Quaternion

5.0

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Files

- file quat.hh

  Define the quaternion class.
- file quat_inline.hh

  Define inline methods for the quaternion class.
- file quat_messages.hh

  Define the class QuatMessages, the class that specifies the message IDs used in the quaternion model.
- file quat.cc

  Define basic methods for the quaternion class.
- file quat_from_mat.cc

  Define left_quat_from_transformation (), which computes the parent-to-child left quaternion from the input transformation matrix.
- file quat_messages.cc

  Implement the class QuatMessages.
- file quat_norm.cc

  Define quaternion normalization methods.
- file quat_to_eigenrot.cc

  Define Quaternion::left_quat_to_eigen_rotation, which computes the eigen rotation corresponding to a quaternion.
- file quat_to_mat.cc

  Define Quaternion::left_quat_to_transformation, which computes the parent- to-child transformation matrix from the parent-to-child left quaternion.

Namespaces

- jeod

  Namespace jeod.

Data Structures

- class QuatMessages

  Specifies the message IDs used in the orbital elements model.

Macros

- #define PATH "utils/quaternion/"

Variables

- static char const * QuatMessages::undefined

  Issued an undefined behaviour is encountered.
- static char const * QuatMessages::invalid_entry

  Issued when function input is invalid.

5.3.1 Detailed Description

5.3.2 Macro Definition Documentation

5.3.2.1 PATH

```
#define PATH "utils/quaternion/"
```

Definition at line 37 of file quat_messages.cc.

5.3.3 Variable Documentation

5.3.3.1 invalid_entry

```
char const * QuatMessages::invalid_entry  [static]
```

Initial value:

```
=
    "utils/quaternion/"  "invalid_entry"
```

Issued when function input is invalid.

trick_units(–)

Definition at line 97 of file quat_messages.hh.

5.3.3.2 undefined

```
char const * QuatMessages::undefined  [static]
```

Initial value:

```
=
    "utils/quaternion/"  "undefined"
```

Issued an undefined behaviour is encountered.

trick_units(–)

Definition at line 92 of file quat_messages.hh.

Referenced by jeod::Quaternion::compute_slerp().

Chapter 6

Namespace Documentation

6.1 jeod Namespace Reference

Namespace jeod.

Data Structures

- class Quaternion

  Implement quaternions to the extent needed to represent orientations.

6.1.1 Detailed Description

Namespace jeod.

Chapter 7

Data Structure Documentation

7.1 jeod::Quaternion Class Reference

Implement quaternions to the extent needed to represent orientations.

`#include <quat.hh>`

Public Member Functions

- Quaternion (void)

  Construct a quaternion; default constructor.
- Quaternion (const double s)

  Construct a pure real quaternion.
- Quaternion (const double s, const double v[3])

  Construct from a scalar and a vector.
- Quaternion (const double arr[4])

  Construct from a double array.
- Quaternion (const double T[3][3])

  Construct a left transformation unit quaternion.
- void set_to_zero (void)

  Set all components of the quaternion to zero.
- void make_identity (void)

  Make the quaternion represent an identity transform.
- operator double * (void)

  Make a quaternion look like a double array.
- void copy_to (double arr[4]) const

  Copy a quaternion to a four vector, with the scalar part copied to arr[0] and the vector part to arr[1] to arr[3].
- void copy_from (const double arr[4])

  Copy a quaternion from a four vector, with the scalar part of the quaternion in arr[0] and the vector part in arr[1] to arr[3].
- void scale (const double scale)

  Scale the quaternion by a real.
- void scale (const double scale, Quaternion &quat) const

  Scale the quaternion by a real, leaving original intact.

