DynamicBodyModel

5.1

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  Define StructureIntegratedDynBody methods related to force and torque accumulation and propagation.
- file torque.cc

  Define torque model member functions.

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- jeod

  Namespace jeod.

Macros

- #define PATH "dynamics/dyn_body/"

6.3.1 Detailed Description

6.3.2 Macro Definition Documentation

6.3.2.1 #define PATH "dynamics/dyn_body/"

Definition at line 37 of file dyn_body_messages.cc.

Chapter 7

Namespace Documentation

7.1 jeod Namespace Reference

Namespace jeod.

Data Structures

- class JPVCollectForce

  This is a derived version of the template class JeodPointerVector<CollectForce>::type with an implementation of the method perform_cleanup_action which frees and clears stale data following a restore.
- class JPVCollectTorque

  This is a derived version of the template class JeodPointerVector<CollectTorque>::type with an implementation of the method perform_cleanup_action which frees and clears stale data following a restore.
- class BodyForceCollect

  Serves as the collection point for forces and torques that act on a vehicle.
- class BodyRefFrame

  Extend RefFrame to add coupling between the reference frame tree and the mass tree and to keep track of which state items have been set.
- class BodyWrenchCollect

  Serves as the collection point for wrenches that act on a vehicle.
- class DynBody

  Class DynBody is the base class for all dynamic bodies.
- class DynBodyGenericFrameAttachment

  A wrench comprises a torque and a force applied at a point on a DynBody.
- class DynBodyMessages

  Specify the message IDs used in the DynBody model.
- class Force

  A Force represents a Newtonian force that acts on a DynBody.
- class CollectForce

  A CollectForce represents a collected force that acts on a vehicle.
- class CInterfaceForce

  This class is deprecated.
- class FrameDerivs

  Contains translational and rotational second derivatives.
- class StructureIntegratedDynBody

  Extends DynBody to integrate an object's structural reference frame as opposed to its center of mass.
- class Torque

A Torque represents a Newtonian torque that acts on a DynBody.

- class CollectTorque

  A CollectTorque represents a collected torque that acts on a vehicle.
- class CInterfaceTorque

  This class is deprecated.
- class VehicleNonGravState

  Encapsulates various aspects of a vehicle's state with respect to inertial.
- class VehicleProperties

  Captures pointers to various vehicle properties that are commonly used in the constraint concept.
- class Wrench

  A wrench comprises a torque and a force applied at a point on a DynBody.

Functions

- template<class CollectType >
  void release_vector (CollectType &vec)

  Release JEOD-allocated memory in the collect vector.
- template<typename CollectType , typename value_type >
  void collect_insert (CollectType &collect_in, value_type &elem)
- template<typename CollectType , typename value_type >
  void collect_push_back (CollectType &collect_in, value_type &elem)
- static void accumulate_forces (const JeodPointerVector< CollectForce >::type &vec, double ∗cumulation)

  Accumulate forces acting on a vehicle.
- static void accumulate_torques (const JeodPointerVector< CollectTorque >::type &vec, double ∗cumulation)

  Accumulate torques acting on a vehicle.
- static void check_frame_ownership (const BodyRefFrame &frame, const DynBody ∗dyn_body, const char ∗file, unsigned int line)

  Check that the dyn_body 'owns' the subject frame.
- static void accumulate_forces (const JeodPointerVector< CollectForce >::type &vec, double ∗cumulation)

  Accumulate forces acting on a vehicle.
- static void accumulate_torques (const JeodPointerVector< CollectTorque >::type &vec, double ∗cumulation)

  Accumulate torques acting on a vehicle.

7.1.1 Detailed Description

Namespace jeod.

7.1.2 Function Documentation

7.1.2.1 static void jeod::accumulate_forces (const JeodPointerVector< CollectForce >::type & *vec,* double ∗ *cumulation*) [inline], [static]

Accumulate forces acting on a vehicle.

Parameters

in	*vec*	Forces
out	*cumulation*	Accumulated force

Definition at line 40 of file structure_integrated_dyn_body_collect.cc.

7.1.2.2 static void jeod::accumulate_forces (const JeodPointerVector< CollectForce >::type & *vec,* double ∗ *cumulation*) [inline], [static]

Accumulate forces acting on a vehicle.

Parameters

in	*vec*	Forces
out	*cumulation*	Accumulated force

Definition at line 59 of file dyn_body_collect.cc.

Referenced by jeod::DynBody::collect_forces_and_torques(), and jeod::StructureIntegratedDynBody::collect_local_forces_and_torques().

7.1.2.3 static void jeod::accumulate_torques (const JeodPointerVector$<$ CollectTorque $>$::type & *vec,* double $*$ *cumulation*) [inline], [static]

Accumulate torques acting on a vehicle.

Parameters

in	*vec*	Torques
out	*cumulation*	Accumulated torque

Definition at line 61 of file structure_integrated_dyn_body_collect.cc.

7.1.2.4 static void jeod::accumulate_torques (const JeodPointerVector$<$ CollectTorque $>$::type & *vec,* double $*$ *cumulation*) [inline], [static]

Accumulate torques acting on a vehicle.

Parameters

in	*vec*	Torques
out	*cumulation*	Accumulated torque

Definition at line 81 of file dyn_body_collect.cc.

Referenced by jeod::DynBody::collect_forces_and_torques(), and jeod::StructureIntegratedDynBody::collect_local_forces_and_torques().

7.1.2.5 static void jeod::check_frame_ownership (const BodyRefFrame & *frame,* const DynBody $*$ *dyn_body,* const char $*$ *file,* unsigned int *line*) [inline], [static]

Check that the dyn_body 'owns' the subject frame.

Parameters

in	*frame*	Frame to test
in	*dyn_body*	Typically this
in	*file*	Typically **FILE**
in	*line*	Typically **LINE**

Definition at line 62 of file dyn_body_set_state.cc.

References jeod::DynBodyMessages::invalid_frame, and jeod::DynBody::name.

Referenced by jeod::DynBody::set_attitude_left_quaternion(), jeod::DynBody::set_attitude_matrix(), jeod::DynBody::set_attitude_rate(), jeod::DynBody::set_attitude_right_quaternion(), jeod::DynBody::set_position(), jeod::DynBody::set_state(), and jeod::DynBody::set_velocity().

7.1.2.6 template$<$typename CollectType , typename value_type $>$ void jeod::collect_insert (CollectType & *collect_in,* value_type & *elem*)

Definition at line 99 of file body_force_collect.hh.

7.1.2.7 template<typename CollectType , typename value_type > void jeod::collect_push_back (CollectType & *collect_in,* value_type & *elem*)

Definition at line 131 of file body_force_collect.hh.

7.1.2.8 template<class CollectType > void jeod::release_vector (CollectType & *vec*)

Release JEOD-allocated memory in the collect vector.

Parameters

in,out	*vec*	Collected vectors

Definition at line 84 of file body_force_collect.hh.

Referenced by jeod::BodyForceCollect::∼BodyForceCollect().

Chapter 8

Data Structure Documentation

8.1 jeod::BodyForceCollect Class Reference

Serves as the collection point for forces and torques that act on a vehicle.

```
#include <body_force_collect.hh>
```

Public Member Functions

- BodyForceCollect ()

  Default constructor.
- ∼BodyForceCollect ()

  Destructor.

Data Fields

- double effector_forc [3]

  Sum of effector forces, struct ref.
- double environ_forc [3]

  Sum of env forces, struct ref.
- double no_xmit_forc [3]

  Sum of local forces, struct ref.
- double extern_forc_struct [3]

  Sum of external forces, struct ref.
- double extern_forc_inrtl [3]

  Sum of external forces, inertial.
- double effector_torq [3]

  Sum of effector torques about body CoM, struct ref.
- double environ_torq [3]

  Sum of environment torqs about body CoM, struct ref.
- double no_xmit_torq [3]

  Sum of torqs not transmitted to a parent about body CoM, struct ref.
- double inertial_torq [3]

  Induced inertial torques from second order rotational dynamics, w x Iw, body ref.
- double extern_torq_struct [3]

  Sum of external torques, struct ref.
- double extern_torq_body [3]

Sum of external torques, body ref.
- JPVCollectForce collect_effector_forc

  Vector of effector forces, (struct)
- JPVCollectForce collect_environ_forc

  Vector of env forces, (struct)
- JPVCollectForce collect_no_xmit_forc

  Vector of local forces, (struct)
- JPVCollectTorque collect_effector_torq

  Vector of effector torques, (struct)
- JPVCollectTorque collect_environ_torq

  Vector of env torques, (struct)
- JPVCollectTorque collect_no_xmit_torq

  Vector of local torques, (struct)

Private Member Functions

- BodyForceCollect (BodyForceCollect &)
- BodyForceCollect & operator= (const BodyForceCollect &)

8.1.1 Detailed Description

Serves as the collection point for forces and torques that act on a vehicle.

This class is a simple class that is tightly coupled with the DynBody class. The DynBody class contains (has-a) a BodyForceCollect member.

The Trick vcollect mechanism (or a similar mechanism in a non-Trick sim) pushes the individual forces and torques onto the various collect_XXX members of a BodyForceCollect. DynBody members cumulate these collected forces and torques to form the total forces and torques acting on the vehicle.

Definition at line 258 of file body_force_collect.hh.

8.1.2 Constructor & Destructor Documentation

8.1.2.1 jeod::BodyForceCollect::BodyForceCollect (**BodyForceCollect &**) [private]

8.1.2.2 jeod::BodyForceCollect::BodyForceCollect (void)

Default constructor.

Definition at line 43 of file aux_classes.cc.

References collect_effector_forc, collect_effector_torq, collect_environ_forc, collect_environ_torq, collect_no_xmit_forc, collect_no_xmit_torq, effector_forc, effector_torq, environ_forc, environ_torq, extern_forc_inrtl, extern_forc_struct, extern_torq_body, extern_torq_struct, inertial_torq, no_xmit_forc, and no_xmit_torq.

8.1.2.3 jeod::BodyForceCollect::∼BodyForceCollect (void)

Destructor.

Definition at line 83 of file aux_classes.cc.

References collect_effector_forc, collect_effector_torq, collect_environ_forc, collect_environ_torq, collect_no_xmit_forc, collect_no_xmit_torq, and jeod::release_vector().

8.1.3 Member Function Documentation

8.1.3.1 BodyForceCollect& jeod::BodyForceCollect::operator= (const BodyForceCollect &) [private]

8.1.4 Field Documentation

8.1.4.1 JPVCollectForce jeod::BodyForceCollect::collect_effector_forc

Vector of effector forces, (struct)

trick_io(**)

Definition at line 337 of file body_force_collect.hh.

Referenced by BodyForceCollect(), jeod::DynBody::collect_forces_and_torques(), jeod::StructureIntegratedDynBody::collect_local_forces_and_torques(), and ∼BodyForceCollect().

8.1.4.2 JPVCollectTorque jeod::BodyForceCollect::collect_effector_torq

Vector of effector torques, (struct)

trick_io(**)

Definition at line 352 of file body_force_collect.hh.

Referenced by BodyForceCollect(), jeod::DynBody::collect_forces_and_torques(), jeod::StructureIntegratedDynBody::collect_local_forces_and_torques(), and ∼BodyForceCollect().

8.1.4.3 JPVCollectForce jeod::BodyForceCollect::collect_environ_forc

Vector of env forces, (struct)

trick_io(**)

Definition at line 342 of file body_force_collect.hh.

Referenced by BodyForceCollect(), jeod::DynBody::collect_forces_and_torques(), jeod::StructureIntegratedDynBody::collect_local_forces_and_torques(), and ∼BodyForceCollect().

8.1.4.4 JPVCollectTorque jeod::BodyForceCollect::collect_environ_torq

Vector of env torques, (struct)

trick_io(**)

Definition at line 357 of file body_force_collect.hh.

Referenced by BodyForceCollect(), jeod::DynBody::collect_forces_and_torques(), jeod::StructureIntegratedDynBody::collect_local_forces_and_torques(), and ∼BodyForceCollect().

8.1.4.5 JPVCollectForce jeod::BodyForceCollect::collect_no_xmit_forc

Vector of local forces, (struct)

trick_io(**)

Definition at line 347 of file body_force_collect.hh.

Referenced by BodyForceCollect(), jeod::DynBody::collect_forces_and_torques(), jeod::StructureIntegratedDynBody::collect_local_forces_and_torques(), and ∼BodyForceCollect().

8.1.4.6 JPVCollectTorque jeod::BodyForceCollect::collect_no_xmit_torq

Vector of local torques, (struct)

trick_io(∗∗)

Definition at line 362 of file body_force_collect.hh.

Referenced by BodyForceCollect(), jeod::DynBody::collect_forces_and_torques(), jeod::StructureIntegratedDynBody::collect_local_forces_and_torques(), and ∼BodyForceCollect().

8.1.4.7 double jeod::BodyForceCollect::effector_forc[3]

Sum of effector forces, struct ref.

trick_units(N)

Definition at line 281 of file body_force_collect.hh.

Referenced by BodyForceCollect(), jeod::StructureIntegratedDynBody::collect_forces_and_torques(), jeod::DynBody::collect_forces_and_torques(), jeod::StructureIntegratedDynBody::collect_local_forces_and_torques(), and jeod::StructureIntegratedDynBody::PropagateForcesAndTorques().

8.1.4.8 double jeod::BodyForceCollect::effector_torq[3]

Sum of effector torques about body CoM, struct ref.

trick_units(N∗m)

Definition at line 306 of file body_force_collect.hh.

Referenced by BodyForceCollect(), jeod::StructureIntegratedDynBody::collect_forces_and_torques(), jeod::DynBody::collect_forces_and_torques(), jeod::StructureIntegratedDynBody::collect_local_forces_and_torques(), and jeod::StructureIntegratedDynBody::PropagateForcesAndTorques().

8.1.4.9 double jeod::BodyForceCollect::environ_forc[3]

Sum of env forces, struct ref.

trick_units(N)

Definition at line 286 of file body_force_collect.hh.

Referenced by BodyForceCollect(), jeod::StructureIntegratedDynBody::collect_forces_and_torques(), jeod::DynBody::collect_forces_and_torques(), jeod::StructureIntegratedDynBody::collect_local_forces_and_torques(), and jeod::StructureIntegratedDynBody::PropagateForcesAndTorques().

8.1.4.10 double jeod::BodyForceCollect::environ_torq[3]

Sum of environment torqs about body CoM, struct ref.

trick_units(N∗m)

Definition at line 311 of file body_force_collect.hh.

Referenced by BodyForceCollect(), jeod::StructureIntegratedDynBody::collect_forces_and_torques(), jeod::DynBody::collect_forces_and_torques(), jeod::StructureIntegratedDynBody::collect_local_forces_and_torques(), and jeod::StructureIntegratedDynBody::PropagateForcesAndTorques().

8.1.4.11 double jeod::BodyForceCollect::extern_forc_inrtl[3]

Sum of external forces, inertial.

trick_units(N)

Definition at line 301 of file body_force_collect.hh.

Referenced by BodyForceCollect(), jeod::StructureIntegratedDynBody::collect_forces_and_torques(), jeod::DynBody::collect_forces_and_torques(), and jeod::StructureIntegratedDynBody::compute_translational_acceleration().

8.1.4.12 double jeod::BodyForceCollect::extern_forc_struct[3]

Sum of external forces, struct ref.

trick_units(N)

Definition at line 296 of file body_force_collect.hh.

Referenced by BodyForceCollect(), jeod::StructureIntegratedDynBody::collect_forces_and_torques(), jeod::DynBody::collect_forces_and_torques(), jeod::StructureIntegratedDynBody::compute_translational_acceleration(), and jeod::StructureIntegratedDynBody::solve_constraints().

8.1.4.13 double jeod::BodyForceCollect::extern_torq_body[3]

Sum of external torques, body ref.

trick_units(N∗m)

Definition at line 332 of file body_force_collect.hh.

Referenced by BodyForceCollect(), jeod::StructureIntegratedDynBody::collect_forces_and_torques(), jeod::DynBody::collect_forces_and_torques(), and jeod::StructureIntegratedDynBody::compute_rotational_acceleration().

8.1.4.14 double jeod::BodyForceCollect::extern_torq_struct[3]

Sum of external torques, struct ref.

trick_units(N∗m)

Definition at line 327 of file body_force_collect.hh.

Referenced by BodyForceCollect(), jeod::StructureIntegratedDynBody::collect_forces_and_torques(), jeod::DynBody::collect_forces_and_torques(), and jeod::StructureIntegratedDynBody::compute_rotational_acceleration().

8.1.4.15 double jeod::BodyForceCollect::inertial_torq[3]

Induced inertial torques from second order rotational dynamics, w x Iw, body ref.

trick_units(N∗m)

Definition at line 322 of file body_force_collect.hh.

Referenced by BodyForceCollect(), jeod::StructureIntegratedDynBody::collect_forces_and_torques(), jeod::DynBody::collect_forces_and_torques(), jeod::StructureIntegratedDynBody::compute_inertial_torque(), jeod::StructureIntegratedDynBody::compute_rotational_acceleration(), and jeod::StructureIntegratedDynBody::solve_constraints().

8.1.4.16 double jeod::BodyForceCollect::no_xmit_forc[3]

Sum of local forces, struct ref.

trick_units(N)

Definition at line 291 of file body_force_collect.hh.

Referenced by BodyForceCollect(), jeod::StructureIntegratedDynBody::collect_forces_and_torques(), jeod::DynBody::collect_forces_and_torques(), and jeod::StructureIntegratedDynBody::collect_local_forces_and_torques().

8.1.4.17 double jeod::BodyForceCollect::no_xmit_torq[3]

Sum of torqs not transmitted to a parent about body CoM, struct ref.

trick_units(N∗m)

Definition at line 316 of file body_force_collect.hh.

Referenced by BodyForceCollect(), jeod::StructureIntegratedDynBody::collect_forces_and_torques(), jeod::DynBody::collect_forces_and_torques(), and jeod::StructureIntegratedDynBody::collect_local_forces_and_torques().

