Eigen::Matrix< cplx, Eigen::Dynamic, 1 >`
- using [qpp::types::bra](#) = `Eigen::Matrix< cplx, 1, Eigen::Dynamic >`
- `template<typename Scalar >`
using [qpp::types::DynMat](#) = `Eigen::Matrix< Scalar, Eigen::Dynamic, Eigen::Dynamic >`

Index

- absm
 - qpp, [13](#)
- adjoint
 - qpp, [13](#)
- anticomm
 - qpp, [14](#)
- CUSTOM_EXCEPTION
 - qpp::Exception, [56](#)
- channel
 - qpp, [14](#)
- choi
 - qpp, [15](#)
- choi2kraus
 - qpp, [15](#)
- comm
 - qpp, [16](#)
- compperm
 - qpp, [16](#)
- conjugate
 - qpp, [17](#)
- cosm
 - qpp, [17](#)
- cwise
 - qpp, [17](#)
- DIMS_INVALID
 - qpp::Exception, [56](#)
- DIMS_MISMATCH_CVECTOR
 - qpp::Exception, [56](#)
- DIMS_MISMATCH_MATRIX
 - qpp::Exception, [56](#)
- DIMS_MISMATCH_RVECTOR
 - qpp::Exception, [56](#)
- DIMS_MISMATCH_VECTOR
 - qpp::Exception, [56](#)
- DIMS_NOT_EQUAL
 - qpp::Exception, [56](#)
- det
 - qpp, [18](#)
- disp
 - qpp, [18](#)
- displn
 - qpp, [18](#), [19](#)
- entanglement
 - qpp, [20](#)
- evals
 - qpp, [20](#)
- evects
 - qpp, [21](#)
- expandout
 - qpp, [21](#)
- expm
 - qpp, [22](#)
- funm
 - qpp, [22](#)
- gconcurrency
 - qpp, [23](#)
- grams
 - qpp, [23](#), [24](#)
- gt
 - qpp, [47](#)
- hevals
 - qpp, [24](#)
- hevects
 - qpp, [25](#)
- inverse
 - qpp, [25](#)
- invperm
 - qpp, [25](#)
- kron
 - qpp, [26](#)
- kronpow
 - qpp, [27](#)
- load
 - qpp, [27](#)
- logdet
 - qpp, [27](#)
- logm
 - qpp, [28](#)
- MATRIX_NOT_CVECTOR
 - qpp::Exception, [56](#)
- MATRIX_NOT_RVECTOR
 - qpp::Exception, [56](#)
- MATRIX_NOT_SQUARE
 - qpp::Exception, [56](#)
- MATRIX_NOT_SQUARE_OR_CVECTOR
 - qpp::Exception, [56](#)
- MATRIX_NOT_SQUARE_OR_RVECTOR
 - qpp::Exception, [56](#)
- MATRIX_NOT_SQUARE_OR_VECTOR
 - qpp::Exception, [56](#)
- MATRIX_NOT_VECTOR
 - qpp::Exception, [56](#)

- qpp::Exception, 56
- mket
 - qpp, 28, 29
- multiidx2n
 - qpp, 29
- n2multiidx
 - qpp, 29
- NOT_BIPARTITE
 - qpp::Exception, 56
- NOT_QUBIT_GATE
 - qpp::Exception, 56
- NOT_QUBIT_SUBSYS
 - qpp::Exception, 56
- norm
 - qpp, 30
- OUT_OF_RANGE
 - qpp::Exception, 56
- PERM_INVALID
 - qpp::Exception, 56
- powm
 - qpp, 30
- prj
 - qpp, 30
- ptrace
 - qpp, 31
- ptrace1
 - qpp, 32
- ptrace2
 - qpp, 33
- ptranspose
 - qpp, 33
- qmutualinfo
 - qpp, 34
- qpp, 9
 - absm, 13
 - adjoint, 13
 - anticomm, 14
 - channel, 14
 - choi, 15
 - choi2kraus, 15
 - comm, 16
 - compperm, 16
 - conjugate, 17
 - cosm, 17
 - cwise, 17
 - det, 18
 - disp, 18
 - displn, 18, 19
 - entanglement, 20
 - evals, 20
 - evects, 21
 - expandout, 21
 - expm, 22
 - funm, 22
 - gconcurrency, 23
 - grams, 23, 24
 - gt, 47
 - hevals, 24
 - hevects, 25
 - inverse, 25
 - invperm, 25
 - kron, 26
 - kronpow, 27
 - load, 27
 - logdet, 27
 - logm, 28
 - mket, 28, 29
 - multiidx2n, 29
 - n2multiidx, 29
 - norm, 30
 - powm, 30
 - prj, 30
 - ptrace, 31
 - ptrace1, 32
 - ptrace2, 33
 - ptranspose, 33
 - qmutualinfo, 34
 - rand, 35, 36
 - randint, 36
 - randket, 37
 - randkraus, 37
 - randn, 37, 38
 - randperm, 38
 - randrho, 39
 - rdevs, 47
 - renyi, 39
 - reshape, 40
 - save, 40
 - schmidtcoeff, 41
 - schmidtprob, 42
 - shannon, 43
 - sinm, 44
 - spectralpowm, 44
 - sqrtn, 44
 - st, 47
 - sum, 45
 - super, 45
 - syspermute, 45
 - trace, 46
 - transpose, 46
 - tsallis, 47
- qpp::Exception
 - CUSTOM_EXCEPTION, 56
 - DIMS_INVALID, 56
 - DIMS_MISMATCH_CVECTOR, 56
 - DIMS_MISMATCH_MATRIX, 56
 - DIMS_MISMATCH_RVECTOR, 56
 - DIMS_MISMATCH_VECTOR, 56
 - DIMS_NOT_EQUAL, 56
 - MATRIX_NOT_CVECTOR, 56
 - MATRIX_NOT_RVECTOR, 56
 - MATRIX_NOT_SQUARE, 56
 - MATRIX_NOT_SQUARE_OR_CVECTOR, 56

MATRIX_NOT_SQUARE_OR_RVECTOR, 56
MATRIX_NOT_SQUARE_OR_VECTOR, 56
MATRIX_NOT_VECTOR, 56
NOT_BIPARTITE, 56
NOT_QUBIT_GATE, 56
NOT_QUBIT_SUBSYS, 56
OUT_OF_RANGE, 56
PERM_INVALID, 56
SUBSYS_MISMATCH_DIMS, 56
TYPE_MISMATCH, 56
UNDEFINED_TYPE, 56
UNKNOWN_EXCEPTION, 56
ZERO_SIZE, 56

rand
 qpp, 35, 36
randint
 qpp, 36
randket
 qpp, 37
randkraus
 qpp, 37
randn
 qpp, 37, 38
randperm
 qpp, 38
randrho
 qpp, 39
rdevs
 qpp, 47
renyi
 qpp, 39
reshape
 qpp, 40

SUBSYS_MISMATCH_DIMS
 qpp::Exception, 56
save
 qpp, 40
schmidtcoeff
 qpp, 41
schmidtprob
 qpp, 42
shannon
 qpp, 43
sinm
 qpp, 44
spectralpowm
 qpp, 44
sqrtm
 qpp, 44
st
 qpp, 47
sum
 qpp, 45
super
 qpp, 45
syspermute
 qpp, 45

TYPE_MISMATCH
 qpp::Exception, 56
trace
 qpp, 46
transpose
 qpp, 46
tsallis
 qpp, 47

UNDEFINED_TYPE
 qpp::Exception, 56
UNKNOWN_EXCEPTION
 qpp::Exception, 56

ZERO_SIZE
 qpp::Exception, 56