- double norm_sq (void) const

  Compute the square of the norm of the quaternion.
- void normalize (void)

  Normalize the quaternion, making the scalar part of the quaternion non-negative.
- void normalize (Quaternion &quat) const

  Form the normalized quaternion, leaving original intact.
- void normalize_integ (void)

  Normalize the quaternion, but do not make the scalar part non-negative.
- void normalize_integ (Quaternion &quat) const

  Form the normalized quaternion, leaving original intact.
- void conjugate (void)

  Replace the quaternion with its conjugate.
- void conjugate (Quaternion &quat) const

  Form the conjugate of a quaternion, leaving original intact.
- void multiply (const Quaternion &quat, Quaternion &prod) const

  Post-multiply this quaternion by another quaternion: prod = this ∗ quat.
- void multiply (const Quaternion &quat)

  Post-multiply this quaternion by another quaternion: this = this ∗ quat.
- void conjugate_multiply (const Quaternion &quat, Quaternion &prod) const

  Post-multiply this quaternion's conjugate by another quaternion: prod = conj(this) ∗ quat.
- void conjugate_multiply (const Quaternion &quat)

  Post-multiply this quaternion's conjugate by another quaternion: this = conj(this) ∗ quat.
- void multiply_conjugate (const Quaternion &quat, Quaternion &prod) const

  Post-multiply this quaternion by another's conjugate: prod = this ∗ conj(quat).
- void multiply_conjugate (const Quaternion &quat)

  Post-multiply this quaternion by another's conjugate: this = this ∗ conj(quat).
- void multiply_left (const Quaternion &quat, Quaternion &prod) const

  Pre-multiply this quaternion by another quaternion: prod = quat ∗ this.
- void multiply_left (const Quaternion &quat)

  Pre-multiply this quaternion by another quaternion: this = quat ∗ this.
- void multiply_left_conjugate (const Quaternion &quat, Quaternion &prod) const

  Pre-multiply this quaternion by another's conjugate: prod = conj(quat) ∗ this.
- void multiply_left_conjugate (const Quaternion &quat)

  Pre-multiply this quaternion by another's conjugate: this = conj(quat) ∗ this.
- void multiply_vector_left (const double vec[3], Quaternion &prod) const

  Pre-multiply this quaternion by a pure imaginary quaternion, the latter represented by a vector: prod = [0, vec] ∗ quat.
- void multiply_vector_right (const double vec[3], Quaternion &prod) const

  Post-multiply this quaternion by a pure imaginary quaternion, the latter represented by a vector: prod = quat ∗ [0, vec].
- void left_quat_from_transformation (const double T[3][3])

  Compute the parent-to-child left quaternion from the input transformation matrix.
- void left_quat_to_transformation (double T[3][3]) const

  Compute the parent-to-child transformation matrix from the parent-to-child left quaternion.
- void left_quat_from_eigen_rotation (double eigen_angle, const double eigen_axis[3])

  Construct the quaternion corresponding to an eigen rotation.
- void left_quat_to_eigen_rotation (double ∗eigen_angle, double eigen_axis[3]) const

  Compute the eigen rotation corresponding to a quaternion.
- void eigen_compare (const Quaternion &compare_to, double ∗eigen_angle, double eigen_axis[3]) const

  Compute eigen decomposition of this∗conj(quat).
- void left_quat_transform (const double vec_in[3], double vec_out[3]) const

  Transform a vector.

- void compute_left_quat_deriv (const double ang_vel[3], Quaternion &qdot) const

  Compute the time derivative of a left quaternion.
- void compute_left_quat_second_deriv (const double ang_vel[3], const double ang_acc[3], Quaternion &qdot) const

  Compute the time derivative of a left quaternion.

Static Public Member Functions

- static void normalize_integ (double arr[4])

  Normalize the quaternion, but do not make the scalar part non-negative.
- static void compute_left_quat_deriv (const double quat[4], const double ang_vel[3], double qdot[4])

  Compute the time derivative of a left quaternion.
- static void compute_left_quat_second_deriv (const double quat[4], const double ang_vel[3], const double ang_acc[3], double qddot[4])

  Compute the second time derivative of a left quaternion.
- static Quaternion compute_slerp (Quaternion &q1, Quaternion &q2, const double T)

  Compute the minimum interpolation quaternion between a start quarternion and end quaternion.