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

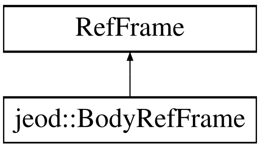
- body_force_collect.hh
- aux_classes.cc

8.2 jeod::BodyRefFrame Class Reference

Extend RefFrame to add coupling between the reference frame tree and the mass tree and to keep track of which state items have been set.

```
#include <body_ref_frame.hh>
```

Inheritance diagram for jeod::BodyRefFrame:



Public Member Functions

- BodyRefFrame (void)

  Default constructor.
- ∼BodyRefFrame (void) override

  Destructor.

Data Fields

- RefFrameItems initialized_items

  Specifies which state elements (position, velocity, attitude, and rate) have been initialized.
- MassPoint ∗ mass_point

  Pointer to the mass point that defines the origin and orientation of this frame, but with respect to the mass tree rather than with respect to the reference frame tree.

Private Member Functions

- BodyRefFrame (const BodyRefFrame &)
- BodyRefFrame & operator= (const BodyRefFrame &)

Friends

- class InputProcessor
- void init_attrjeod__BodyRefFrame ()

8.2.1 Detailed Description

Extend RefFrame to add coupling between the reference frame tree and the mass tree and to keep track of which state items have been set.

Definition at line 79 of file body_ref_frame.hh.

8.2.2 Constructor & Destructor Documentation

8.2.2.1 jeod::BodyRefFrame::BodyRefFrame (const BodyRefFrame &) [private]

8.2.2.2 jeod::BodyRefFrame::BodyRefFrame (void) [inline]

Default constructor.

Definition at line 126 of file body_ref_frame.hh.

8.2.2.3 jeod::BodyRefFrame::∼BodyRefFrame (void) [inline], [override]

Destructor.

Definition at line 140 of file body_ref_frame.hh.

8.2.3 Member Function Documentation

8.2.3.1 BodyRefFrame& jeod::BodyRefFrame::operator= (const BodyRefFrame &) [private]

8.2.4 Friends And Related Function Documentation

8.2.4.1 void init_attrjeod__BodyRefFrame ( ) [friend]

8.2.4.2 friend class InputProcessor [friend]

Definition at line 81 of file body_ref_frame.hh.

8.2.5 Field Documentation

8.2.5.1 RefFrameItems jeod::BodyRefFrame::initialized_items

Specifies which state elements (position, velocity, attitude, and rate) have been initialized.

trick_units(–)

Definition at line 92 of file body_ref_frame.hh.

Referenced by jeod::DynBody::compute_derived_state_forward(), jeod::DynBody::compute_derived_state_reverse(), jeod::DynBody::compute_state_elements_forward(), jeod::DynBody::compute_state_elements_reverse(), jeod::DynBody::propagate_state_from_composite(), jeod::DynBody::propagate_state_from_structure(), jeod::DynBody::set_state_source_internal(), and jeod::DynBody::update_integrated_state().

8.2.5.2 MassPoint∗ jeod::BodyRefFrame::mass_point

Pointer to the mass point that defines the origin and orientation of this frame, but with respect to the mass tree rather than with respect to the reference frame tree.

trick_units(–)

Definition at line 99 of file body_ref_frame.hh.

Referenced by jeod::DynBody::add_mass_body(), jeod::DynBody::add_mass_body_frames(), jeod::DynBody::add_mass_point(), jeod::DynBody::attach_child(), jeod::DynBody::attach_to_frame(), jeod::DynBody::compute_ref_point_transform(), jeod::StructureIntegratedDynBody::compute_vehicle_point_derivatives(), jeod::DynBody::compute_vehicle_point_derivatives(), jeod::DynBody::compute_vehicle_point_states(), and jeod::DynBody::DynBody().

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

- body_ref_frame.hh

8.3 jeod::BodyWrenchCollect Class Reference

Serves as the collection point for wrenches that act on a vehicle.

```
#include <body_wrench_collect.hh>
```

Public Member Functions

- BodyWrenchCollect ()

  Default constructor.
- ∼BodyWrenchCollect ()

  Destructor.
- BodyWrenchCollect (const BodyWrenchCollect &)=delete
- BodyWrenchCollect & operator= (const BodyWrenchCollect &)=delete
- Wrench & accumulate (Wrench &sum) const

  Accumulate the collected wrenches.
- Wrench & accumulate (const double point[3], Wrench &sum) const

  Accumulate the collected wrenches.

Data Fields

- JeodPointerVector< Wrench >::type collect_wrench

  Vector of effector wrenches.

8.3.1 Detailed Description

Serves as the collection point for wrenches that act on a vehicle.

This is a simple class that is tightly coupled with the StructureIntegratedDynBody class. This latter class contains (has-a) a BodyWrenchCollect data member.

The Trick vcollect mechanism (or a similar mechanism in a non-Trick sim) pushes pointers to the individual wrenches onto the various collection member of a BodyWrenchCollect. StructureIntegratedDynBody members cumulate these collected wrenches to form the total wrench acting on the vehicle.

Definition at line 80 of file body_wrench_collect.hh.

8.3.2 Constructor & Destructor Documentation

8.3.2.1 jeod::BodyWrenchCollect::BodyWrenchCollect ( )

Default constructor.

Definition at line 26 of file body_wrench_collect.cc.

References collect_wrench.

8.3.2.2 jeod::BodyWrenchCollect::∼BodyWrenchCollect ( )

Destructor.

Definition at line 35 of file body_wrench_collect.cc.

References collect_wrench.

8.3.2.3 jeod::BodyWrenchCollect::BodyWrenchCollect (const **BodyWrenchCollect** &) [delete]

8.3.3 Member Function Documentation

8.3.3.1 **Wrench**& jeod::BodyWrenchCollect::accumulate (**Wrench** & *sum*) const [inline]

Accumulate the collected wrenches.

Parameters

sum	Wrench into which the accumulated sum is to be placed. The summation is about sum.point.

Returns

Reference to the input wrench.

Definition at line 131 of file body_wrench_collect.hh.

References jeod::Wrench::accumulate(), and collect_wrench.

Referenced by accumulate(), and jeod::StructureIntegratedDynBody::collect_local_forces_and_torques().

8.3.3.2 **Wrench**& jeod::BodyWrenchCollect::accumulate (const double *point[3]*, **Wrench** & *sum*) const [inline]

Accumulate the collected wrenches.

Parameters

point	Point about which summation is to be performed.
sum	Wrench into which the accumulated sum is to be placed.

Returns

Reference to the input wrench.

Definition at line 143 of file body_wrench_collect.hh.

References accumulate(), and jeod::Wrench::set_point().

8.3.3.3 **BodyWrenchCollect**& jeod::BodyWrenchCollect::operator= (const **BodyWrenchCollect** &) [delete]

8.3.4 Field Documentation

8.3.4.1 JeodPointerVector< **Wrench** >::type jeod::BodyWrenchCollect::collect_wrench

Vector of effector wrenches.

The effector wrenches are collected into the vector at the S_define level via & vcollect containing_body.effector_wrench_collection.collect_wrench { pointer_to_wrench1, ... pointer_to_wrench_n };

The vector of collected wrenches are processed by the containing body's collect_forces_and_torques member function.trick_io(∗∗)

Definition at line 100 of file body_wrench_collect.hh.

Referenced by accumulate(), BodyWrenchCollect(), and ∼BodyWrenchCollect().

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

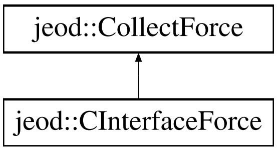
- body_wrench_collect.hh
- body_wrench_collect.cc

8.4 jeod::CInterfaceForce Class Reference

This class is deprecated.

`#include <force.hh>`

Inheritance diagram for jeod::CInterfaceForce:



Public Member Functions

- CInterfaceForce ()

  CInterfaceForce default constructor.
- CInterfaceForce (double ∗vec)

  CInterfaceForce constructor for use with C force array.
- ∼CInterfaceForce () override

  CInterfaceForce destructor; frees 'active' but not the force.

Private Member Functions

- CInterfaceForce (const CInterfaceForce &)

  Not implemented.
- CInterfaceForce & operator= (const CInterfaceForce &)

  Not implemented.

Additional Inherited Members

8.4.1 Detailed Description

This class is deprecated.

Definition at line 227 of file force.hh.

8.4.2 Constructor & Destructor Documentation

8.4.2.1 jeod::CInterfaceForce::CInterfaceForce (void)

CInterfaceForce default constructor.

Note that this has changed from JEOD 2.1. In JEOD 2.2 the default constructor of a JEOD-allocable class must not allocate any resources.

Definition at line 140 of file force.cc.

8.4.2.2 jeod::CInterfaceForce::CInterfaceForce (double ∗ *force_3vec*) [explicit]

CInterfaceForce constructor for use with C force array.

Note that the new CInterfaceForce's force *is* the force_3vec.

Parameters

`in,out`	*force_3vec*	Force vector to encapsulate Units: N

Definition at line 154 of file force.cc.

References jeod::CollectForce::active, and jeod::CollectForce::force.

8.4.2.3 jeod::CInterfaceForce::∼CInterfaceForce (void) [override]

CInterfaceForce destructor; frees 'active' but not the force.

Definition at line 167 of file force.cc.

References jeod::CollectForce::active.

8.4.2.4 jeod::CInterfaceForce::CInterfaceForce (const CInterfaceForce &) [private]

Not implemented.

8.4.3 Member Function Documentation

8.4.3.1 CInterfaceForce& jeod::CInterfaceForce::operator= (const CInterfaceForce &) [private]

Not implemented.

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

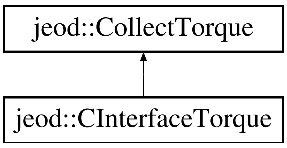
- force.hh
- force.cc

8.5 jeod::CInterfaceTorque Class Reference

This class is deprecated.

`#include <torque.hh>`

Inheritance diagram for jeod::CInterfaceTorque:



Public Member Functions

- CInterfaceTorque ()

  CInterfaceTorque default constructor.
- CInterfaceTorque (double ∗vec)

  CInterfaceTorque constructor for use with C torque array.
- ∼CInterfaceTorque () override

  CInterfaceTorque destructor; frees 'active' but not the torque.

Private Member Functions

- CInterfaceTorque (const CInterfaceTorque &)

  Not implemented.
- CInterfaceTorque & operator= (const CInterfaceTorque &)

  Not implemented.

Additional Inherited Members

8.5.1 Detailed Description

This class is deprecated.

Definition at line 222 of file torque.hh.

8.5.2 Constructor & Destructor Documentation

8.5.2.1 jeod::CInterfaceTorque::CInterfaceTorque (void)

CInterfaceTorque default constructor.

Note that this has changed from JEOD 2.1. In JEOD 2.2 the default constructor of a JEOD-allocable class must not allocate any resources.

Definition at line 140 of file torque.cc.

8.5.2.2 jeod::CInterfaceTorque::CInterfaceTorque (double ∗ *torque_3vec*) [explicit]

CInterfaceTorque constructor for use with C torque array.

Note that the new CInterfaceTorque's torque *is* the torque_3vec.

Parameters

in,out	*torque_3vec*	Torque vector to encapsulate Units: NM

Definition at line 154 of file torque.cc.

References jeod::CollectTorque::active, and jeod::CollectTorque::torque.

8.5.2.3 jeod::CInterfaceTorque::∼CInterfaceTorque (void) [override]

CInterfaceTorque destructor; frees 'active' but not the torque.

Definition at line 167 of file torque.cc.

References jeod::CollectTorque::active.

8.5.2.4 jeod::CInterfaceTorque::CInterfaceTorque (const CInterfaceTorque &) [private]

Not implemented.

8.5.3 Member Function Documentation

8.5.3.1 CInterfaceTorque& jeod::CInterfaceTorque::operator= (const CInterfaceTorque &) [private]

Not implemented.

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

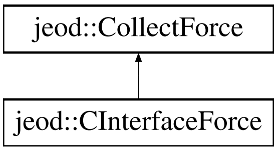
- torque.hh
- torque.cc

8.6 jeod::CollectForce Class Reference

A CollectForce represents a collected force that acts on a vehicle.

`#include <force.hh>`

Inheritance diagram for jeod::CollectForce:



Public Member Functions

- CollectForce ()

  CollectForce default constructor.
- CollectForce (double vec[3])

  CollectForce constructor that encapsulates a C-style 3-vector.
- CollectForce (Force &)

  CollectForce constructor that encapsulates a Force.
- CollectForce (CollectForce &)

  CollectForce constructor that encapsulates another CollectForce.
- virtual ∼CollectForce ()

  CollectForce destructor.
- bool is_active () const

  A force is active if it has a non-null force vector and the active pointer is null or the pointed-to boolean is true.
- double & operator[] (const unsigned int index)

  Access a force element, non-const version.

- double operator[] (const unsigned int index) const

    Access a force element, const version.
- bool operator== (const CollectForce &other)

Static Public Member Functions

- static CollectForce ∗ create (double ∗vec)

    Create a CollectForce whose force is the specified array.
- static CollectForce ∗ create (Force &force)

    Create a shallow copy of a Force.
- static CollectForce ∗ create (CollectForce &force)

    Create a shallow copy of a CollectForce.
- static CollectForce ∗ create (Force ∗force)

    Create a shallow copy of a Force.
- static CollectForce ∗ create (CollectForce ∗force)

    Create a shallow copy of a CollectForce.

Data Fields

- bool ∗ active

    Is this force active?
- double ∗ force

    Force vector.

Private Member Functions

- CollectForce (const CollectForce &)

    Not implemented.
- CollectForce & operator= (const CollectForce &)

    Not implemented.

8.6.1 Detailed Description

A CollectForce represents a collected force that acts on a vehicle.

The BodyForceCollect class contains STL vectors that in turn contain CollectForce pointers. These vectors are populated via the Trick vcollect mechanism. A Trick simulation issues vcollect statements such as

```
vcollect vehicle.body.collect.collect_XXX_forc CollectForce::create {
   vehicle.force_model1.force,
   vehicle.force_model2.force
};
```

This invokes the appropriate CollectForce create method on each listed element.

CollectForces should not be used in model code to represent forces. Use the Force class instead.

Definition at line 149 of file force.hh.

8.6.2 Constructor & Destructor Documentation

8.6.2.1 jeod::CollectForce::CollectForce (void)

CollectForce default constructor.

Definition at line 67 of file force.cc.

8.6.2.2 jeod::CollectForce::CollectForce (double *force_3vec[3]*) [explicit]

CollectForce constructor that encapsulates a C-style 3-vector.

Note that the new CollectForce's force *is* the force_3vec.

Parameters

in,out	*force_3vec*	Force vector to encapsulate Units: N

Definition at line 97 of file force.cc.

8.6.2.3 jeod::CollectForce::CollectForce (Force & *source_force*) [explicit]

CollectForce constructor that encapsulates a Force.

Note that this performs a shallow copy by intent.

Parameters

in,out	*source_force*	Force to encapsulate

Definition at line 82 of file force.cc.

8.6.2.4 jeod::CollectForce::CollectForce (CollectForce & *source_force*) [explicit]

CollectForce constructor that encapsulates another CollectForce.

Note that this performs a shallow copy by intent.

Parameters

in,out	*source_force*	Force to encapsulate

Definition at line 112 of file force.cc.

8.6.2.5 jeod::CollectForce::∼CollectForce (void) [virtual]

CollectForce destructor.

Note that this does not free any element memory.

Definition at line 126 of file force.cc.

8.6.2.6 jeod::CollectForce::CollectForce (const CollectForce &) [private]

Not implemented.

8.6.3 Member Function Documentation

8.6.3.1 CollectForce ∗ jeod::CollectForce::create (double ∗ *force_3vec*) [static]

Create a CollectForce whose force is the specified array.

Note that the created instance is actually a CInterfaceForce.

Returns

Constructed CollectForce

Parameters

in,out	*force_3vec*	Force vector to encapsulate Units: N

Definition at line 214 of file force.cc.

Referenced by create().

8.6.3.2 CollectForce ∗ jeod::CollectForce::create (Force & *source_force*) [static]

Create a shallow copy of a Force.

Note that the new CollectForce refers to the Force's active flag and force array.

Returns

Constructed CollectForce

Parameters

in,out	*source_force*	Force object to encapsulate

Definition at line 185 of file force.cc.

8.6.3.3 CollectForce ∗ jeod::CollectForce::create (CollectForce & *source_force*) [static]

Create a shallow copy of a CollectForce.

Note that both the source and new CollectForces refer to the same active flag and force array.

Returns

Constructed CollectForce

Parameters

in,out	*source_force*	Force to copy

Definition at line 229 of file force.cc.

8.6.3.4 CollectForce ∗ jeod::CollectForce::create (Force ∗ *source_force*) [static]

Create a shallow copy of a Force.

Note that the new CollectForce refers to the Force's active flag and force array.

Returns

Constructed CollectForce

Parameters

in,out	*source_force*	Force object to encapsulate

Definition at line 200 of file force.cc.

References create().

8.6.3.5 CollectForce ∗ jeod::CollectForce::create (CollectForce ∗ *source_force*) [static]

Create a shallow copy of a CollectForce.

Note that both the source and new CollectForces refer to the same active flag and force array.

Returns

Constructed CollectForce

Parameters

in,out	*source_force*	Force to copy

Definition at line 244 of file force.cc.

References create().

8.6.3.6 bool jeod::CollectForce::is_active (void) const [inline]

A force is active if it has a non-null force vector and the active pointer is null or the pointed-to boolean is true.

Returns

Is the force active?

Definition at line 104 of file force_inline.hh.

References active, and force.

8.6.3.7 CollectForce& jeod::CollectForce::operator= (const CollectForce &) [private]

Not implemented.

8.6.3.8 bool jeod::CollectForce::operator== (const CollectForce & *other*) [inline]

Definition at line 185 of file force.hh.

References force.

8.6.3.9 double & jeod::CollectForce::operator[] (const unsigned int *index*) [inline]

Access a force element, non-const version.

Returns

Force component at specified index
Units: N

Parameters

in	*index*	Index number

Definition at line 118 of file force_inline.hh.

References force.

8.6.3.10 double jeod::CollectForce::operator[] (const unsigned int *index*) const [inline]

Access a force element, const version.

Returns

Force component at specified index
Units: N

Parameters

in	*index*	Index number

Definition at line 131 of file force_inline.hh.

References force.