Data Fields

- double scalar

  The scalar, or real, part of the quaternion.
- double vector [3]

  The vectorial, or imaginary, part of the quaternion.

Friends

- class InputProcessor
- void init_attrjeod__Quaternion ()

7.1.1 Detailed Description

Implement quaternions to the extent needed to represent orientations.

Definition at line 87 of file quat.hh.

7.1.2 Constructor & Destructor Documentation

7.1.2.1 Quaternion() [1/5]

```
jeod::Quaternion::Quaternion (
            void  )
```

Construct a quaternion; default constructor.

Definition at line 52 of file quat.cc.

References scalar, and vector.

7.1.2.2 Quaternion() [2/5]

```
jeod::Quaternion::Quaternion (
            const double real_part )
```

Construct a pure real quaternion.

Parameters

in	*real_part*	Scalar

Definition at line 68 of file quat.cc.

References vector.

7.1.2.3 Quaternion() [3/5]

```
jeod::Quaternion::Quaternion (
            const double s,
            const double v[3] )  [inline]
```

Construct from a scalar and a vector.

Parameters

in	*s*	Scalar part
in	*v*	Vector part

Definition at line 84 of file quat_inline.hh.

References vector.

7.1.2.4 Quaternion() [4/5]

```
jeod::Quaternion::Quaternion (
            const double arr[4] )  [inline]
```

Construct from a double array.

Parameters

in	*arr*	Quaternion source

Definition at line 101 of file quat_inline.hh.

References copy_from().

7.1.2.5 Quaternion() [5/5]

```
jeod::Quaternion::Quaternion (
            const double T[3][3] )
```

Construct a left transformation unit quaternion.

Parameters

in	*T*	Transformation matrix

Definition at line 81 of file quat.cc.

References left_quat_from_transformation().

7.1.3 Member Function Documentation

7.1.3.1 compute_left_quat_deriv() [1/2]

```
void jeod::Quaternion::compute_left_quat_deriv (
            const double ang_vel[3],
            Quaternion & qdot ) const  [inline]
```

Compute the time derivative of a left quaternion.

Parameters

in	*ang_vel*	Angular velocity Units: r/s
out	*qdot*	Quaternion derivative

Definition at line 581 of file quat_inline.hh.

References multiply_vector_left().

7.1.3.2 compute_left_quat_deriv() [2/2]

```
void jeod::Quaternion::compute_left_quat_deriv (
            const double quat[4],
            const double ang_vel[3],
            double qdot[4] )  [inline], [static]
```

Compute the time derivative of a left quaternion.

Parameters

in	*quat*	Quaternion as 4-vector
in	*ang_vel*	Angular velocity Units: r/s
out	*qdot*	Derivative as 4-vector

Definition at line 619 of file quat_inline.hh.

7.1.3.3 compute_left_quat_second_deriv() [1/2]

```
void jeod::Quaternion::compute_left_quat_second_deriv (
             const double ang_vel[3],
             const double ang_acc[3],
             Quaternion & qddot ) const  [inline]
```

Compute the time derivative of a left quaternion.

Parameters

in	*ang_vel*	Angular velocity Units: r/s
in	*ang_acc*	Angular acceleration Units: r/s2
out	*qddot*	Quaternion 2nd deriv

Definition at line 599 of file quat_inline.hh.

References multiply_left().

7.1.3.4 compute_left_quat_second_deriv() [2/2]

```
void jeod::Quaternion::compute_left_quat_second_deriv (
             const double quat[4],
             const double ang_vel[3],
             const double ang_acc[3],
             double qddot[4] )  [inline], [static]
```

Compute the second time derivative of a left quaternion.

Parameters

in	*quat*	Quaternion as 4-vector
in	*ang_vel*	Angular velocity Units: r/s
in	*ang_acc*	Angular acceleration Units: r/s2
out	*qddot*	2nd derivative as 4-vector

Definition at line 640 of file quat_inline.hh.

7.1.3.5 compute_slerp()

```
Quaternion jeod::Quaternion::compute_slerp (
            Quaternion & q1,
            Quaternion & q2,
            const double T )  [static]
```

Compute the minimum interpolation quaternion between a start quarternion and end quaternion.

Parameters

in	*q1*	Starting quaternion
in	*q2*	Ending quaternion
in	*T*	Interpolation coefficient between 0.0 and 1.0 representing a rotational scale factor between the intial and final quaternion. When the compute_slerp method is used in a loop to rotate an object from a start and end orientation, a smaller step or change in T results in a smoother object rotation

Definition at line 99 of file quat.cc.

References normalize(), scalar, QuatMessages::undefined, and vector.

7.1.3.6 conjugate() [1/2]

```
void jeod::Quaternion::conjugate (
            void  )  [inline]
```

Replace the quaternion with its conjugate.

Definition at line 261 of file quat_inline.hh.

References vector.

7.1.3.7 conjugate() [2/2]

```
void jeod::Quaternion::conjugate (
            Quaternion & quat ) const  [inline]
```

Form the conjugate of a quaternion, leaving original intact.

Parameters

out	*quat*	Conjugated quaternion

Definition at line 273 of file quat_inline.hh.

References scalar, and vector.

7.1.3.8 conjugate_multiply() [1/2]

```
void jeod::Quaternion::conjugate_multiply (
            const Quaternion & quat,
            Quaternion & prod ) const  [inline]
```

Post-multiply this quaternion's conjugate by another quaternion: prod = conj(this) * quat.

Parameters

in	*quat*	Right multiplicand
out	*prod*	Quaternion product

Definition at line 331 of file quat_inline.hh.

References scalar, and vector.

7.1.3.9 conjugate_multiply() [2/2]

```
void jeod::Quaternion::conjugate_multiply (
            const Quaternion & quat )  [inline]
```

Post-multiply this quaternion's conjugate by another quaternion: this = conj(this) * quat.

Parameters

in	*quat*	Right multiplicand

Definition at line 349 of file quat_inline.hh.

References scalar, and vector.

7.1.3.10 copy_from()

```
void jeod::Quaternion::copy_from (
            const double arr[4] )  [inline]
```

Copy a quaternion from a four vector, with the scalar part of the quaternion in arr[0] and the vector part in arr[1] to arr[3].

Parameters

in	*arr*	Quaternion source

Definition at line 155 of file quat_inline.hh.

References scalar, and vector.

Referenced by Quaternion().

7.1.3.11 copy_to()

```
void jeod::Quaternion::copy_to (
             double arr[4] ) const  [inline]
```

Copy a quaternion to a four vector, with the scalar part copied to arr[0] and the vector part to arr[1] to arr[3].

Parameters

out	*arr*	Copy of quaternion

Definition at line 138 of file quat_inline.hh.

References scalar, and vector.

7.1.3.12 eigen_compare()

```
void jeod::Quaternion::eigen_compare (
             const Quaternion & quat,
             double * eigen_angle,
             double eigen_axis[3] ) const  [inline]
```

Compute eigen decomposition of this∗conj(quat).

Parameters

in	*quat*	Quaternion to compare to
out	*eigen_angle*	Eigen angle Units: r
out	*eigen_axis*	Eigen axis

Definition at line 563 of file quat_inline.hh.

References left_quat_to_eigen_rotation(), and multiply_conjugate().

7.1.3.13 left_quat_from_eigen_rotation()

```
void jeod::Quaternion::left_quat_from_eigen_rotation (
            double eigen_angle,
            const double eigen_axis[3] )  [inline]
```

Construct the quaternion corresponding to an eigen rotation.

Parameters

in	*eigen_angle*	Eigen angle Units: r
in	*eigen_axis*	Eigen axis

Definition at line 171 of file quat_inline.hh.

References scalar, and vector.

7.1.3.14 left_quat_from_transformation()

```
void jeod::Quaternion::left_quat_from_transformation (
            const double T[3][3] )
```

Compute the parent-to-child left quaternion from the input transformation matrix.