8.6.4 Field Documentation

8.6.4.1 bool∗ jeod::CollectForce::active

Is this force active?

trick_units(–)

Definition at line 197 of file force.hh.

Referenced by jeod::CInterfaceForce::CInterfaceForce(), is_active(), and jeod::CInterfaceForce::∼CInterfaceForce().

8.6.4.2 double∗ jeod::CollectForce::force

Force vector.

trick_units(N)

Definition at line 202 of file force.hh.

Referenced by jeod::CInterfaceForce::CInterfaceForce(), is_active(), operator==(), and operator[]().

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

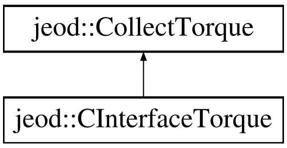
- force.hh
- force_inline.hh
- force.cc

8.7 jeod::CollectTorque Class Reference

A CollectTorque represents a collected torque that acts on a vehicle.

```
#include <torque.hh>
```

Inheritance diagram for jeod::CollectTorque:



Public Member Functions

- CollectTorque ()

    CollectTorque default constructor.
- CollectTorque (double vec[3])

    CollectTorque constructor that encapsulates a C-style 3-vector.
- CollectTorque (Torque &)

  CollectTorque constructor that encapsulates a Torque.
- CollectTorque (CollectTorque &)

  CollectTorque constructor that encapsulates another CollectTorque.
- virtual ∼CollectTorque ()

  CollectTorque destructor.
- bool is_active () const

  A torque is active if it has a non-null torque vector and the active pointer is null or the pointed-to boolean is true.
- double & operator[] (const unsigned int index)

  Access a torque element, non-const version.
- double operator[] (const unsigned int index) const

  Access a torque element, const version.
- bool operator== (const CollectTorque &other)

Static Public Member Functions

- static CollectTorque * create (double *vec)

  Create a CollectTorque whose torque is the specified array.
- static CollectTorque * create (Torque &torque)

  Create a shallow copy of a Torque.
- static CollectTorque * create (CollectTorque &torque)

  Create a shallow copy of a CollectTorque.
- static CollectTorque * create (Torque *torque)

  Create a shallow copy of a Torque.
- static CollectTorque * create (CollectTorque *torque)

  Create a shallow copy of a CollectTorque.

Data Fields

- bool * active

  Is this torque active?
- double * torque

  Torque vector.

Private Member Functions

- CollectTorque (const CollectTorque &)

  Not implemented.
- CollectTorque & operator= (const CollectTorque &)

  Not implemented.

8.7.1 Detailed Description

A CollectTorque represents a collected torque that acts on a vehicle.

The BodyTorqueCollect class contains STL vectors that in turn contain CollectTorque pointers. These vectors are populated via the Trick vcollect mechanism. A Trick simulation issues vcollect statements such as

```
vcollect vehicle.body.collect.collect_XXX_forc CollectTorque::create {
   vehicle.torque_model1.torque,
   vehicle.torque_model2.torque
};
```

This invokes the appropriate CollectTorque create method on each listed element.

CollectTorques should not be used in model code to represent torques. Use the Torque class instead.

Definition at line 147 of file torque.hh.

8.7.2 Constructor & Destructor Documentation

8.7.2.1 jeod::CollectTorque::CollectTorque (void)

CollectTorque default constructor.

Definition at line 67 of file torque.cc.

8.7.2.2 jeod::CollectTorque::CollectTorque (double *torque_3vec[3]*) [explicit]

CollectTorque constructor that encapsulates a C-style 3-vector.

Note that the new CollectTorque's torque *is* the torque_3vec.

Parameters

in,out	*torque_3vec*	Torque vector to encapsulate Units: NM

Definition at line 97 of file torque.cc.

8.7.2.3 jeod::CollectTorque::CollectTorque (Torque & *source_torque*) [explicit]

CollectTorque constructor that encapsulates a Torque.

Note that this performs a shallow copy by intent.

Parameters

in,out	*source_torque*	Torque to encapsulate

Definition at line 82 of file torque.cc.

8.7.2.4 jeod::CollectTorque::CollectTorque (CollectTorque & *source_torque*) [explicit]

CollectTorque constructor that encapsulates another CollectTorque.

Note that this performs a shallow copy by intent.

Parameters

in,out	*source_torque*	Torque to encapsulate

Definition at line 112 of file torque.cc.

8.7.2.5 jeod::CollectTorque::∼CollectTorque (void) [virtual]

CollectTorque destructor.

Note that this does not free any element memory.

Definition at line 126 of file torque.cc.

8.7.2.6 jeod::CollectTorque::CollectTorque (const **CollectTorque** &) [private]

Not implemented.

8.7.3 Member Function Documentation

8.7.3.1 **CollectTorque** ∗ jeod::CollectTorque::create (double ∗ *torque_3vec*) [static]

Create a CollectTorque whose torque is the specified array.

Note that the created instance is actually a CInterfaceTorque.

Returns

Constructed CollectTorque

Parameters

in,out	*torque_3vec*	Torque vector to encapsulate Units: NM

Definition at line 214 of file torque.cc.

Referenced by create().

8.7.3.2 **CollectTorque** ∗ jeod::CollectTorque::create (**Torque** & *source_torque*) [static]

Create a shallow copy of a Torque.

Note that the new CollectTorque refers to the Torque's active flag and torque array.

Returns

Constructed CollectTorque

Parameters

in,out	*source_torque*	Torque object to encapsulate

Definition at line 185 of file torque.cc.

8.7.3.3 **CollectTorque** ∗ jeod::CollectTorque::create (**CollectTorque** & *source_torque*) [static]

Create a shallow copy of a CollectTorque.

Note that both the source and new CollectTorques refer to the same active flag and torque array.

Returns

Constructed CollectTorque

Parameters

in,out	*source_torque*	Torque to copy

Definition at line 229 of file torque.cc.

8.7.3.4 **CollectTorque** ∗ jeod::CollectTorque::create (**Torque** ∗ *source_torque*) [static]

Create a shallow copy of a Torque.

Note that the new CollectTorque refers to the Torque's active flag and torque array.

Returns

Constructed CollectTorque

Parameters

in,out	*source_torque*	Torque object to encapsulate

Definition at line 200 of file torque.cc.

References create().

8.7.3.5 CollectTorque ∗ jeod::CollectTorque::create (CollectTorque ∗ *source_torque*) [static]

Create a shallow copy of a CollectTorque.

Note that both the source and new CollectTorques refer to the same active flag and torque array.

Returns

Constructed CollectTorque

Parameters

in,out	*source_torque*	Torque to copy

Definition at line 244 of file torque.cc.

References create().

8.7.3.6 bool jeod::CollectTorque::is_active (void) const [inline]

A torque is active if it has a non-null torque vector and the active pointer is null or the pointed-to boolean is true.

Returns

Is the torque active?

Definition at line 104 of file torque_inline.hh.

References active, and torque.

8.7.3.7 CollectTorque& jeod::CollectTorque::operator= (const CollectTorque &) [private]

Not implemented.

8.7.3.8 bool jeod::CollectTorque::operator== (const CollectTorque & *other*) [inline]

Definition at line 180 of file torque.hh.

References torque.

8.7.3.9 double & jeod::CollectTorque::operator[] (const unsigned int *index*) [inline]

Access a torque element, non-const version.

Returns

Torque component at specified index
Units: N

Parameters

in	*index*	Index number

Definition at line 118 of file torque_inline.hh.

References torque.

8.7.3.10 double jeod::CollectTorque::operator[] (const unsigned int *index*) const [inline]

Access a torque element, const version.

Returns

Torque component at specified index
Units: N

Parameters

in	*index*	Index number

Definition at line 131 of file torque_inline.hh.

References torque.

8.7.4 Field Documentation

8.7.4.1 bool∗ jeod::CollectTorque::active

Is this torque active?

trick_units(–)

Definition at line 192 of file torque.hh.

Referenced by jeod::CInterfaceTorque::CInterfaceTorque(), is_active(), and jeod::CInterfaceTorque::∼CInterfaceTorque().

8.7.4.2 double∗ jeod::CollectTorque::torque

Torque vector.

trick_units(N∗m)

Definition at line 197 of file torque.hh.

Referenced by jeod::CInterfaceTorque::CInterfaceTorque(), is_active(), operator==(), and operator[]().

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

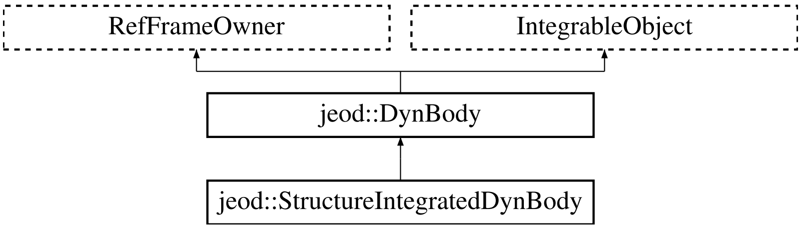
- torque.hh
- torque_inline.hh
- torque.cc

8.8 jeod::DynBody Class Reference

Class DynBody is the base class for all dynamic bodies.

```
#include <dyn_body.hh>
```

Inheritance diagram for jeod::DynBody:



Public Member Functions

- DynBody ()

  DynBody default constructor.
- ∼DynBody () override

  DynBody destructor.
- virtual void initialize_model (BaseDynManager &dyn_manager_in)

  Initialize internal and external interrelations, including registration / with the dynamics manager.
- void activate ()

  Activate a DynBody object.
- void deactivate ()

  Deactivate a DynBody object.
- void set_name (const std::string &name_in)

  Set the name of the vehicle.
- virtual void add_control (GravityControls ∗control)

  Add a new GravityControls to the list in grav_interaction.
- virtual void initialize_controls (GravityManager &grav_manager)

  Initialize the gravity controls of this DynBody.
- virtual void reset_controls ()

  Make the frame subscriptions for each control consistent with the requirements for that control.
- virtual void sort_controls ()

  Sort the gravity controls in ascending acceleration magnitude order.
- virtual void collect_forces_and_torques ()

  Collect forces and torques acting on the vehicle.
- virtual void create_body_integrators (const er7_utils::IntegratorConstructor &generator, er7_utils::IntegrationControls &controls, const JeodIntegrationTime &time_mngr)

  Create the integrator (integrators) needed to propagate the translational and rotational state of a DynBody.
- er7_utils::IntegratorResult integrate (double dyn_dt, unsigned int target_stage) override

  Integrate state by the specified dynamic time interval.
- virtual void switch_integration_frames (EphemerisRefFrame &new_integ_frame)

  Switch the integration frame for this body and all its child bodies to the indicated frame.
- virtual void switch_integration_frames (const char ∗new_integ_frame_name)

  Switch the integration frame for this body and all its child bodies to the frame indicated by the provided name.
- void create_integrators (const er7_utils::IntegratorConstructor &generator, er7_utils::IntegrationControls &controls, const er7_utils::TimeInterface &time_if) override

  This interface is required by er7_utils::IntegrableObject.
- void destroy_integrators (void) override

  Destroy the integrators.
- void reset_integrators (void) override

  Reset the translational and rotational integrators.
- virtual BodyRefFrame ∗ find_body_frame (const char ∗frame_id) const

  Find the BodyRefFrame named by the provided identifier.
- DynamicsIntegrationGroup ∗ get_dynamics_integration_group ()

Get the DynamicsIntegrationGroup that integrates this DynBody object.

- JeodPointerVector
  < er7_utils::IntegrableObject >
  ::type get_integrable_objects ()

  Get the IntegrableObjects associated with this DynBody.
- void clear_integrable_objects ()

  Remove all IntegrableObjects associated with this DynBody.
- void migrate_integrable_objects ()

  Call this method before switching this dyn body to a new group if you want the associated integrable objects to follow.
- void add_integrable_object (er7_utils::IntegrableObject &associated_integrable_object)

  Add an IntegrableObject to be integrated with this DynBody.
- void remove_integrable_object (er7_utils::IntegrableObject &associated_integrable_object)

  Remove an IntegrableObject from association with this DynBody.
- void set_position (const double position[3], BodyRefFrame &subject_frame)

  Set the position of the vehicle.
- void set_velocity (const double velocity[3], BodyRefFrame &subject_frame)

  Set the velocity of the vehicle.
- void set_attitude_left_quaternion (const Quaternion &left_quat, BodyRefFrame &subject_frame)

  Set the attitude of the vehicle.
- void set_attitude_right_quaternion (const Quaternion &right_quat, BodyRefFrame &subject_frame)

  Set the attitude of the vehicle.
- void set_attitude_matrix (const double matrix[3][3], BodyRefFrame &subject_frame)

  Set the attitude of the vehicle.
- void set_attitude_rate (const double attitude_rate[3], BodyRefFrame &subject_frame)

  Set the attitude rate of the vehicle.
- void set_state (RefFrameItems::Items set_items, const RefFrameState &state, BodyRefFrame &subject_-frame)

  Set the parts of the specified reference frame as indicated by the set_items parameter from the supplied state and propagate these items to all dynamic bodies attached to this body.
- void set_state_source (RefFrameItems::Items items, BodyRefFrame &frame)

  Set the source of aspects of the state.
- virtual void propagate_state ()

  Propagate state from the integrated state to attached bodies.
- virtual void update_integrated_state ()

  Propagate state from state owners to the integrated state.
- virtual void compute_vehicle_point_states (RefFrameItems::Items set_items)

  Propagate structure frame state to vehicle points.
- bool is_root_body ()

  Indicates whether this DynBody object is a root body.
- virtual const DynBody * get_parent_body () const

  Returns this DynBody object's parent body.
- virtual const DynBody * get_root_body () const

  Finds this DynBody object's root body.
- virtual void add_mass_point (const MassPointInit &mass_point_init)

  Add a mass point to the dyn body's list of such and make a vehicle point that corresponds to the added mass point.
- const BodyRefFrame * find_vehicle_point (const char *pt_name) const

  Find the vehicle point with the given name.
- virtual void compute_vehicle_point_derivatives (const BodyRefFrame &frame, FrameDerivs &derivs)

  Compute the state derivatives at a vehicle point.
- const RefFrameItems & get_initialized_states () const

  Indicate which state elements have been initialized.

- bool initialized_states_contains (RefFrameItems::Items test_items) const

  Indicate whether the specified state elements have been initialized.
- virtual bool add_mass_body (const char ∗this_point_name, const char ∗child_point_name, MassBody &child)
- virtual bool add_mass_body (const double offset[3], const double T_pstr_cstr[3][3], MassBody &child)
- virtual bool attach_to (const char ∗this_point_name, const char ∗parent_point_name, DynBody &parent)

  Attach this dyn body's root body as a child of the specified dyn body such that the specified mass points on the two bodies are coincident and the frames associated with those mass points are related by a 180 degree yaw.
- virtual bool attach_to (const double offset_pstr_cstr_pstr[3], const double T_pstr_cstr[3][3], DynBody &parent)

  Attach this dyn body's root body as a child of the specified dyn body such that this body's structural origin is offset from the parent body's structural origin and this body's structural axes are oriented with respect to the parent body's structural axes as specified.
- virtual bool attach_child (const char ∗this_point_name, const char ∗child_point_name, DynBody &child)

  Attach a child DynBody by point specification.
- virtual bool attach_child (const double offset_pstr_cstr_pstr[3], const double T_pstr_cstr[3][3], DynBody &child)

  Attach a child DynBody by location specification.
- virtual bool attach_to_frame (const char ∗parent_ref_frame_name)
- virtual bool attach_to_frame (RefFrame &parent)
- virtual bool attach_to_frame (const char ∗this_point_name, const char ∗parent_ref_frame_name, const double offset_pframe_cpt_pframe[3], const double T_pframe_cpt[3][3])
- virtual bool attach_to_frame (const double offset_pframe_cstr_pframe[3], const double T_pframe_cstr[3][3], RefFrame &parent)
- virtual bool detach (DynBody &other_body)

  Detach parent and child DynBodies, 'this' and the argument body, such that the detachment happens at the parent body level.
- virtual bool detach (void)

  Detach this DynBody from its parent RefFrame or DynBody parent.
- virtual bool remove_mass_body (MassBody &child)

  Remove connectivity between this (parent) DynBody and the argument (child) MassBody mass subbody.

Data Fields

- MassBody mass

  Mass properties of the vehicle, defined about the structure reference frame.
- NamedItem & name

  Body name, reference linked to mass.name.
- char ∗ integ_frame_name

  The name of the reference frame with respect to which the body's reference frames (core, composite, structure, plus vehicle point frames) are to be represented and propagated.
- EphemerisRefFrame ∗ integ_frame

  The current integration frame.
- BodyRefFrame core_body

  Vehicle core body reference frame.
- BodyRefFrame composite_body

  Vehicle composite body reference frame.
- BodyRefFrame structure

  Vehicle structural reference frame.
- bool translational_dynamics

  Is translational dynamics enabled? The body's translational state is integrated only if this member is true.
- bool rotational_dynamics

  Is rotational dynamics enabled? The body's rotational state is integrated only if this member is true.
- bool compute_point_derivative

Should the point derivatives for the body be computed? A child body's translational and rotational derivatives are only computed if this is true.

- bool three_dof

  Is this a three degrees of freedom (translation only) body? This data member has effect only when set prior to the creation of the body's integrators.
- GeneralizedSecondOrderODETechnique::TechniqueType rotation_integration

  Specifies the preferred mechanism for integrating rotational state.
- bool autoupdate_vehicle_points

  Are vehicle points automatically updated? The vehicle points are automatically calculated at initialization time but are only automatically updated at runtime if this member is true.
- GravityInteraction grav_interaction

  Gravitational interactions.
- FrameDerivs derivs

  Translational/rotational accelerations.
- BodyForceCollect collect

  Force/Torque collection mechanism.