Assumptions and Limitations

- Matrix is orthonormal.

Parameters

in	*T*	Transformation matrix

Definition at line 118 of file quat_from_mat.cc.

References scalar, and vector.

Referenced by Quaternion().

7.1.3.15 left_quat_to_eigen_rotation()

```
void jeod::Quaternion::left_quat_to_eigen_rotation (
            double * eigen_angle,
            double eigen_axis[3] ) const
```

Compute the eigen rotation corresponding to a quaternion.

Assumptions and Limitations

- Quaternion is normalized.

Parameters

out	*eigen_angle*	Eigen angle Units: r
out	*eigen_axis*	Eigen axis

Definition at line 49 of file quat_to_eigenrot.cc.

References scalar, and vector.

Referenced by eigen_compare().

7.1.3.16 left_quat_to_transformation()

```
void jeod::Quaternion::left_quat_to_transformation (
            double T[3][3] ) const
```

Compute the parent-to-child transformation matrix from the parent-to-child left quaternion.

Assumptions and Limitations

- Quaternion is normalized.

Parameters

out	*T*	Transformation matrix

Definition at line 84 of file quat_to_mat.cc.

References scalar, and vector.

7.1.3.17 left_quat_transform()

```
void jeod::Quaternion::left_quat_transform (
            const double vec_in[3],
            double vec_out[3] ) const  [inline]
```

Transform a vector.

Parameters

in	*vec_in*	Vector to be transformed
out	*vec_out*	Transformed vector

Definition at line 536 of file quat_inline.hh.

References scalar, and vector.

7.1.3.18 make_identity()

```
void jeod::Quaternion::make_identity (
            void  )  [inline]
```

Make the quaternion represent an identity transform.

Definition at line 124 of file quat_inline.hh.

References scalar, and vector.

7.1.3.19 multiply() [1/2]

```
void jeod::Quaternion::multiply (
            const Quaternion & quat,
            Quaternion & prod ) const  [inline]
```

Post-multiply this quaternion by another quaternion: prod = this * quat.

Parameters

in	*quat*	Right multiplicand
out	*prod*	Quaternion product

Definition at line 289 of file quat_inline.hh.

References scalar, and vector.

7.1.3.20 multiply() [2/2]

```
void jeod::Quaternion::multiply (
            const Quaternion & quat )  [inline]
```

Post-multiply this quaternion by another quaternion: this = this * quat.

Parameters

in	*quat*	Right multiplicand

Definition at line 307 of file quat_inline.hh.

References scalar, and vector.

7.1.3.21 multiply_conjugate() [1/2]

```
void jeod::Quaternion::multiply_conjugate (
            const Quaternion & quat,
            Quaternion & prod ) const  [inline]
```

Post-multiply this quaternion by another's conjugate: prod = this * conj(quat).

Parameters

in	*quat*	Right multiplicand
out	*prod*	Quaternion product

Definition at line 373 of file quat_inline.hh.

References scalar, and vector.

Referenced by eigen_compare().

7.1.3.22 multiply_conjugate() [2/2]

```
void jeod::Quaternion::multiply_conjugate (
            const Quaternion & quat )  [inline]
```

Post-multiply this quaternion by another's conjugate: this = this * conj(quat).

Parameters

in	*quat*	Right multiplicand

Definition at line 391 of file quat_inline.hh.

References scalar, and vector.

7.1.3.23 multiply_left() [1/2]

```
void jeod::Quaternion::multiply_left (
            const Quaternion & quat,
            Quaternion & prod ) const  [inline]
```

Pre-multiply this quaternion by another quaternion: prod = quat * this.

Parameters

in	*quat*	Left multiplicand
out	*prod*	Quaternion product

Definition at line 415 of file quat_inline.hh.

References scalar, and vector.

Referenced by compute_left_quat_second_deriv().

7.1.3.24 multiply_left() [2/2]

```
void jeod::Quaternion::multiply_left (
            const Quaternion & quat )  [inline]
```

Pre-multiply this quaternion by another quaternion: this = quat * this.

Parameters

in	*quat*	Left multiplicand

Definition at line 433 of file quat_inline.hh.

References scalar, and vector.

7.1.3.25 multiply_left_conjugate() [1/2]

```
void jeod::Quaternion::multiply_left_conjugate (
            const Quaternion & quat,
            Quaternion & prod ) const  [inline]
```

Pre-multiply this quaternion by another's conjugate: prod = conj(quat) * this.

Parameters

in	*quat*	Left multiplicand
out	*prod*	Quaternion product

Definition at line 457 of file quat_inline.hh.

References scalar, and vector.

7.1.3.26 multiply_left_conjugate() [2/2]

```
void jeod::Quaternion::multiply_left_conjugate (
            const Quaternion & quat ) [inline]
```

Pre-multiply this quaternion by another's conjugate: this = conj(quat) * this.

Parameters

in	*quat*	Left multiplicand

Definition at line 475 of file quat_inline.hh.

References scalar, and vector.

7.1.3.27 multiply_vector_left()

```
void jeod::Quaternion::multiply_vector_left (
            const double vec[3],
            Quaternion & prod ) const [inline]
```

Pre-multiply this quaternion by a pure imaginary quaternion, the latter represented by a vector: prod = [0, vec] * quat.

Parameters

in	*vec*	Right multiplicand
out	*prod*	Quaternion product

Definition at line 500 of file quat_inline.hh.

References scalar, and vector.

Referenced by compute_left_quat_deriv().

7.1.3.28 multiply_vector_right()

```
void jeod::Quaternion::multiply_vector_right (
            const double vec[3],
            Quaternion & prod ) const [inline]
```

Post-multiply this quaternion by a pure imaginary quaternion, the latter represented by a vector: prod = quat * [0, vec].

Parameters

in	*vec*	Right multiplicand
out	*prod*	Quaternion product

Definition at line 519 of file quat_inline.hh.

References scalar, and vector.

7.1.3.29 norm_sq()

```
double jeod::Quaternion::norm_sq (
            void  ) const  [inline]
```

Compute the square of the norm of the quaternion.

Returns

Square of the norm of the quaternion

Definition at line 221 of file quat_inline.hh.

References scalar, and vector.

Referenced by normalize(), and normalize_integ().

7.1.3.30 normalize() [1/2]

```
void jeod::Quaternion::normalize (
            void  )
```

Normalize the quaternion, making the scalar part of the quaternion non-negative.

Definition at line 48 of file quat_norm.cc.

References norm_sq(), scalar, and scale().

Referenced by compute_slerp(), and normalize().

7.1.3.31 normalize() [2/2]

```
void jeod::Quaternion::normalize (
            Quaternion & quat ) const  [inline]
```

Form the normalized quaternion, leaving original intact.

Parameters

out	*quat*	Normalized quaternion

Definition at line 234 of file quat_inline.hh.

References normalize().

7.1.3.32 normalize_integ() [1/3]

```
void jeod::Quaternion::normalize_integ (
             void  )
```

Normalize the quaternion, but do not make the scalar part non-negative.

Definition at line 82 of file quat_norm.cc.

References norm_sq(), and scale().

Referenced by normalize_integ().

7.1.3.33 normalize_integ() [2/3]

```
void jeod::Quaternion::normalize_integ (
             Quaternion & quat ) const  [inline]
```

Form the normalized quaternion, leaving original intact.

Parameters

out	*quat*	Normalized quaternion

Definition at line 248 of file quat_inline.hh.

References normalize_integ().

7.1.3.34 normalize_integ() [3/3]

```
void jeod::Quaternion::normalize_integ (
             double quat[4] )  [static]
```

Normalize the quaternion, but do not make the scalar part non-negative.

Parameters

quat	Quaternion to be normalized.

Definition at line 106 of file quat_norm.cc.