Protected Member Functions

- virtual void set_integ_frame (EphemerisRefFrame &new_integ_frame)

  Set the integration frame for this body and all its child bodies to the provided frame.
- virtual void set_integ_frame (const char ∗new_integ_frame_name)

  Set the integration frame for this body and all its child bodies to the frame indicated by the provided name.
- virtual er7_utils::IntegratorResult trans_integ (double dyn_dt, unsigned int target_stage)

  Integrate the vehicle's translational state.
- virtual er7_utils::IntegratorResult rot_integ (double dyn_dt, unsigned int target_stage)

  Integrate the vehicle's rotational state.
- void set_state_source_internal (RefFrameItems::Items items, BodyRefFrame &frame)

  Set the source of aspects of the state.
- virtual DynBody ∗ get_parent_body_internal ()

  Returns this DynBody object's parent body.
- virtual DynBody ∗ get_root_body_internal ()

  Finds this DynBody object's root body.
- virtual bool attach_validate_parent (const DynBody &parent, bool generate_message) const

  Validate whether the pending attachment is legal from a connectivity point of view.
- virtual bool attach_validate_child (const DynBody &child, bool generate_message) const

  Validate whether the pending attachment is legal from a physical point of view.
- virtual bool add_mass_body_validate (const MassBody &child, bool generate_message) const

  Validate whether the pending sub body is legal from a mass tree point of view.
- virtual void add_mass_body_frames (MassBody &subbody)

  For a newly attached mass sub-body, create body frames for the root sub-body and all child sub-bodies via recursion.
- virtual void detach_mass_body_frames (MassBody &subbody)

  For a newly detached mass sub-body, remove body frames for the root sub-body and all child sub-bodies via recursion.
- virtual void attach_establish_links (DynBody &parent)

  Establish the logical connectivity between parent and child.
- virtual void attach_update_properties (const double offset_pstr_cstr_pstr[3], const double T_pstr_cstr[3][3], DynBody &child)

  Set the relation between parent and child and update the mass properties.
- virtual void process_dynamic_attachment (const double offset_pstr_cstr_pstr[3], const double T_pstr_cstr[3][3], DynBody &root_body, DynBody &child_body)

  Process the attachment event of one body from another.

- virtual void detach_mass_internal (MassBody &child)

  Update parent and child properties to reflect that they are detached.
- virtual void propagate_state_from_structure ()

  Propagate state to attached bodies starting from this body's structural frame.
- virtual void propagate_state_from_composite ()

  Propagate state to attached bodies starting from this body's composite frame.
- void compute_ref_point_transform (const BodyRefFrame &source_frame, const MassPoint $**$const ref_point, MassPointState &rel_state)

  Compute the relative state between the integrated frame's mass point and the source frame's mass point.
- void compute_derived_state_forward (const BodyRefFrame &source_frame, const MassPoint &rel_state, BodyRefFrame &derived_frame) const

  Compute a derived state given the source state and the position/ attitude transformation from the source to the derived state.
- void compute_state_elements_forward (const BodyRefFrame &source_frame, const MassPoint &rel_state, const RefFrameItems &state_items, BodyRefFrame &derived_frame) const

  Compute selected aspects of the derived state given the source state and the position/ attitude transformation from the source to the derived state.
- void compute_derived_state_reverse (const BodyRefFrame &source_frame, const MassPoint &rel_state, BodyRefFrame &derived_frame) const

  Compute a derived state given the source state and the position/ attitude transformation from the derived to the source state.
- void compute_state_elements_reverse (const BodyRefFrame &source_frame, const MassPoint &rel_state, const RefFrameItems &state_items, BodyRefFrame &derived_frame) const

  Compute selected aspects of the derived state given the source state and the position/ attitude transformation from the derived to the source state.

Protected Attributes

- BaseDynManager $*$& dyn_manager

  The dynamics manager for the simulation.
- const JeodIntegrationTime $*$ time_manager

  The time manager to be used to obtain timestamp information.
- DynBody $*$ dyn_parent

  The DynBody to which this body is attached.
- DynBodyGenericFrameAttachment frame_attach

  The RefFrame this body is attached to.
- std::list$<$ DynBody $*$ $>$ dyn_children

  The subset of the dynamic bodies attached to this dynamic body.
- std::list$<$ MassBody $*$ $>$ mass_children

  The subset of the mass bodies attached to this dynamic body that are themselves not dynamic bodies.
- std::list$<$ BodyRefFrame $*$ $>$ vehicle_points

  An array of vehicle points associated with this dynamic body.
- RefFrameItems initialized_states

  Enum value indicating which of position, velocity, attitude, and rate have been initialized.
- BodyRefFrame $*$ position_source

  The reference frame that contains the user-set position.
- BodyRefFrame $*$ velocity_source

  The reference frame that contains the user-set velocity.
- BodyRefFrame $*$ attitude_source

  The reference frame that contains the user-set attitude.
- BodyRefFrame $*$ rate_source

  The reference frame that contains the user-set attitude rate.

- BodyRefFrame ∗ integrated_frame

  The reference frame whose state is updated via the state integrator.
- std::vector
  < er7_utils::IntegrableObject ∗ > associated_integrable_objects

  List of integrable objects to be integrated with this DynBody.
- er7_utils::IntegratorResultMergerContainer integ_results_merger

  The object that merges integration results.
- RestartableT3SecondOrderODEIntegrator trans_integrator

  Translational state checkpointable/restartable integrator generator.
- RestartableSO3SecondOrderODEIntegrator rot_integrator

  Rotational state checkpointable/restartable integrator generator.

Private Member Functions

- DynBody (const DynBody &)

  Not implemented.
- DynBody & operator= (const DynBody &)

  Not implemented.

Friends

- class InputProcessor
- void init_attrjeod__DynBody ()

8.8.1 Detailed Description

Class DynBody is the base class for all dynamic bodies.

A DynBody is a MassBody that is connected to the outside world. These connections are in the form of three reference frames tied to the body – the structural, core body, and composite body frames.

For a non-root body, the states for each of these frames is calculated based on the parent body's state and on the body attachment.

For a root body, one of these three frames must be integrated. The details of how that integration is performed is the subject of classes that derive from DynBody.

Definition at line 113 of file dyn_body.hh.

8.8.2 Constructor & Destructor Documentation

8.8.2.1 jeod::DynBody::DynBody ( )

DynBody default constructor.

Definition at line 63 of file dyn_body.cc.

References composite_body, core_body, initialized_states, integrated_frame, mass, jeod::BodyRefFrame::mass_-point, rot_integrator, structure, and trans_integrator.

8.8.2.2 jeod::DynBody::∼DynBody ( ) [override]

DynBody destructor.

Definition at line 113 of file dyn_body.cc.

References composite_body, core_body, detach(), dyn_children, dyn_manager, dyn_parent, mass_children, remove_mass_body(), rot_integrator, structure, trans_integrator, and vehicle_points.

8.8.2.3 jeod::DynBody::DynBody (const DynBody &) [private]

Not implemented.

8.8.3 Member Function Documentation

8.8.3.1 void jeod::DynBody::activate ( ) [inline]

Activate a DynBody object.

The current implementation does nothing. DynBody objects are always active.

Definition at line 151 of file dyn_body.hh.

8.8.3.2 void jeod::DynBody::add_control (GravityControls * *control*) [virtual]

Add a new GravityControls to the list in grav_interaction.

Parameters

in	*control*	Control to be added

Definition at line 222 of file dyn_body.cc.

References grav_interaction.

8.8.3.3 void jeod::DynBody::add_integrable_object (er7_utils::IntegrableObject & *associated_integrable_object*)

Add an IntegrableObject to be integrated with this DynBody.

Note that the associated IntegrableObject may or may not follow this DynBody if it is moved to a new integration group/loop.

Parameters

in	*associated_integrable_object*	The IntegrableObject to be associated with this DynBody.

Definition at line 290 of file dyn_body.cc.

References associated_integrable_objects.

8.8.3.4 bool jeod::DynBody::add_mass_body (const char * *this_point_name,* const char * *child_point_name,* MassBody & *child*) [virtual]

Definition at line 592 of file dyn_body_attach.cc.

References find_vehicle_point(), jeod::DynBodyMessages::invalid_attachment, mass, and jeod::BodyRefFrame::mass_point.

8.8.3.5 bool jeod::DynBody::add_mass_body (const double *offset[3],* const double *T_pstr_cstr[3][3],* MassBody & *child*) [virtual]

Definition at line 716 of file dyn_body_attach.cc.

References add_mass_body_frames(), add_mass_body_validate(), mass, mass_children, and name.

8.8.3.6 void jeod::DynBody::add_mass_body_frames (MassBody & *subbody*) [protected], [virtual]

For a newly attached mass sub-body, create body frames for the root sub-body and all child sub-bodies via recursion.

Returns

Validity indicator

Parameters

in	*subbody*	the root of the newly attached sub-bodies

Definition at line 803 of file dyn_body_attach.cc.

References dyn_manager, integ_frame, jeod::BodyRefFrame::mass_point, name, and vehicle_points.

Referenced by add_mass_body().

8.8.3.7 bool jeod::DynBody::add_mass_body_validate (const MassBody & *child,* bool *generate_message*) const [protected], [virtual]

Validate whether the pending sub body is legal from a mass tree point of view.

Note

Assumptions and Limitations

- The subject mass, child, must not belong to a child body.

Returns

Validity indicator

Parameters

in	*child*	The child body; the body to be attached to this body.
in	*generate_-message*	Generate message if invalid?

Definition at line 185 of file dyn_body_attach.cc.

References dyn_manager, and name.

Referenced by add_mass_body().

8.8.3.8 void jeod::DynBody::add_mass_point (const MassPointInit & *mass_point_init*) [virtual]

Add a mass point to the dyn body's list of such and make a vehicle point that corresponds to the added mass point.

Parameters

in	*mass_point_init*	Mass point specification

Definition at line 53 of file dyn_body_vehicle_point.cc.

References dyn_manager, integ_frame, jeod::DynBodyMessages::invalid_body, mass, jeod::BodyRefFrame::mass-_point, name, and vehicle_points.

8.8.3.9 bool jeod::DynBody::attach_child (const char ∗ *this_point_name,* const char ∗ *child_point_name,* DynBody & *child*) [virtual]

Attach a child DynBody by point specification.

See corresponding DynBody::attach_to() method for more information.

Definition at line 373 of file dyn_body_attach.cc.

References find_vehicle_point(), jeod::DynBodyMessages::invalid_attachment, mass, and jeod::BodyRefFrame::mass_point.

Referenced by attach_to().

8.8.3.10 bool jeod::DynBody::attach_child (const double *xyz_cstr_wrt_pstr[3],* const double *T_pstr_to_cstr[3][3],* DynBody & *child*) [virtual]

Attach a child DynBody by location specification.

See corresponding DynBody::attach_to() method for more information. Note that the offset and transformation are specified w.r.t. the parent in both attach_to() and attach_child()

Definition at line 511 of file dyn_body_attach.cc.

References attach_establish_links(), attach_update_properties(), attach_validate_child(), attach_validate_parent(), get_root_body_internal(), mass, and name.

8.8.3.11 void jeod::DynBody::attach_establish_links (DynBody & *parent*) [protected], [virtual]

Establish the logical connectivity between parent and child.

Extensibility comments –

- This method is invoked before the computing the physical relation between parent and child.
- The generic purpose of this method is to establish the logical connectivity between parent and child in terms of the child class.
- Any class that overrides this method must either invoke this method or perform the actions performed herein.

Note

Assumptions and Limitations

- The attachment is valid; not checked.

Parameters

in,out	*parent*	The new parent body; the body to which this body is to be attached.

Definition at line 845 of file dyn_body_attach.cc.

References dyn_children, dyn_parent, integ_frame, mass, and set_integ_frame().

Referenced by attach_child().

8.8.3.12 bool jeod::DynBody::attach_to (const char ∗ *this_point_name,* const char ∗ *parent_point_name,* DynBody & *parent*) [virtual]

Attach this dyn body's root body as a child of the specified dyn body such that the specified mass points on the two bodies are coincident and the frames associated with those mass points are related by a 180 degree yaw.

Returns

Success indicator: true=success, false=attachment not performed.

Parameters

in	*this_point_name*	The name of a mass point contained in this dyn body's list of mass points.
in	*parent_point_-name*	The name of a mass point contained in the parent body's list of mass points.
in,out	*parent*	The parent body; the body to which this body's root body is to be attached.

Definition at line 238 of file dyn_body_attach.cc.

References attach_child().

8.8.3.13 bool jeod::DynBody::attach_to (const double *offset_pstr_cstr_pstr[3],* const double *T_pstr_cstr[3][3],* DynBody & *parent*) [virtual]

Attach this dyn body's root body as a child of the specified dyn body such that this body's structural origin is offset from the parent body's structural origin and this body's structural axes are oriented with respect to the parent body's structural axes as specified.

Returns

Success indicator: true=success, false=attachment not performed.

Parameters

in	*offset_pstr_cstr-_pstr*	Location of this body's structural origin with respect to the new parent body's structural origin, specified in structural coordinates of the parent body. Units: M
in	*T_pstr_cstr*	Transformation matrix from the parent body's structural frame to this body's structural frame.
in,out	*parent*	The parent body; the body to which this body's root body is to be attached.

Definition at line 257 of file dyn_body_attach.cc.

References attach_child().

8.8.3.14 bool jeod::DynBody::attach_to_frame (const char * *parent_ref_frame_name*) [virtual]

Definition at line 267 of file dyn_body_attach.cc.

References dyn_manager, jeod::DynBodyMessages::invalid_attachment, and mass.

8.8.3.15 bool jeod::DynBody::attach_to_frame (RefFrame & *parent*) [virtual]

Definition at line 287 of file dyn_body_attach.cc.

References frame_attach, get_root_body_internal(), jeod::DynBodyGenericFrameAttachment::initialize_attachment(), and structure.

8.8.3.16 bool jeod::DynBody::attach_to_frame (const char * *this_point_name,* const char * *parent_ref_frame_name,* const double *offset_pframe_cpt_pframe[3],* const double *T_pframe_cpt[3][3]*) [virtual]

Definition at line 296 of file dyn_body_attach.cc.

References dyn_manager, find_vehicle_point(), frame_attach, get_root_body_internal(), jeod::DynBodyGenericFrameAttachment::initialize_attachment(), jeod::DynBodyMessages::invalid_attachment, mass, jeod::BodyRefFrame::mass_point, and structure.

8.8.3.17 bool jeod::DynBody::attach_to_frame (const double *offset_pframe_cstr_pframe[3],* const double *T_pframe_cstr[3][3],* RefFrame & *parent*) [virtual]

Definition at line 355 of file dyn_body_attach.cc.

References frame_attach, get_root_body_internal(), and jeod::DynBodyGenericFrameAttachment::initialize_attachment().

8.8.3.18 void jeod::DynBody::attach_update_properties (const double *offset_pstr_cstr_pstr[3],* const double *T_pstr_cstr[3][3],* DynBody & *child*) [protected], [virtual]

Set the relation between parent and child and update the mass properties.

Extensibility comments –

- This method is sent to the parent body of the attachment after the child body has established the logical connectivity between the parent body and child body.
- The generic purpose of this method is to establish the physical relation between parent and child and to update any physical properties that change as a result of the attachment.
- Any class that overrides this method must either invoke this method or perform the actions performed herein.

Note

Assumptions and Limitations

- The attachment is valid
- Logical connectivity has been established.

Neither assumption is checked.

Parameters

in	*offset_pstr_cstr_pstr*	Location of this body's structural origin with respect to the new parent body's structural origin, specified in structural coordinates of the new parent body. Units: m
in	*T_pstr_cstr*	Transformation matrix from the new parent body's structural frame to this body's structural frame.
in,out	*child*	The child body; the body newly attached to this body.

Reimplemented in jeod::StructureIntegratedDynBody.

Definition at line 871 of file dyn_body_attach.cc.

References get_dynamics_integration_group(), get_root_body_internal(), initialized_states, mass, process_dynamic_attachment(), propagate_state(), set_state_source_internal(), and structure.

Referenced by attach_child(), and jeod::StructureIntegratedDynBody::attach_update_properties().

8.8.3.19 bool jeod::DynBody::attach_validate_child (const DynBody & *child,* bool *generate_message*) const [protected], [virtual]

Validate whether the pending attachment is legal from a physical point of view.

Extensibility comments –

- This method determines whether invoking attach_update_properties makes sense.

Note

Assumptions and Limitations

- The subject body, child, must be a root body. This is not checked.

Returns

Validity indicator

Parameters

in	*child*	The child body; the body to be attached to this body.
in	*generate_message*	Generate message if invalid?

Definition at line 110 of file dyn_body_attach.cc.

References get_root_body(), initialized_states, jeod::DynBodyMessages::invalid_attachment, and name.

Referenced by attach_child().

8.8.3.20 bool jeod::DynBody::attach_validate_parent (const DynBody & *parent,* bool *generate_message*) const [protected], [virtual]

Validate whether the pending attachment is legal from a connectivity point of view.

Extensibility comments –

- This method determines whether invoking attach_establish_links makes sense.
- Any class that overrides this method must either invoke this method or perform the actions performed herein.

Note

Assumptions and Limitations:

- The subject body, this, must be a root body. This is not checked.

Returns

Validity indicator

Parameters

in	*parent*	The new parent body; the body to which this body is to be attached.
in	*generate_message*	Generate message if invalid?

Definition at line 58 of file dyn_body_attach.cc.

References dyn_manager, get_root_body(), jeod::DynBodyMessages::invalid_attachment, jeod::DynBodyMessages::invalid_body, name, and jeod::DynBodyMessages::not_dyn_body.

Referenced by attach_child().

8.8.3.21 void jeod::DynBody::clear_integrable_objects ( )

Remove all IntegrableObjects associated with this DynBody.

You might do this if you want to switch the DynBody to a new group without switching the associated IntegrableObjects.

Definition at line 330 of file dyn_body.cc.

References associated_integrable_objects.

8.8.3.22 void jeod::DynBody::collect_forces_and_torques ( ) [virtual]

Collect forces and torques acting on the vehicle.

Reimplemented in jeod::StructureIntegratedDynBody.

Definition at line 98 of file dyn_body_collect.cc.

References jeod::accumulate_forces(), jeod::accumulate_torques(), collect, jeod::BodyForceCollect::collect_effector_forc, jeod::BodyForceCollect::collect_effector_torq, jeod::BodyForceCollect::collect_environ_forc, jeod::BodyForceCollect::collect_environ_torq, collect_forces_and_torques(), jeod::BodyForceCollect::collect_no_xmit_forc, jeod::BodyForceCollect::collect_no_xmit_torq, composite_body, compute_point_derivative, compute_vehicle_point_derivatives(), derivs, dyn_children, dyn_parent, jeod::BodyForceCollect::effector_forc, jeod::BodyForceCollect::effector_torq, jeod::BodyForceCollect::environ_forc, jeod::BodyForceCollect::environ_torq, jeod::BodyForceCollect::extern_forc_inrtl, jeod::BodyForceCollect::extern_forc_struct, jeod::BodyForceCollect::extern_torq_body, jeod::BodyForceCollect::extern_torq_struct, grav_interaction, jeod::BodyForceCollect::inertial_torq, mass, jeod::BodyForceCollect::no_xmit_forc, jeod::BodyForceCollect::no_xmit_torq, jeod::FrameDerivs::non_grav_accel, jeod::FrameDerivs::rot_accel, rotational_dynamics, structure, jeod::FrameDerivs::trans_accel, and translational_dynamics.

Referenced by collect_forces_and_torques().

8.8.3.23 void jeod::DynBody::compute_derived_state_forward (const BodyRefFrame & *source_frame,* const MassPoint & *rel_state,* BodyRefFrame & *derived_frame*) const [protected]

Compute a derived state given the source state and the position/ attitude transformation from the source to the derived state.

Parameters

in	*source_frame*	Source state
in	*rel_state*	Relative state
out	*derived_frame*	Derived state

Definition at line 160 of file dyn_body_propagate_state.cc.

References jeod::BodyRefFrame::initialized_items.

Referenced by compute_vehicle_point_states(), propagate_state_from_composite(), and propagate_state_from_structure().

8.8.3.24 void jeod::DynBody::compute_derived_state_reverse (const BodyRefFrame & *source_frame,* const MassPoint & *rel_state,* BodyRefFrame & *derived_frame*) const [protected]

Compute a derived state given the source state and the position/ attitude transformation from the derived to the source state.

Parameters

in	*source_frame*	Source state
in	*rel_state*	Relative state
out	*derived_frame*	Derived state

Definition at line 278 of file dyn_body_propagate_state.cc.

References jeod::BodyRefFrame::initialized_items.

Referenced by propagate_state_from_composite().

8.8.3.25 void jeod::DynBody::compute_ref_point_transform (const BodyRefFrame & *source_frame,* const MassPoint **const *ref_point,* MassPointState & *rel_state*) [protected]

Compute the relative state between the integrated frame's mass point and the source frame's mass point.

Note

Assumptions and Limitations

- This method is only called to be called for a root body. This assumption is not enforced.

Parameters

in	*source_frame*	The frame that contains the relevant state data.
in,out	*ref_point*	The mass point corresponding to the previous call to this function. This is an efficiency hack used to avoid duplicative computations.
in,out	*rel_state*	The relative state between the integration frame mass point and the source frame mass point.

Definition at line 51 of file dyn_body_propagate_state.cc.

References composite_body, core_body, integrated_frame, jeod::DynBodyMessages::invalid_frame, mass, jeod::-BodyRefFrame::mass_point, name, and structure.

Referenced by update_integrated_state().

8.8.3.26 void jeod::DynBody::compute_state_elements_forward (const BodyRefFrame & *source_frame,* const MassPoint & *rel_state,* const RefFrameItems & *state_items,* BodyRefFrame & *derived_frame*) const [protected]

Compute selected aspects of the derived state given the source state and the position/ attitude transformation from the source to the derived state.

Parameters

in	*source_frame*	Source state
in	*rel_state*	Relative state
in	*state_items*	States to compute
out	*derived_frame*	Derived state

Definition at line 215 of file dyn_body_propagate_state.cc.

References jeod::BodyRefFrame::initialized_items.

Referenced by compute_vehicle_point_states(), propagate_state_from_composite(), and propagate_state_from_-structure().

8.8.3.27 void jeod::DynBody::compute_state_elements_reverse (const BodyRefFrame & *source_frame,* const MassPoint & *rel_state,* const RefFrameItems & *state_items,* BodyRefFrame & *derived_frame*) const [protected]

Compute selected aspects of the derived state given the source state and the position/ attitude transformation from the derived to the source state.

Parameters

in	*source_frame*	Source state
in	*rel_state*	Relative state
in	*state_items*	States to compute
out	*derived_frame*	Derived state

Definition at line 333 of file dyn_body_propagate_state.cc.

References jeod::BodyRefFrame::initialized_items.

Referenced by propagate_state_from_composite().

8.8.3.28 void jeod::DynBody::compute_vehicle_point_derivatives (const BodyRefFrame & *vehicle_pt,* FrameDerivs & *pt_derivs*) [virtual]

Compute the state derivatives at a vehicle point.

Parameters

in	*vehicle_pt*	Vehicle point reference frame
out	*pt_derivs*	Computed derivatives

Reimplemented in jeod::StructureIntegratedDynBody.

Definition at line 129 of file dyn_body_vehicle_point.cc.

References composite_body, derivs, get_root_body(), grav_interaction, jeod::DynBodyMessages::invalid_frame, mass, jeod::BodyRefFrame::mass_point, name, jeod::FrameDerivs::non_grav_accel, jeod::FrameDerivs::Qdot_parent_this, jeod::FrameDerivs::rot_accel, and jeod::FrameDerivs::trans_accel.

Referenced by collect_forces_and_torques().

8.8.3.29 void jeod::DynBody::compute_vehicle_point_states (RefFrameItems::Items *set_items*) [virtual]

Propagate structure frame state to vehicle points.

Parameters

in	*set_items*	States truly propagated

Definition at line 789 of file dyn_body_propagate_state.cc.

References compute_derived_state_forward(), compute_state_elements_forward(), jeod::BodyRefFrame::mass_point, structure, and vehicle_points.

Referenced by propagate_state_from_composite(), and propagate_state_from_structure().

8.8.3.30 void jeod::DynBody::create_body_integrators (const er7_utils::IntegratorConstructor & *generator,* er7_utils::IntegrationControls & *controls,* const JeodIntegrationTime & *time_mngr*) [virtual]

Create the integrator (integrators) needed to propagate the translational and rotational state of a DynBody.

Create the translational and rotational integrators for a DynBody.

Parameters

in	*generator*	Integrator constructor to be used to create state integrators.
in	*controls*	The integration ontrols created the integrator constructor's create_integration_controls method.
in	*time_mngr*	The JEOD time manager object.

A DynBody integrates forces and torques in the body frame and forces induced by changes in mass properties.

Parameters

in	*generator*	Integrator constructor to be used to create state integrators.
in	*controls*	The integration ontrols created the integrator constructor's create_integration_controls method.
in	*time_mngr*	The JEOD time manager object.

Definition at line 219 of file dyn_body_integration.cc.

References integ_results_merger, name, rot_integrator, rotation_integration, three_dof, time_manager, and trans_integrator.

Referenced by create_integrators().

8.8.3.31 void jeod::DynBody::create_integrators (const er7_utils::IntegratorConstructor & *generator,* er7_utils::IntegrationControls & *controls,* const er7_utils::TimeInterface & *time_if*) [override]

This interface is required by er7_utils::IntegrableObject.

It should not be used. Use DynBody::create_body_integrators instead.

Parameters

in	*generator*	Unused.
in	*controls*	Unused.
in	*time_if*	Unused.

Definition at line 259 of file dyn_body_integration.cc.

References create_body_integrators(), and jeod::DynBodyMessages::internal_error.

8.8.3.32 void jeod::DynBody::deactivate ( ) [inline]

Deactivate a DynBody object.

The current implementation does nothing. DynBody objects are always active.

Definition at line 159 of file dyn_body.hh.

8.8.3.33 void jeod::DynBody::destroy_integrators (void) [override]

Destroy the integrators.

Does nothing, but must be implemented to complete abstract function from the inherited IntegrableObject

Definition at line 285 of file dyn_body_integration.cc.

8.8.3.34 bool jeod::DynBody::detach (DynBody & *other_body*) [virtual]

Detach parent and child DynBodies, 'this' and the argument body, such that the detachment happens at the parent body level.

Returns true if successfully detached the bodies. Returns false if unable to detach. Will fail if, for example, the bodies are not in the same mass tree.

Assumptions and Limitations

- The detach point between non-immediate attachments (i.e. not parent/child attachments) takes place at whichever body is a progenitor. For example, a call to A.detach(D) in an A->B->C->D attachment is interpreted as a call desiring A // B->C->D. A call to D.detach(B) is interpreted as a call to A->B // C->D.

Returns

Success flag

Parameters

in	*other_body*	The other body at which the detach will occur

Reimplemented in jeod::StructureIntegratedDynBody.

Definition at line 50 of file dyn_body_detach.cc.

References detach_mass_internal(), dyn_children, dyn_parent, jeod::DynBodyMessages::invalid_attachment, mass, and name.

Referenced by ∼DynBody().

8.8.3.35 bool jeod::DynBody::detach (void) [virtual]

Detach this DynBody from its parent RefFrame or DynBody parent.

If detaching from a DynBody, evoking this method is the equivalent to the above function via detach(∗dyn_parent)

Assumptions and Limitations

- Will inform and return false if the body has no parent.

Returns

Success flag

Definition at line 138 of file dyn_body_detach.cc.

References jeod::DynBodyGenericFrameAttachment::clear_attachment(), dyn_parent, frame_attach, jeod::DynBodyMessages::invalid_technique, jeod::DynBodyGenericFrameAttachment::isAttached(), and name.

Referenced by jeod::StructureIntegratedDynBody::detach(), remove_mass_body(), and ∼DynBody().

8.8.3.36 void jeod::DynBody::detach_mass_body_frames (MassBody & *subbody*) [protected], [virtual]

For a newly detached mass sub-body, remove body frames for the root sub-body and all child sub-bodies via recursion.

Returns

Validity indicator

Parameters

in	*subbody*	the root of the newly attached sub-bodies

Definition at line 239 of file dyn_body_detach.cc.

References dyn_manager, find_body_frame(), and vehicle_points.

Referenced by remove_mass_body().

8.8.3.37 void jeod::DynBody::detach_mass_internal (MassBody & *child*) [protected], [virtual]

Update parent and child properties to reflect that they are detached.

Extensibility comments –

- This method is sent to the parent body of the detachment after the child body has severed the logical connectivity between the parent body and child body.
- The generic purpose of this method is to update any physical properties that change as a result of the detachment.
- Any class that overrides this method must either invoke this method or perform the actions performed herein.

Note

Assumptions and Limitations

- The detachment is valid and logical connectivity has been severed. Neither assumption is checked.

Parameters

in,out	*child*	The child body; the body newly detached from this body.

Definition at line 285 of file dyn_body_detach.cc.

References core_body, get_root_body_internal(), mass, propagate_state(), and set_state_source_internal().

Referenced by detach(), and remove_mass_body().

8.8.3.38 BodyRefFrame * jeod::DynBody::find_body_frame (const char * *frame_id*) const [virtual]

Find the BodyRefFrame named by the provided identifier.

The name of a BodyRefFrame must be prefixed by the body name. The provided identifier can include or exclude this prefix. The body name is used as the prefix if the the provided name does not start with the body name.

Note

Assumptions and Limitations

- Limitation: Provided identifier must be non-NULL and non-empty. Failure to comply is a fatal error.
- Limitation: The found frame must be a BodyRefFrame. Finding a non-BodyRefFrame that matches the name is a fatal error.
- Assumption: Failure to find a frame is not an error. The method returns NULL if this is the case.

Returns

Found frame

Parameters

in	*frame_id*	Frame ID suffix

Definition at line 50 of file dyn_body_find_body_frame.cc.

References dyn_manager, jeod::DynBodyMessages::invalid_name, and name.

Referenced by detach_mass_body_frames().

8.8.3.39 const BodyRefFrame * jeod::DynBody::find_vehicle_point (const char * *pt_name*) const

Find the vehicle point with the given name.

Returns

Vehicle point

Parameters

in	*pt_name*	Vehicle point name

Definition at line 101 of file dyn_body_vehicle_point.cc.

References name, and vehicle_points.

Referenced by add_mass_body(), attach_child(), and attach_to_frame().

8.8.3.40 DynamicsIntegrationGroup * jeod::DynBody::get_dynamics_integration_group ( )

Get the DynamicsIntegrationGroup that integrates this DynBody object.

Returns

Pointer to the DynamicsIntegrationGroup of this DynBody.

Definition at line 261 of file dyn_body.cc.

References jeod::DynBodyMessages::internal_error.

Referenced by attach_update_properties(), and set_integ_frame().

8.8.3.41 const RefFrameItems& jeod::DynBody::get_initialized_states ( ) const [inline]

Indicate which state elements have been initialized.

Returns

Initialized states indicator.

Definition at line 528 of file dyn_body.hh.

References initialized_states.

8.8.3.42 JeodPointerVector<er7_utils::IntegrableObject>::type jeod::DynBody::get_integrable_objects ( ) [inline]

Get the IntegrableObjects associated with this DynBody.

Returns

A pointer to a JeodPointerVector containing the associated integrable objects.

Definition at line 308 of file dyn_body.hh.

References associated_integrable_objects.

8.8.3.43 const DynBody ∗ jeod::DynBody::get_parent_body ( ) const [virtual]

Returns this DynBody object's parent body.

Returns

Const pointer to the parent body.

Definition at line 177 of file dyn_body.cc.

References dyn_parent.

Referenced by jeod::StructureIntegratedDynBody::detach().

8.8.3.44 DynBody ∗ jeod::DynBody::get_parent_body_internal ( ) [protected], [virtual]

Returns this DynBody object's parent body.

Returns

Pointer to parent body.

Definition at line 186 of file dyn_body.cc.

References dyn_parent.

8.8.3.45 const DynBody ∗ jeod::DynBody::get_root_body ( ) const [virtual]

Finds this DynBody object's root body.

Returns

Const pointer to the root body.

Definition at line 194 of file dyn_body.cc.

Referenced by attach_validate_child(), attach_validate_parent(), jeod::StructureIntegratedDynBody::compute_vehicle_point_derivatives(), compute_vehicle_point_derivatives(), and set_state_source().

8.8.3.46 DynBody * jeod::DynBody::get_root_body_internal ( ) [protected], [virtual]

Finds this DynBody object's root body.

Returns

Pointer to the root body.

Definition at line 205 of file dyn_body.cc.

References dyn_parent.

Referenced by attach_child(), attach_to_frame(), attach_update_properties(), detach_mass_internal(), set_attitude_left_quaternion(), set_attitude_matrix(), set_attitude_rate(), set_attitude_right_quaternion(), set_position(), set_state(), set_state_source(), set_velocity(), and update_integrated_state().

8.8.3.47 void jeod::DynBody::initialize_controls (GravityManager & *grav_manager*) [virtual]

Initialize the gravity controls of this DynBody.

Note

Initialization phasing:
The following must have been called prior to calling this method:

- GravityManager::initialize_model to register the GravityManager object with the dynamics manager.
- GravityManager::add_grav_source to register the pertinent GravitySource objects with the Gravity Manager.
- Planet::register_model to associate the planet with a GravitySource.

Parameters

in	*grav_manager*	Reference to Gravity Manager

Definition at line 232 of file dyn_body.cc.

References dyn_manager, and grav_interaction.

8.8.3.48 void jeod::DynBody::initialize_model (BaseDynManager & *dyn_manager_in*) [virtual]

Initialize internal and external interrelations, including registration / with the dynamics manager.

Parameters

in,out	*dyn_manager_in*	Dynamics manager

Definition at line 45 of file dyn_body_initialize_model.cc.

References composite_body, core_body, dyn_manager, initialized_states, integ_frame, integ_frame_name, jeod::DynBodyMessages::invalid_frame, jeod::DynBodyMessages::invalid_name, mass, name, set_integ_frame(), and structure.

8.8.3.49 bool jeod::DynBody::initialized_states_contains (RefFrameItems::Items *test_items*) const [inline]

Indicate whether the specified state elements have been initialized.

Parameters

test_items	States to test.

Returns

True if all test items have been initialized, false otherwise.

Definition at line 538 of file dyn_body.hh.

References initialized_states.

8.8.3.50 er7_utils::IntegratorResult jeod::DynBody::integrate (double *dyn_dt,* unsigned int *target_stage*) [override]

Integrate state by the specified dynamic time interval.

Integrate the translational and rotational state and propagate the integrated state to derived states.

Parameters

in	*dyn_dt*	Dynamic time step, in dynamic time seconds.
in	*target_stage*	The stage of the integration process that the integrator should try to attain.

Returns

The status (time advance, pass/fail status) of the integration.

Definition at line 316 of file dyn_body_integration.cc.

References frame_attach, jeod::DynBodyGenericFrameAttachment::get_attach_offset(), jeod::DynBodyGenericFrameAttachment::get_parent_frame(), initialized_states, integ_frame, integ_results_merger, jeod::DynBodyGenericFrameAttachment::isAttached(), propagate_state(), rot_integ(), rotational_dynamics, set_state(), structure, trans_integ(), and translational_dynamics.

8.8.3.51 bool jeod::DynBody::is_root_body ( )

Indicates whether this DynBody object is a root body.

Returns

Is this a root body?

Definition at line 169 of file dyn_body.cc.

References dyn_parent.

8.8.3.52 void jeod::DynBody::migrate_integrable_objects (void)

Call this method before switching this dyn body to a new group if you want the associated integrable objects to follow.

Definition at line 337 of file dyn_body.cc.

References associated_integrable_objects, jeod::DynBodyMessages::invalid_group, and name.

8.8.3.53 DynBody& jeod::DynBody::operator= (const DynBody &) [private]

Not implemented.

8.8.3.54 void jeod::DynBody::process_dynamic_attachment (const double *offset_pstr_cstr_pstr[3],* const double *T_pstr_cstr[3][3],* DynBody & *root_body,* DynBody & *child_body*) [protected], [virtual]

Process the attachment event of one body from another.

This method is called by the attach method after the links have established or severed and is invoked twice:

- On the parent, in which case the parent argument is null and the child argument is the child that attached from the parent, and
- On the detaching child, in which case the child argument is null and the parent argument is the body from which the child was detached.

Note

Assumptions and Limitations:

- Instances of more derived classes, with presumably more involved dynamics, are situated higher in the mass tree than are more basic instances. For example, a simple MassBody can be a child of a DynBody, but not the other way around.
- The attachment in the mass tree between the immediate child and the superior body is assumed to reflect a real physical attachment.