7.1.3.35 operator double *()

```
jeod::Quaternion::operator double * (
            void  )  [inline]
```

Make a quaternion look like a double array.

Definition at line 134 of file quat.hh.

References scalar.

7.1.3.36 scale() [1/2]

```
void jeod::Quaternion::scale (
            const double fact )  [inline]
```

Scale the quaternion by a real.

Parameters

in	*fact*	Scale factor

Definition at line 192 of file quat_inline.hh.

References scalar, and vector.

Referenced by normalize(), and normalize_integ().

7.1.3.37 scale() [2/2]

```
void jeod::Quaternion::scale (
            const double fact,
            Quaternion & quat ) const  [inline]
```

Scale the quaternion by a real, leaving original intact.

Parameters

in	*fact*	Scale factor
out	*quat*	Scaled quaternion

Definition at line 206 of file quat_inline.hh.

References scalar, and vector.

7.1.3.38 set_to_zero()

```
void jeod::Quaternion::set_to_zero (
            void  )  [inline]
```

Set all components of the quaternion to zero.

Definition at line 112 of file quat_inline.hh.

References scalar, and vector.

7.1.4 Friends And Related Function Documentation

7.1.4.1 init_attrjeod__Quaternion

```
void init_attrjeod__Quaternion ( )  [friend]
```

7.1.4.2 InputProcessor

```
friend class InputProcessor  [friend]
```

Definition at line 89 of file quat.hh.

7.1.5 Field Documentation

7.1.5.1 scalar

```
double jeod::Quaternion::scalar
```

The scalar, or real, part of the quaternion.

trick_units(–)

Definition at line 97 of file quat.hh.

Referenced by compute_slerp(), conjugate(), conjugate_multiply(), copy_from(), copy_to(), left_quat_from_↩ eigen_rotation(), left_quat_from_transformation(), left_quat_to_eigen_rotation(), left_quat_to_transformation(), left_quat_transform(), make_identity(), multiply(), multiply_conjugate(), multiply_left(), multiply_left_conjugate(), multiply_vector_left(), multiply_vector_right(), norm_sq(), normalize(), operator double ∗(), Quaternion(), scale(), and set_to_zero().

7.1.5.2 vector

```
double jeod::Quaternion::vector[3]
```

The vectorial, or imaginary, part of the quaternion.

trick_units(–)

Definition at line 102 of file quat.hh.

Referenced by compute_slerp(), conjugate(), conjugate_multiply(), copy_from(), copy_to(), left_quat_from_↩ eigen_rotation(), left_quat_from_transformation(), left_quat_to_eigen_rotation(), left_quat_to_transformation(), left_quat_transform(), make_identity(), multiply(), multiply_conjugate(), multiply_left(), multiply_left_conjugate(), multiply_vector_left(), multiply_vector_right(), norm_sq(), Quaternion(), scale(), and set_to_zero().

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

- quat.hh
- quat_inline.hh
- quat.cc
- quat_from_mat.cc
- quat_norm.cc
- quat_to_eigenrot.cc
- quat_to_mat.cc

7.2 QuatMessages Class Reference

Specifies the message IDs used in the orbital elements model.

```
#include <quat_messages.hh>
```

Static Public Attributes

- static char const * undefined

  Issued an undefined behaviour is encountered.
- static char const * invalid_entry

  Issued when function input is invalid.

Private Member Functions

- QuatMessages (void)
- QuatMessages (const QuatMessages &)
- QuatMessages & operator= (const QuatMessages &)

Friends

- class InputProcessor
- void init_attrjeod__QuatMessages ()

7.2.1 Detailed Description

Specifies the message IDs used in the orbital elements model.

Definition at line 80 of file quat_messages.hh.

7.2.2 Constructor & Destructor Documentation

7.2.2.1 QuatMessages() [1/2]

```
QuatMessages::QuatMessages (
            void  )  [private]
```

7.2.2.2 QuatMessages() [2/2]

```
QuatMessages::QuatMessages (
            const QuatMessages &  )  [private]
```

7.2.3 Member Function Documentation

7.2.3.1 operator=()

```
QuatMessages& QuatMessages::operator= (
            const QuatMessages &  )  [private]
```

7.2.4 Friends And Related Function Documentation

7.2.4.1 init_attrjeod__QuatMessages

```
void init_attrjeod__QuatMessages ( )  [friend]
```

7.2.4.2 InputProcessor

```
friend class InputProcessor  [friend]
```

Definition at line 83 of file quat_messages.hh.

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

- quat_messages.hh
- quat_messages.cc

Chapter 8

File Documentation

8.1 quat.cc File Reference

Define basic methods for the quaternion class.

```
#include "utils/math/include/vector3.hh"
#include "utils/math/include/numerical.hh"
#include "../include/quat.hh"
#include "utils/message/include/message_handler.hh"
#include "../include/quat_messages.hh"
#include <cmath>
#include <fstream>
#include <iomanip>
```

Namespaces

- jeod

  Namespace jeod.

8.1.1 Detailed Description

Define basic methods for the quaternion class.

8.2 quat.hh File Reference

Define the quaternion class.

```
#include <cstdlib>
#include "utils/sim_interface/include/jeod_class.hh"
#include "quat_inline.hh"
```

Data Structures

- class jeod::Quaternion

  Implement quaternions to the extent needed to represent orientations.

Namespaces

- jeod

  Namespace jeod.

8.2.1 Detailed Description

Define the quaternion class.

8.3 quat_from_mat.cc File Reference

Define left_quat_from_transformation (), which computes the parent-to-child left quaternion from the input transformation matrix.

```
#include <cmath>
#include "../include/quat.hh"
```

Namespaces

- jeod

  Namespace jeod.

8.3.1 Detailed Description

Define left_quat_from_transformation (), which computes the parent-to-child left quaternion from the input transformation matrix.

8.4 quat_inline.hh File Reference

Define inline methods for the quaternion class.

```
#include <cmath>
#include "quat.hh"
#include "utils/math/include/vector3.hh"
```

Namespaces

- jeod

  Namespace jeod.

8.4.1 Detailed Description

Define inline methods for the quaternion class.

8.5 quat_messages.cc File Reference

Implement the class QuatMessages.

```
#include "../include/quat_messages.hh"
```

Macros

- #define PATH "utils/quaternion/"

8.5.1 Detailed Description

Implement the class QuatMessages.

8.6 quat_messages.hh File Reference

Define the class QuatMessages, the class that specifies the message IDs used in the quaternion model.

```
#include "utils/sim_interface/include/jeod_class.hh"
```

Data Structures

- class QuatMessages

  Specifies the message IDs used in the orbital elements model.

8.6.1 Detailed Description

Define the class QuatMessages, the class that specifies the message IDs used in the quaternion model.

8.7 quat_norm.cc File Reference

Define quaternion normalization methods.

```
#include <cmath>
#include "../include/quat.hh"
```

Namespaces

- jeod

  Namespace jeod.

8.7.1 Detailed Description

Define quaternion normalization methods.

8.8 quat_to_eigenrot.cc File Reference

Define Quaternion::left_quat_to_eigen_rotation, which computes the eigen rotation corresponding to a quaternion.

```
#include <cmath>
#include "utils/math/include/vector3.hh"
#include "../include/quat.hh"
```

Namespaces

- jeod

  Namespace jeod.

8.8.1 Detailed Description

Define Quaternion::left_quat_to_eigen_rotation, which computes the eigen rotation corresponding to a quaternion.

8.9 quat_to_mat.cc File Reference

Define Quaternion::left_quat_to_transformation, which computes the parent- to-child transformation matrix from the parent-to-child left quaternion.

```
#include "utils/math/include/vector3.hh"
#include "../include/quat.hh"
```

Namespaces

- jeod

  Namespace jeod.

8.9.1 Detailed Description

Define Quaternion::left_quat_to_transformation, which computes the parent- to-child transformation matrix from the parent-to-child left quaternion.

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