Parameters

in	*offset_pstr_cstr-_pstr*	Location of this body's structural origin with respect to the new parent body's structural origin, specified in structural coordinates of the new parent body. Units: m
in	*T_pstr_cstr*	Transformation matrix from the new parent body's structural frame to this body's structural frame.
in,out	*root_body*	Body at the root of the mass tree
in,out	*child_body*	Body that is being attached to this body.

Definition at line 953 of file dyn_body_attach.cc.

References composite_body, core_body, mass, propagate_state(), set_state_source_internal(), and structure.

Referenced by attach_update_properties().

8.8.3.55 void jeod::DynBody::propagate_state ( ) [virtual]

Propagate state from the integrated state to attached bodies.

Definition at line 574 of file dyn_body_propagate_state.cc.

References composite_body, dyn_parent, initialized_states, integrated_frame, jeod::DynBodyMessages::invalid_-frame, name, propagate_state(), propagate_state_from_composite(), propagate_state_from_structure(), structure, and update_integrated_state().

Referenced by attach_update_properties(), detach_mass_internal(), integrate(), process_dynamic_attachment(), propagate_state(), and switch_integration_frames().

8.8.3.56 void jeod::DynBody::propagate_state_from_composite ( ) [protected], [virtual]

Propagate state to attached bodies starting from this body's composite frame.

Note

Assumptions and Limitations

- At least some states are set.

Definition at line 700 of file dyn_body_propagate_state.cc.

References autoupdate_vehicle_points, composite_body, compute_derived_state_forward(), compute_derived_state_reverse(), compute_state_elements_forward(), compute_state_elements_reverse(), compute_vehicle_point_states(), core_body, dyn_children, jeod::BodyRefFrame::initialized_items, initialized_states, mass, propagate_state_from_composite(), propagate_state_from_structure(), and structure.

Referenced by propagate_state(), and propagate_state_from_composite().

8.8.3.57 void jeod::DynBody::propagate_state_from_structure ( ) [protected], [virtual]

Propagate state to attached bodies starting from this body's structural frame.

Note

Assumptions and Limitations

- At least some states are set.

Definition at line 608 of file dyn_body_propagate_state.cc.

References autoupdate_vehicle_points, composite_body, compute_derived_state_forward(), compute_state_elements_forward(), compute_vehicle_point_states(), core_body, dyn_children, jeod::BodyRefFrame::initialized_items, initialized_states, mass, propagate_state_from_structure(), and structure.

Referenced by propagate_state(), propagate_state_from_composite(), and propagate_state_from_structure().

8.8.3.58 void jeod::DynBody::remove_integrable_object (er7_utils::IntegrableObject & *associated_integrable_object*)

Remove an IntegrableObject from association with this DynBody.

Parameters

in	*associated_integrable_object*	The IntegrableObject to be associated with this DynBody.

Definition at line 309 of file dyn_body.cc.

References associated_integrable_objects.

8.8.3.59 bool jeod::DynBody::remove_mass_body (MassBody & *child*) [virtual]

Remove connectivity between this (parent) DynBody and the argument (child) MassBody mass subbody.

The MassBody and associated body frames are removed, such that the MassBody effectively "jettisons" from dynamics operations.

Extensibility comments –

- This method is invoked before the updating the parent/child states.
- The generic purpose of this method is to sever all connectivity links between parent and child, most importantly mass properties.
- Any class that overrides this method must either invoke this method or perform the actions performed herein.

Note

Assumptions and Limitations

- The detachment must be valid or it is not performed. The MassBody must not belong to a DynBody-derived dynamic body.

Parameters

in,out	*child*	The child mass subbody; the body to be detached

Definition at line 166 of file dyn_body_detach.cc.

References detach(), detach_mass_body_frames(), detach_mass_internal(), jeod::DynBodyMessages::invalid_technique, mass, mass_children, and name.

Referenced by ∼DynBody().

8.8.3.60 void jeod::DynBody::reset_controls ( ) [virtual]

Make the frame subscriptions for each control consistent with the requirements for that control.

Definition at line 243 of file dyn_body.cc.

References dyn_manager, and grav_interaction.

8.8.3.61 void jeod::DynBody::reset_integrators (void) [override]

Reset the translational and rotational integrators.

Definition at line 295 of file dyn_body_integration.cc.

References rot_integrator, rotational_dynamics, trans_integrator, and translational_dynamics.

8.8.3.62 er7_utils::IntegratorResult jeod::DynBody::rot_integ (double *dyn_dt*, unsigned int *target_stage*) [protected], [virtual]

Integrate the vehicle's rotational state.

Integrate the rotational state of a DynBody.

Parameters

in	*target_stage*	The stage of the integration process that the integrator should try to attain.

Returns

The status (time advance, pass/fail status) of the integration.

Parameters

in	*dyn_dt*	Dynamic time step, in dynamic time seconds.
in	*target_stage*	The stage of the integration process that the integrator should try to attain.

Returns

The status (time advance, pass/fail status) of the integration.

Reimplemented in jeod::StructureIntegratedDynBody.

Definition at line 388 of file dyn_body_integration.cc.

References composite_body, derivs, jeod::FrameDerivs::Qdot_parent_this, jeod::FrameDerivs::rot_accel, and rot_integrator.

Referenced by integrate().

8.8.3.63 void jeod::DynBody::set_attitude_left_quaternion (const Quaternion & *left_quat*, BodyRefFrame & *subject_frame*)

Set the attitude of the vehicle.

Note

Assumptions and Limitations

- Provided quaternion is a unit quaternion.

Parameters

in	*left_quat*	Attitude wrt integ frame
out	*subject_frame*	Frame to update

Definition at line 218 of file dyn_body_set_state.cc.

References jeod::check_frame_ownership(), get_root_body_internal(), and set_state_source_internal().

8.8.3.64 void jeod::DynBody::set_attitude_matrix (const double *matrix[3][3],* BodyRefFrame & *subject_frame*)

Set the attitude of the vehicle.

Note

Assumptions and Limitations

- Provided matrix is orthogonal.

Parameters

in	*matrix*	Attitude wrt integ frame
out	*subject_frame*	Frame to update

Definition at line 256 of file dyn_body_set_state.cc.

References jeod::check_frame_ownership(), get_root_body_internal(), and set_state_source_internal().

8.8.3.65 void jeod::DynBody::set_attitude_rate (const double *attitude_rate[3],* BodyRefFrame & *subject_frame*)

Set the attitude rate of the vehicle.

Note

Assumptions and Limitations

- Provided vector is expressed in body frame coordinates.

Parameters

in	*attitude_rate*	Attitude wrt integ frame Units: r/s
out	*subject_frame*	Frame to update

Definition at line 275 of file dyn_body_set_state.cc.

References jeod::check_frame_ownership(), get_root_body_internal(), and set_state_source_internal().

8.8.3.66 void jeod::DynBody::set_attitude_right_quaternion (const Quaternion & *right_quat,* BodyRefFrame & *subject_frame*)

Set the attitude of the vehicle.

Note

Assumptions and Limitations

- Provided quaternion is a unit quaternion.

Parameters

in	*right_quat*	Attitude wrt integ frame
out	*subject_frame*	Frame to update

Definition at line 237 of file dyn_body_set_state.cc.

References jeod::check_frame_ownership(), get_root_body_internal(), and set_state_source_internal().

8.8.3.67 void jeod::DynBody::set_integ_frame (EphemerisRefFrame & *new_integ_frame*) [protected], [virtual]

Set the integration frame for this body and all its child bodies to the provided frame.

Note

Assumptions and Limitations

- Provided frame is a valid integration frame.

Parameters

in	*new_integ_frame*	New integration frame

Definition at line 60 of file dyn_body_integration.cc.

References composite_body, core_body, dyn_children, dyn_manager, get_dynamics_integration_group(), grav_interaction, integ_frame, set_integ_frame(), structure, and vehicle_points.

Referenced by attach_establish_links(), initialize_model(), set_integ_frame(), and switch_integration_frames().

8.8.3.68 void jeod::DynBody::set_integ_frame (const char * *new_integ_frame_name*) [protected], [virtual]

Set the integration frame for this body and all its child bodies to the frame indicated by the provided name.

Note

Assumptions and Limitations

- Assumption: Provided string is a non-NULL, non-empty string.
- Assumption: State is not to be updated.
- Limitation: Assocated frame must be a valid integration frame.

Parameters

in	*new_integ_frame_name*	New integration frame

Definition at line 127 of file dyn_body_integration.cc.

References dyn_manager, jeod::DynBodyMessages::invalid_name, name, and set_integ_frame().

8.8.3.69 void jeod::DynBody::set_name (const std::string & *name_in*)

Set the name of the vehicle.

Parameters

in	*name_in*	Name of this body

Definition at line 161 of file dyn_body.cc.

References mass.

8.8.3.70 void jeod::DynBody::set_position (const double *position[3],* BodyRefFrame & *subject_frame*)

Set the position of the vehicle.

Parameters

in	*position*	Position wrt integ frame Units: M
out	*subject_frame*	Frame to update

Definition at line 184 of file dyn_body_set_state.cc.

References jeod::check_frame_ownership(), get_root_body_internal(), and set_state_source_internal().

8.8.3.71 void jeod::DynBody::set_state (RefFrameItems::Items *set_items,* const RefFrameState & *state,* BodyRefFrame & *subject_frame*)

Set the parts of the specified reference frame as indicated by the set_items parameter from the supplied state and propagate these items to all dynamic bodies attached to this body.

This method forms an integral part of the state initialization process and can also be used by a simulation that that receives state overrides from some other simulation.

Note

Assumptions and Limitations

- The subject reference frame is owned by this dynamic body. This limitation is enforced.

Parameters

in	*set_items*	Items to set
in	*state*	State to be copied
out	*subject_frame*	Frame to be set

Definition at line 79 of file dyn_body_set_state.cc.

References jeod::check_frame_ownership(), get_root_body_internal(), and set_state_source_internal().

Referenced by integrate().

8.8.3.72 void jeod::DynBody::set_state_source (RefFrameItems::Items *items,* BodyRefFrame & *frame*)

Set the source of aspects of the state.

The setting is applied to the root of the DynBody tree.

Note

Assumptions and Limitations

- The supplied frame must either be owned directly by this body or this body must be a root body and the owner of the supplied frame must be a child body of this body.

Parameters

in	*items*	Items to propagate
in	*frame*	Frame containing state

Definition at line 132 of file dyn_body_set_state.cc.

References dyn_parent, get_root_body(), get_root_body_internal(), jeod::DynBodyMessages::invalid_frame, name, and set_state_source_internal().

8.8.3.73 void jeod::DynBody::set_state_source_internal (RefFrameItems::Items *items,* BodyRefFrame & *frame*) [protected]

Set the source of aspects of the state.

Note

Assumptions and Limitations

- Assumptions, neither of which is checked:
  - This is a root body.
  - The supplied frame is owned by a body that is a child of this body.

Parameters

in	*items*	Items to propagate
in	*frame*	Frame containing state

Definition at line 293 of file dyn_body_set_state.cc.

References attitude_source, jeod::BodyRefFrame::initialized_items, initialized_states, position_source, rate_source, and velocity_source.

Referenced by attach_update_properties(), detach_mass_internal(), process_dynamic_attachment(), set_attitude_left_quaternion(), set_attitude_matrix(), set_attitude_rate(), set_attitude_right_quaternion(), set_position(), set_state(), set_state_source(), and set_velocity().

8.8.3.74 void jeod::DynBody::set_velocity (const double *velocity[3],* BodyRefFrame & *subject_frame*)

Set the velocity of the vehicle.

Parameters

in	*velocity*	Velocity wrt integ frame Units: M/s
out	*subject_frame*	Frame to update

Definition at line 201 of file dyn_body_set_state.cc.

References jeod::check_frame_ownership(), get_root_body_internal(), and set_state_source_internal().

8.8.3.75 void jeod::DynBody::sort_controls ( ) [virtual]

Sort the gravity controls in ascending acceleration magnitude order.

Definition at line 252 of file dyn_body.cc.

References grav_interaction.

8.8.3.76 void jeod::DynBody::switch_integration_frames (EphemerisRefFrame & *new_integ_frame*) [virtual]

Switch the integration frame for this body and all its child bodies to the indicated frame.

Note

Assumptions and Limitations

- Limitation: Assocated frame must be a valid integration frame.

Parameters

in	*new_integ_frame*	New integration frame

Definition at line 148 of file dyn_body_integration.cc.

References dyn_manager, dyn_parent, integrated_frame, jeod::DynBodyMessages::invalid_frame, name, propagate_state(), set_integ_frame(), switch_integration_frames(), and update_integrated_state().

Referenced by switch_integration_frames().

8.8.3.77 void jeod::DynBody::switch_integration_frames (const char ∗ *new_integ_frame_name*) [virtual]

Switch the integration frame for this body and all its child bodies to the frame indicated by the provided name.

Note

Assumptions and Limitations

- Assumption: Provided string is a non-NULL, non-empty string.
- Limitation: Assocated frame must be a valid integration frame.

Parameters

in	*new_integ_frame_name*	New integration frame

Definition at line 190 of file dyn_body_integration.cc.

References dyn_manager, jeod::DynBodyMessages::invalid_name, name, and switch_integration_frames().

8.8.3.78 er7_utils::IntegratorResult jeod::DynBody::trans_integ (double *dyn_dt,* unsigned int *target_stage*) [protected], [virtual]

Integrate the vehicle's translational state.

Integrate the translational state of a DynBody.

Parameters

in	*target_stage*	The stage of the integration process that the integrator should try to attain.

Returns

The status (time advance, pass/fail status) of the integration.

Parameters

in	*dyn_dt*	Dynamic time step, in dynamic time seconds.
in	*target_stage*	The stage of the integration process that the integrator should try to attain.

Returns

The status (time advance, pass/fail status) of the integration.

Reimplemented in jeod::StructureIntegratedDynBody.

Definition at line 368 of file dyn_body_integration.cc.

References composite_body, derivs, jeod::FrameDerivs::trans_accel, and trans_integrator.

Referenced by integrate().

8.8.3.79 void jeod::DynBody::update_integrated_state ( ) [virtual]

Propagate state from state owners to the integrated state.

Definition at line 396 of file dyn_body_propagate_state.cc.

References attitude_source, compute_ref_point_transform(), dyn_parent, get_root_body_internal(), jeod::BodyRefFrame::initialized_items, initialized_states, integrated_frame, position_source, rate_source, time_manager, update_integrated_state(), and velocity_source.

Referenced by propagate_state(), switch_integration_frames(), and update_integrated_state().

8.8.4 Friends And Related Function Documentation

8.8.4.1 void init_attrjeod__DynBody ( ) [friend]

8.8.4.2 friend class InputProcessor [friend]

Definition at line 116 of file dyn_body.hh.

8.8.5 Field Documentation

8.8.5.1 std::vector<er7_utils::IntegrableObject∗> jeod::DynBody::associated_integrable_objects [protected]

List of integrable objects to be integrated with this DynBody.

trick_io(∗∗)

Definition at line 1225 of file dyn_body.hh.

Referenced by add_integrable_object(), clear_integrable_objects(), get_integrable_objects(), migrate_integrable_objects(), and remove_integrable_object().

8.8.5.2 BodyRefFrame∗ jeod::DynBody::attitude_source [protected]

The reference frame that contains the user-set attitude.

trick_units(–)

Definition at line 1207 of file dyn_body.hh.

Referenced by set_state_source_internal(), and update_integrated_state().

8.8.5.3 bool jeod::DynBody::autoupdate_vehicle_points

Are vehicle points automatically updated? The vehicle points are automatically calculated at initialization time but are only automatically updated at runtime if this member is true.

Setting this member to false indicates the responsibility for updating vehicle point states is performed elsewhere, such as in a scheduled call to compute_vehicle_point_states.trick_units(–)

Definition at line 762 of file dyn_body.hh.

Referenced by propagate_state_from_composite(), and propagate_state_from_structure().

8.8.5.4 BodyForceCollect jeod::DynBody::collect

Force/Torque collection mechanism.

trick_units(–)

Definition at line 781 of file dyn_body.hh.

Referenced by jeod::StructureIntegratedDynBody::collect_forces_and_torques(), collect_forces_and_torques(), jeod::StructureIntegratedDynBody::collect_local_forces_and_torques(), jeod::StructureIntegratedDynBody::compute_inertial_torque(), jeod::StructureIntegratedDynBody::compute_rotational_acceleration(), jeod::StructureIntegratedDynBody::compute_translational_acceleration(), jeod::StructureIntegratedDynBody::PropagateForcesAndTorques(), and jeod::StructureIntegratedDynBody::solve_constraints().

8.8.5.5 BodyRefFrame jeod::DynBody::composite_body

Vehicle composite body reference frame.

The reference frame origin is at the composite body center of mass, and the reference frame axes are the body frame axes as defined in the composite mass properties.trick_units(–)

Definition at line 697 of file dyn_body.hh.

Referenced by collect_forces_and_torques(), compute_ref_point_transform(), jeod::StructureIntegratedDynBody::compute_vehicle_point_derivatives(), compute_vehicle_point_derivatives(), DynBody(), initialize_model(), process_dynamic_attachment(), propagate_state(), propagate_state_from_composite(), propagate_state_from_structure(), jeod::StructureIntegratedDynBody::PropagateForcesAndTorques(), rot_integ(), set_integ_frame(), jeod::StructureIntegratedDynBody::solve_constraints(), trans_integ(), and ∼DynBody().

8.8.5.6 bool jeod::DynBody::compute_point_derivative

Should the point derivatives for the body be computed? A child body's translational and rotational derivatives are only computed if this is true.

If this is false, they will be 0.trick_units(–)

Definition at line 731 of file dyn_body.hh.

Referenced by collect_forces_and_torques().

8.8.5.7 BodyRefFrame jeod::DynBody::core_body

Vehicle core body reference frame.

The reference frame origin is at the core body center of mass, and the reference frame axes are the body frame axes as defined in the core mass properties.trick_units(–)

Definition at line 689 of file dyn_body.hh.

Referenced by compute_ref_point_transform(), detach_mass_internal(), DynBody(), initialize_model(), process_dynamic_attachment(), propagate_state_from_composite(), propagate_state_from_structure(), set_integ_frame(), and ∼DynBody().

8.8.5.8 FrameDerivs jeod::DynBody::derivs

Translational/rotational accelerations.

trick_units(–)

Definition at line 775 of file dyn_body.hh.

Referenced by jeod::StructureIntegratedDynBody::collect_forces_and_torques(), collect_forces_and_torques(), jeod::StructureIntegratedDynBody::complete_translational_acceleration(), jeod::StructureIntegratedDynBody::compute_rotational_acceleration(), jeod::StructureIntegratedDynBody::compute_translational_acceleration(), compute_vehicle_point_derivatives(), jeod::StructureIntegratedDynBody::rot_integ(), rot_integ(), jeod::StructureIntegratedDynBody::solve_constraints(), and trans_integ().

8.8.5.9 std::list<DynBody∗> jeod::DynBody::dyn_children [protected]

The subset of the dynamic bodies attached to this dynamic body.

Definition at line 1175 of file dyn_body.hh.

Referenced by attach_establish_links(), jeod::StructureIntegratedDynBody::collect_forces_and_torques(), collect_forces_and_torques(), detach(), propagate_state_from_composite(), propagate_state_from_structure(), set_integ_frame(), and ∼DynBody().

8.8.5.10 BaseDynManager∗& jeod::DynBody::dyn_manager [protected]

The dynamics manager for the simulation.

trick_units(–)

Definition at line 1149 of file dyn_body.hh.

Referenced by add_mass_body_frames(), add_mass_body_validate(), add_mass_point(), attach_to_frame(), attach_validate_parent(), detach_mass_body_frames(), find_body_frame(), initialize_controls(), initialize_model(), reset_controls(), set_integ_frame(), switch_integration_frames(), and ∼DynBody().

8.8.5.11 DynBody∗ jeod::DynBody::dyn_parent [protected]

The DynBody to which this body is attached.

This points to exactly the same object as does the links.parent member. While a mass body can be attached to any kind of mass body, a dynamic body can only be attached to another dynamic body.trick_units(–)

Definition at line 1162 of file dyn_body.hh.

Referenced by attach_establish_links(), jeod::StructureIntegratedDynBody::collect_forces_and_torques(), collect_forces_and_torques(), detach(), get_parent_body(), get_parent_body_internal(), get_root_body_internal(), is_root_body(), propagate_state(), jeod::StructureIntegratedDynBody::PropagateForcesAndTorques(), set_state_source(), jeod::StructureIntegratedDynBody::solve_constraints(), switch_integration_frames(), update_integrated_state(), and ∼DynBody().

8.8.5.12 DynBodyGenericFrameAttachment jeod::DynBody::frame_attach [protected]

The RefFrame this body is attached to.

Once attached, the DynBody will no longer numerically integrate rotational or dynamic states and is considered fixed wrt the RefFrame. The DynBody's integration frame will continue to be used to populate the composite_body, structure, core_body and mass point dynamic states.

Definition at line 1170 of file dyn_body.hh.

Referenced by attach_to_frame(), detach(), and integrate().

8.8.5.13 GravityInteraction jeod::DynBody::grav_interaction

Gravitational interactions.

This data member specifies how the vehicle interacts gravitationally with various planetary bodies in the simulation and contains the computed acceleration toward those planetary bodies.trick_units(–)

Definition at line 770 of file dyn_body.hh.

Referenced by add_control(), collect_forces_and_torques(), jeod::StructureIntegratedDynBody::complete_translational_acceleration(), jeod::StructureIntegratedDynBody::compute_vehicle_point_derivatives(), compute_vehicle_point_derivatives(), initialize_controls(), reset_controls(), set_integ_frame(), and sort_controls().

8.8.5.14 RefFrameItems jeod::DynBody::initialized_states [protected]

Enum value indicating which of position, velocity, attitude, and rate have been initialized.

trick_units(–)

Definition at line 1192 of file dyn_body.hh.

Referenced by attach_update_properties(), attach_validate_child(), DynBody(), get_initialized_states(), initialize_model(), initialized_states_contains(), integrate(), propagate_state(), propagate_state_from_composite(), propagate_state_from_structure(), set_state_source_internal(), and update_integrated_state().

8.8.5.15 EphemerisRefFrame∗ jeod::DynBody::integ_frame

The current integration frame.

trick_units(–)

Definition at line 681 of file dyn_body.hh.

Referenced by add_mass_body_frames(), add_mass_point(), attach_establish_links(), initialize_model(), integrate(), and set_integ_frame().

8.8.5.16 char∗ jeod::DynBody::integ_frame_name

The name of the reference frame with respect to which the body's reference frames (core, composite, structure, plus vehicle point frames) are to be represented and propagated.

The value must identify a valid integration frame, i.e., a non-rotating, ephemeris based reference frame.

This member is used at initialization time only. To change the integration frame post-initialization use the function DynBody::switch_integration_frames. This can be invoked directly, or indirectly via a FrameSwitch body action.trick_units(–)

Definition at line 676 of file dyn_body.hh.

Referenced by initialize_model().

8.8.5.17 er7_utils::IntegratorResultMergerContainer jeod::DynBody::integ_results_merger [protected]

The object that merges integration results.

trick_units(–)

Definition at line 1231 of file dyn_body.hh.

Referenced by create_body_integrators(), and integrate().

8.8.5.18 BodyRefFrame∗ jeod::DynBody::integrated_frame [protected]

The reference frame whose state is updated via the state integrator.

All other reference frames are calculated from this frame.trick_units(–)

Definition at line 1218 of file dyn_body.hh.

Referenced by compute_ref_point_transform(), DynBody(), propagate_state(), jeod::StructureIntegratedDynBody::StructureIntegratedDynBody(), switch_integration_frames(), and update_integrated_state().

8.8.5.19 MassBody jeod::DynBody::mass

Mass properties of the vehicle, defined about the structure reference frame.

Definition at line 658 of file dyn_body.hh.

Referenced by add_mass_body(), add_mass_point(), attach_child(), attach_establish_links(), attach_to_frame(), attach_update_properties(), jeod::StructureIntegratedDynBody::collect_forces_and_torques(), collect_forces_and_torques(), jeod::StructureIntegratedDynBody::complete_translational_acceleration(), jeod::StructureIntegratedDynBody::compute_inertial_torque(), compute_ref_point_transform(), jeod::StructureIntegratedDynBody::compute_rotational_acceleration(), jeod::StructureIntegratedDynBody::compute_translational_acceleration(), jeod::StructureIntegratedDynBody::compute_vehicle_point_derivatives(), compute_vehicle_point_derivatives(), detach(), detach_mass_internal(), DynBody(), initialize_model(), process_dynamic_attachment(), propagate_state_from_composite(), propagate_state_from_structure(), jeod::StructureIntegratedDynBody::PropagateForcesAndTorques(), remove_mass_body(), set_name(), and jeod::StructureIntegratedDynBody::solve_constraints().

8.8.5.20 std::list<MassBody∗> jeod::DynBody::mass_children [protected]

The subset of the mass bodies attached to this dynamic body that are themselves not dynamic bodies.

Definition at line 1181 of file dyn_body.hh.

Referenced by add_mass_body(), remove_mass_body(), and ∼DynBody().

8.8.5.21 NamedItem& jeod::DynBody::name

Body name, reference linked to mass.name.

trick_units(–)

Definition at line 663 of file dyn_body.hh.

Referenced by add_mass_body(), add_mass_body_frames(), add_mass_body_validate(), add_mass_point(), attach_child(), jeod::StructureIntegratedDynBody::attach_update_properties(), attach_validate_child(), attach_validate_parent(), jeod::check_frame_ownership(), compute_ref_point_transform(), jeod::StructureIntegratedDynBody::compute_vehicle_point_derivatives(), compute_vehicle_point_derivatives(), create_body_integrators(), jeod::StructureIntegratedDynBody::detach(), detach(), find_body_frame(), find_vehicle_point(), initialize_model(), migrate_integrable_objects(), propagate_state(), remove_mass_body(), set_integ_frame(), jeod::StructureIntegratedDynBody::set_solver(), set_state_source(), and switch_integration_frames().

8.8.5.22 BodyRefFrame∗ jeod::DynBody::position_source [protected]

The reference frame that contains the user-set position.

trick_units(–)

Definition at line 1197 of file dyn_body.hh.

Referenced by set_state_source_internal(), and update_integrated_state().

8.8.5.23 BodyRefFrame∗ jeod::DynBody::rate_source [protected]

The reference frame that contains the user-set attitude rate.

trick_units(–)

Definition at line 1212 of file dyn_body.hh.

Referenced by set_state_source_internal(), and update_integrated_state().

8.8.5.24 RestartableSO3SecondOrderODEIntegrator jeod::DynBody::rot_integrator [protected]

Rotational state checkpointable/restartable integrator generator.

Rotational state is much harder to integrate. The canonical position is the attitude quaternion, canonical velocity is angular velocity, and the time derivative of the attitude quaternion is a function of the orientiation and the angular velocity.trick_units(–)

Definition at line 1248 of file dyn_body.hh.

Referenced by create_body_integrators(), DynBody(), reset_integrators(), jeod::StructureIntegratedDynBody::rot_integ(), rot_integ(), and ∼DynBody().

8.8.5.25 GeneralizedSecondOrderODETechnique::TechniqueType jeod::DynBody::rotation_integration

Specifies the preferred mechanism for integrating rotational state.

This data member has effect only when set prior to the creation of the body's integrators. The body's rotational integrator will be created based on the value of this data member.trick_units(–)

Definition at line 752 of file dyn_body.hh.

Referenced by create_body_integrators().

8.8.5.26 bool jeod::DynBody::rotational_dynamics

Is rotational dynamics enabled? The body's rotational state is integrated only if this member is true.

Setting this member to false indicates the responsibility for updating the rotational state is performed elsewhere, such as by a user-defined forced rotation model.trick_units(–)

Definition at line 723 of file dyn_body.hh.

Referenced by jeod::StructureIntegratedDynBody::collect_forces_and_torques(), collect_forces_and_torques(), jeod::StructureIntegratedDynBody::collect_local_forces_and_torques(), integrate(), jeod::StructureIntegratedDynBody::PropagateForcesAndTorques(), reset_integrators(), and jeod::StructureIntegratedDynBody::solve_constraints().

8.8.5.27 BodyRefFrame jeod::DynBody::structure

Vehicle structural reference frame.

The reference frame origin is at the structural origin, and the reference frame axes are the structure frame axes as defined in the composite mass properties.trick_units(–)

Definition at line 705 of file dyn_body.hh.

Referenced by attach_to_frame(), attach_update_properties(), collect_forces_and_torques(), jeod::StructureIntegratedDynBody::complete_translational_acceleration(), jeod::StructureIntegratedDynBody::compute_inertial_torque(), compute_ref_point_transform(), jeod::StructureIntegratedDynBody::compute_translational_acceleration(), jeod::StructureIntegratedDynBody::compute_vehicle_point_derivatives(), compute_vehicle_point_states(), DynBody(), initialize_model(), integrate(), process_dynamic_attachment(), propagate_state(), propagate_state_from_composite(), propagate_state_from_structure(), jeod::StructureIntegratedDynBody::PropagateForcesAndTorques(), jeod::StructureIntegratedDynBody::rot_integ(), set_integ_frame(), jeod::StructureIntegratedDynBody::solve_constraints(), jeod::StructureIntegratedDynBody::StructureIntegratedDynBody(), jeod::StructureIntegratedDynBody::trans_integ(), and ∼DynBody().

8.8.5.28 bool jeod::DynBody::three_dof

Is this a three degrees of freedom (translation only) body? This data member has effect only when set prior to the creation of the body's integrators.

The body's rotational integrator is not created and rotational_dynamics is set to false if this member's value is true.

Note that very bad mojo (a core dump) will result if this member is set to true at initialization time and rotational_dynamics is later enabled during run time.trick_units(–)

Definition at line 743 of file dyn_body.hh.

Referenced by create_body_integrators().

8.8.5.29 const JeodIntegrationTime∗ jeod::DynBody::time_manager [protected]

The time manager to be used to obtain timestamp information.

trick_units(–)

Definition at line 1154 of file dyn_body.hh.

Referenced by create_body_integrators(), and update_integrated_state().

8.8.5.30 RestartableT3SecondOrderODEIntegrator jeod::DynBody::trans_integrator [protected]

Translational state checkpointable/restartable integrator generator.

Translational state is comparatively easy to integrate. The canonical position is just position, canonical velocity is just velocity, and the time derivative of position is velocity.trick_units(–)

Definition at line 1239 of file dyn_body.hh.

Referenced by create_body_integrators(), DynBody(), reset_integrators(), jeod::StructureIntegratedDynBody::trans_integ(), trans_integ(), and ∼DynBody().

8.8.5.31 bool jeod::DynBody::translational_dynamics

Is translational dynamics enabled? The body's translational state is integrated only if this member is true.

Setting this member to false indicates the responsibility for updating the translational state is performed elsewhere, such as by a user-defined forced translation model.trick_units(–)

Definition at line 714 of file dyn_body.hh.

Referenced by jeod::StructureIntegratedDynBody::collect_forces_and_torques(), collect_forces_and_torques(), jeod::StructureIntegratedDynBody::collect_local_forces_and_torques(), integrate(), jeod::StructureIntegratedDynBody::PropagateForcesAndTorques(), reset_integrators(), and jeod::StructureIntegratedDynBody::solve_constraints().

8.8.5.32 std::list<BodyRefFrame∗> jeod::DynBody::vehicle_points [protected]

An array of vehicle points associated with this dynamic body.

Definition at line 1186 of file dyn_body.hh.

Referenced by add_mass_body_frames(), add_mass_point(), compute_vehicle_point_states(), detach_mass_body_frames(), find_vehicle_point(), set_integ_frame(), and ∼DynBody().

8.8.5.33 BodyRefFrame∗ jeod::DynBody::velocity_source [protected]

The reference frame that contains the user-set velocity.

trick_units(–)

Definition at line 1202 of file dyn_body.hh.

Referenced by set_state_source_internal(), and update_integrated_state().

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

- dyn_body.hh
- dyn_body.cc
- dyn_body_attach.cc
- dyn_body_collect.cc
- dyn_body_detach.cc
- dyn_body_find_body_frame.cc
- dyn_body_initialize_model.cc
- dyn_body_integration.cc
- dyn_body_propagate_state.cc
- dyn_body_set_state.cc
- dyn_body_vehicle_point.cc

8.9 jeod::DynBodyGenericFrameAttachment Class Reference

A wrench comprises a torque and a force applied at a point on a DynBody.

```
#include <dyn_body_generic_rigid_attach.hh>
```

Public Member Functions

- DynBodyGenericFrameAttachment ()

  Default constructor.
- void initialize_attachment (RefFrame &parent_frame, const RefFrameState &attach_state)
- void clear_attachment ()
- bool isAttached () const
- RefFrame ∗ get_parent_frame () const
- const RefFrameState & get_attach_offset () const

Private Attributes

- bool active

  trick_units(–)
- RefFrame ∗ rigid_attach_parent

  trick_units(–)
- RefFrameState rigid_attach_state

  trick_units(–)

Friends

- class InputProcessor
- void init_attrjeod__DynBodyGenericFrameAttachment ()

8.9.1 Detailed Description

A wrench comprises a torque and a force applied at a point on a DynBody.

The torque should not include the torque due to the application of the force.
A Trick simulation issues vcollect statements such as

```
vcollect vehicle.dyn_body.collect_wrench.collection
{
    wrench_model1.wrench,
    wrench_model2.wrench
};
```

Definition at line 78 of file dyn_body_generic_rigid_attach.hh.

8.9.2 Constructor & Destructor Documentation

8.9.2.1 jeod::DynBodyGenericFrameAttachment::DynBodyGenericFrameAttachment ( ) [inline]

Default constructor.

Definition at line 88 of file dyn_body_generic_rigid_attach.hh.

8.9.3 Member Function Documentation

8.9.3.1 void jeod::DynBodyGenericFrameAttachment::clear_attachment ( ) [inline]

Definition at line 107 of file dyn_body_generic_rigid_attach.hh.

References active.

Referenced by jeod::DynBody::detach().

8.9.3.2 const RefFrameState& jeod::DynBodyGenericFrameAttachment::get_attach_offset ( ) const [inline]

Definition at line 122 of file dyn_body_generic_rigid_attach.hh.

References rigid_attach_state.

Referenced by jeod::DynBody::integrate().

8.9.3.3 RefFrame∗ jeod::DynBodyGenericFrameAttachment::get_parent_frame ( ) const [inline]

Definition at line 117 of file dyn_body_generic_rigid_attach.hh.

References rigid_attach_parent.

Referenced by jeod::DynBody::integrate().

8.9.3.4 void jeod::DynBodyGenericFrameAttachment::initialize_attachment (RefFrame & *parent_frame,* const RefFrameState & *attach_state*) [inline]

Definition at line 98 of file dyn_body_generic_rigid_attach.hh.

References active, rigid_attach_parent, and rigid_attach_state.

Referenced by jeod::DynBody::attach_to_frame().

8.9.3.5 bool jeod::DynBodyGenericFrameAttachment::isAttached ( ) const [inline]

Definition at line 112 of file dyn_body_generic_rigid_attach.hh.

References active.

Referenced by jeod::DynBody::detach(), and jeod::DynBody::integrate().

8.9.4 Friends And Related Function Documentation

8.9.4.1 void init_attrjeod__DynBodyGenericFrameAttachment ( ) [friend]

8.9.4.2 friend class InputProcessor [friend]

Definition at line 80 of file dyn_body_generic_rigid_attach.hh.

8.9.5 Field Documentation

8.9.5.1 bool jeod::DynBodyGenericFrameAttachment::active [private]

trick_units(–)

Definition at line 132 of file dyn_body_generic_rigid_attach.hh.

Referenced by clear_attachment(), initialize_attachment(), and isAttached().

8.9.5.2 RefFrame∗ jeod::DynBodyGenericFrameAttachment::rigid_attach_parent [private]

trick_units(–)

Definition at line 134 of file dyn_body_generic_rigid_attach.hh.

Referenced by get_parent_frame(), and initialize_attachment().

8.9.5.3 RefFrameState jeod::DynBodyGenericFrameAttachment::rigid_attach_state [private]

trick_units(–)

Definition at line 136 of file dyn_body_generic_rigid_attach.hh.

Referenced by get_attach_offset(), and initialize_attachment().

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

- dyn_body_generic_rigid_attach.hh

8.10 jeod::DynBodyMessages Class Reference

Specify the message IDs used in the DynBody model.

`#include <dyn_body_messages.hh>`

Static Public Attributes

- static char const ∗ invalid_body

  Issued when a body is invalid such as not being initialized.
- static char const ∗ invalid_group

Issued when a group is invalid such as not initialized or NULL.
- static char const ∗ invalid_name

  Issued when a name is invalid – NULL, empty, a duplicate, ...
- static char const ∗ invalid_frame

  Issued when a frame is invalid – not an integ frame, ...
- static char const ∗ invalid_attachment

  Issued when a attachment is invalid from a state point of view.
- static char const ∗ invalid_technique

  Issued when an integration technique is invalid.
- static char const ∗ not_dyn_body

  Issued when a MassBody is expected to be a DynBody but that is not the case.
- static char const ∗ internal_error

  Error issued when some internal error occurred.

Private Member Functions

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

Friends

- class InputProcessor
- void init_attrjeod__DynBodyMessages ()

8.10.1 Detailed Description

Specify the message IDs used in the DynBody model.

Assumptions and Limitations

- This is a complete catalog of all the messages sent by the DynBody model.
- This is not an exhaustive list of all the things that can go awry.

Definition at line 81 of file dyn_body_messages.hh.

8.10.2 Constructor & Destructor Documentation

8.10.2.1 jeod::DynBodyMessages::DynBodyMessages (void) [private]

8.10.2.2 jeod::DynBodyMessages::DynBodyMessages (const DynBodyMessages &) [private]

8.10.3 Member Function Documentation

8.10.3.1 DynBodyMessages& jeod::DynBodyMessages::operator= (const DynBodyMessages &) [private]

8.10.4 Friends And Related Function Documentation

8.10.4.1 void init_attrjeod__DynBodyMessages ( ) [friend]

8.10.4.2 friend class InputProcessor [friend]

Definition at line 83 of file dyn_body_messages.hh.

8.10.5 Field Documentation

8.10.5.1 char const * jeod::DynBodyMessages::internal_error [static]

Initial value:

```
=
     "dynamics/dyn_body/"  "internal_error"
```

Error issued when some internal error occurred.

These errors should never happen.trick_units(–)

Definition at line 130 of file dyn_body_messages.hh.

Referenced by jeod::DynBody::create_integrators(), and jeod::DynBody::get_dynamics_integration_group().

8.10.5.2 char const * jeod::DynBodyMessages::invalid_attachment [static]

Initial value:

```
=
     "dynamics/dyn_body/"  "invalid_attachment"
```

Issued when a attachment is invalid from a state point of view.

trick_units(–)

Definition at line 113 of file dyn_body_messages.hh.

Referenced by jeod::DynBody::add_mass_body(), jeod::DynBody::attach_child(), jeod::DynBody::attach_to_frame(), jeod::StructureIntegratedDynBody::attach_update_properties(), jeod::DynBody::attach_validate_child(), jeod::DynBody::attach_validate_parent(), jeod::StructureIntegratedDynBody::detach(), and jeod::DynBody::detach().

8.10.5.3 char const * jeod::DynBodyMessages::invalid_body [static]

Initial value:

```
=
     "dynamics/dyn_body/"  "invalid_body"
```

Issued when a body is invalid such as not being initialized.

trick_units(–)

Definition at line 93 of file dyn_body_messages.hh.

Referenced by jeod::StructureIntegratedDynBody::add_constraint(), jeod::DynBody::add_mass_point(), jeod::DynBody::attach_validate_parent(), jeod::StructureIntegratedDynBody::set_solver(), and jeod::StructureIntegratedDynBody::solve_constraints().

8.10.5.4 char const * jeod::DynBodyMessages::invalid_frame [static]

Initial value:

```
=
     "dynamics/dyn_body/"  "invalid_frame"
```

Issued when a frame is invalid – not an integ frame, ...

trick_units(–)

Definition at line 108 of file dyn_body_messages.hh.

Referenced by jeod::check_frame_ownership(), jeod::DynBody::compute_ref_point_transform(), jeod::StructureIntegratedDynBody::compute_vehicle_point_derivatives(), jeod::DynBody::compute_vehicle_point_derivatives(), jeod::DynBody::initialize_model(), jeod::DynBody::propagate_state(), jeod::DynBody::set_state_source(), and jeod::DynBody::switch_integration_frames().

8.10.5.5 char const ∗ jeod::DynBodyMessages::invalid_group [static]

Initial value:

```
=
    "dynamics/dyn_body/"  "invalid_group"
```

Issued when a group is invalid such as not initialized or NULL.

trick_units(–)

Definition at line 98 of file dyn_body_messages.hh.

Referenced by jeod::DynBody::migrate_integrable_objects().

8.10.5.6 char const ∗ jeod::DynBodyMessages::invalid_name [static]

Initial value:

```
=
    "dynamics/dyn_body/"  "invalid_name"
```

Issued when a name is invalid – NULL, empty, a duplicate, ...

trick_units(–)

Definition at line 103 of file dyn_body_messages.hh.

Referenced by jeod::DynBody::find_body_frame(), jeod::DynBody::initialize_model(), jeod::DynBody::set_integ_frame(), and jeod::DynBody::switch_integration_frames().

8.10.5.7 char const ∗ jeod::DynBodyMessages::invalid_technique [static]

Initial value:

```
=
    "dynamics/dyn_body/"  "invalid_technique"
```

Issued when an integration technique is invalid.

trick_units(–)

Definition at line 118 of file dyn_body_messages.hh.

Referenced by jeod::DynBody::detach(), and jeod::DynBody::remove_mass_body().

8.10.5.8 char const ∗ jeod::DynBodyMessages::not_dyn_body [static]

Initial value:

```
=
    "dynamics/dyn_body/"  "not_dyn_body"
```

Issued when a MassBody is expected to be a DynBody but that is not the case.

trick_units(–)

Definition at line 124 of file dyn_body_messages.hh.

Referenced by jeod::DynBody::attach_validate_parent().

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

- dyn_body_messages.hh
- dyn_body_messages.cc

8.11 jeod::Force Class Reference

A Force represents a Newtonian force that acts on a DynBody.

```
#include <force.hh>
```

Public Member Functions

- Force ()

  Force default constructor.
- virtual ∼Force ()

  Force destructor.
- double & operator[] (const unsigned int index)

  Access a force element, non-const version.
- double operator[] (const unsigned int index) const

  Access a force element, const version.

Data Fields

- bool active

  Is this force active?
- double force [3]

  Force vector.

Private Member Functions

- Force (const Force &)

  Not implemented.
- Force & operator= (const Force &)

  Not implemented.

8.11.1 Detailed Description

A Force represents a Newtonian force that acts on a DynBody.

The class encapsulates an active flag and a 3-vector that contains the force components. Forces are collected in one of a DynBody object's force collection STL vectors. The force vector is expressed in the structural frame of that DynBody object.

The Force class is the recommended mechanism for representing forces in JEOD. While 3-vectors can also be collected into a collect STL vector, theee is is no way to turn off these collected 3-vectors. Even worse, there is no way to tell whether a collected 3-vector does indeed represent a force – or even if it is a 3-vector. In comparison, Force objects can be turned on and off, and more importantly, they are type-safe.

Definition at line 82 of file force.hh.

8.11.2 Constructor & Destructor Documentation

8.11.2.1 jeod::Force::Force (void)

Force default constructor.

Definition at line 44 of file force.cc.

References force.

8.11.2.2 jeod::Force::∼Force (void) [virtual]

Force destructor.

Definition at line 56 of file force.cc.

8.11.2.3 jeod::Force::Force (const Force &) [private]

Not implemented.

8.11.3 Member Function Documentation

8.11.3.1 Force& jeod::Force::operator= (const Force &) [private]

Not implemented.

8.11.3.2 double & jeod::Force::operator[] (const unsigned int *index*) [inline]

Access a force element, non-const version.

Returns

Force component at specified index
Units: N

Parameters

in	*index*	Index number

Definition at line 76 of file force_inline.hh.

References force.

8.11.3.3 double jeod::Force::operator[] (const unsigned int *index*) const [inline]

Access a force element, const version.

Returns

Force component at specified index
Units: N

Parameters

in	*index*	Index number

Definition at line 89 of file force_inline.hh.

References force.

8.11.4 Field Documentation

8.11.4.1 bool jeod::Force::active

Is this force active?

trick_units(–)

Definition at line 98 of file force.hh.

8.11.4.2 double jeod::Force::force[3]

Force vector.

trick_units(N)

Definition at line 103 of file force.hh.

Referenced by Force(), and operator[]().

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

- force.hh
- force_inline.hh
- force.cc

8.12 jeod::FrameDerivs Class Reference

Contains translational and rotational second derivatives.

```
#include <frame_derivs.hh>
```

Public Member Functions

- FrameDerivs ()

  Default constructor.

Data Fields

- double non_grav_accel [3]

  Non-gravitational acceleration.
- double trans_accel [3]

  Total acceleration.
- Quaternion Qdot_parent_this

  Time derivative of Q_parent_this.
- double rot_accel [3]

  Total rotational acceleration (expressed in body frame)

8.12.1 Detailed Description

Contains translational and rotational second derivatives.

Definition at line 73 of file frame_derivs.hh.

8.12.2 Constructor & Destructor Documentation

8.12.2.1 jeod::FrameDerivs::FrameDerivs (void)

Default constructor.

Definition at line 107 of file aux_classes.cc.

References non_grav_accel, rot_accel, and trans_accel.

8.12.3 Field Documentation

8.12.3.1 double jeod::FrameDerivs::non_grav_accel[3]

Non-gravitational acceleration.

trick_units(m/s2)

Definition at line 83 of file frame_derivs.hh.

Referenced by jeod::StructureIntegratedDynBody::collect_forces_and_torques(), jeod::DynBody::collect_forces_and_torques(), jeod::StructureIntegratedDynBody::complete_translational_acceleration(), jeod::StructureIntegratedDynBody::compute_translational_acceleration(), jeod::StructureIntegratedDynBody::compute_vehicle_point_derivatives(), jeod::DynBody::compute_vehicle_point_derivatives(), FrameDerivs(), and jeod::StructureIntegratedDynBody::solve_constraints().

8.12.3.2 Quaternion jeod::FrameDerivs::Qdot_parent_this

Time derivative of Q_parent_this.

trick_units(1/s)

Definition at line 93 of file frame_derivs.hh.

Referenced by jeod::StructureIntegratedDynBody::compute_vehicle_point_derivatives(), jeod::DynBody::compute_vehicle_point_derivatives(), jeod::StructureIntegratedDynBody::rot_integ(), and jeod::DynBody::rot_integ().

8.12.3.3 double jeod::FrameDerivs::rot_accel[3]

Total rotational acceleration (expressed in body frame)

trick_units(rad/s2)

Definition at line 98 of file frame_derivs.hh.

Referenced by jeod::StructureIntegratedDynBody::collect_forces_and_torques(), jeod::DynBody::collect_forces_and_torques(), jeod::StructureIntegratedDynBody::complete_translational_acceleration(), jeod::StructureIntegratedDynBody::compute_rotational_acceleration(), jeod::StructureIntegratedDynBody::compute_vehicle_point_derivatives(), jeod::DynBody::compute_vehicle_point_derivatives(), FrameDerivs(), jeod::StructureIntegratedDynBody::rot_integ(), jeod::DynBody::rot_integ(), and jeod::StructureIntegratedDynBody::solve_constraints().

8.12.3.4 double jeod::FrameDerivs::trans_accel[3]

Total acceleration.

trick_units(m/s2)

Definition at line 88 of file frame_derivs.hh.

Referenced by jeod::StructureIntegratedDynBody::collect_forces_and_torques(), jeod::DynBody::collect_forces_and_torques(), jeod::StructureIntegratedDynBody::complete_translational_acceleration(), jeod::StructureIntegratedDynBody::compute_vehicle_point_derivatives(), jeod::DynBody::compute_vehicle_point_derivatives(), FrameDerivs(), jeod::StructureIntegratedDynBody::trans_integ(), and jeod::DynBody::trans_integ().

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

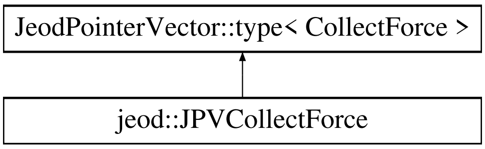
- frame_derivs.hh
- aux_classes.cc

8.13 jeod::JPVCollectForce Class Reference

This is a derived version of the template class JeodPointerVector<CollectForce>::type with an implementation of the method perform_cleanup_action which frees and clears stale data following a restore.

```
#include <body_force_collect.hh>
```

Inheritance diagram for jeod::JPVCollectForce:



Public Member Functions

- void perform_insert_action (const std::string &value) override

  Interpret the provided value and add it to the list.
- void push_back (CollectForce ∗const &elem)

  Add an element to the end of the contents.

Friends

- template<typename CollectType , typename value_type >
  void collect_insert (CollectType &collect_in, value_type &elem)
- template<typename CollectType , typename value_type >
  void collect_push_back (CollectType &collect_in, value_type &elem)

8.13.1 Detailed Description

This is a derived version of the template class JeodPointerVector<CollectForce>::type with an implementation of the method perform_cleanup_action which frees and clears stale data following a restore.

Definition at line 168 of file body_force_collect.hh.

8.13.2 Member Function Documentation

8.13.2.1 void jeod::JPVCollectForce::perform_insert_action (const std::string & *value*) [inline], [override]

Interpret the provided value and add it to the list.

For a JPVCollectForce, the value should specify (in string form) the address of a unique force vector pointer in active memory. If the entry already exists, check and delete the "restored" CollectTorque

Definition at line 185 of file body_force_collect.hh.

References collect_insert.

8.13.2.2 void jeod::JPVCollectForce::push_back (CollectForce ∗const & *elem*) [inline]

Add an element to the end of the contents.

Parameters

elem	Element to be added.

Definition at line 198 of file body_force_collect.hh.

References collect_push_back.

8.13.3 Friends And Related Function Documentation

8.13.3.1 template<typename CollectType , typename value_type > void collect_insert (CollectType & *collect_in,* value_type & *elem*) [friend]

Definition at line 99 of file body_force_collect.hh.

Referenced by perform_insert_action().

8.13.3.2 template<typename CollectType , typename value_type > void collect_push_back (CollectType & *collect_in,* value_type & *elem*) [friend]

Definition at line 131 of file body_force_collect.hh.

Referenced by push_back().

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

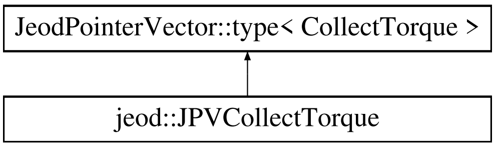
- body_force_collect.hh

8.14 jeod::JPVCollectTorque Class Reference

This is a derived version of the template class JeodPointerVector<CollectTorque>::type with an implementation of the method perform_cleanup_action which frees and clears stale data following a restore.

`#include <body_force_collect.hh>`

Inheritance diagram for jeod::JPVCollectTorque:



Public Member Functions

- void perform_insert_action (const std::string &value) override

  Interpret the provided value and add it to the list.

- void push_back (CollectTorque ∗const &elem)

  Add an element to the end of the contents.

Friends

- template<typename CollectType , typename value_type >
  void collect_insert (CollectType &collect_in, value_type &elem)
- template<typename CollectType , typename value_type >
  void collect_push_back (CollectType &collect_in, value_type &elem)

8.14.1 Detailed Description

This is a derived version of the template class JeodPointerVector<CollectTorque>::type with an implementation of the method perform_cleanup_action which frees and clears stale data following a restore.

Definition at line 211 of file body_force_collect.hh.

8.14.2 Member Function Documentation

8.14.2.1 void jeod::JPVCollectTorque::perform_insert_action (const std::string & *value*) [inline], [override]

Interpret the provided value and add it to the list.

For a JPVCollectTorque, the value should specify (in string form) the address of a unique torque vector pointer in active memory. If the entry already exists, check and delete the "restored" CollectTorque

Definition at line 226 of file body_force_collect.hh.

References collect_insert.

8.14.2.2 void jeod::JPVCollectTorque::push_back (CollectTorque ∗const & *elem*) [inline]

Add an element to the end of the contents.

Parameters

elem	Element to be added.

Definition at line 239 of file body_force_collect.hh.

References collect_push_back.

8.14.3 Friends And Related Function Documentation

8.14.3.1 template<typename CollectType , typename value_type > void collect_insert (CollectType & *collect_in,* value_type & *elem*) [friend]

Definition at line 99 of file body_force_collect.hh.

Referenced by perform_insert_action().

8.14.3.2 template<typename CollectType , typename value_type > void collect_push_back (CollectType & *collect_in,* value_type & *elem*) [friend]

Definition at line 131 of file body_force_collect.hh.

Referenced by push_back().

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

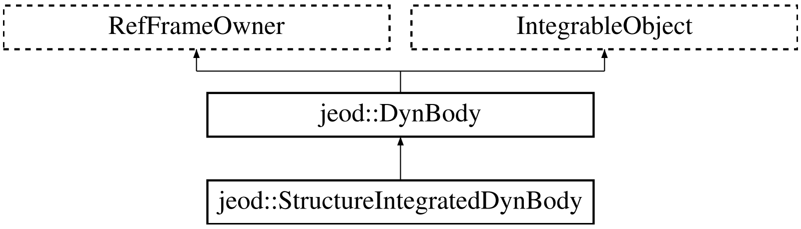
- body_force_collect.hh

8.15 jeod::StructureIntegratedDynBody Class Reference

Extends DynBody to integrate an object's structural reference frame as opposed to its center of mass.

```
#include <structure_integrated_dyn_body.hh>
```

Inheritance diagram for jeod::StructureIntegratedDynBody:



Public Member Functions

- StructureIntegratedDynBody ()

  Constructor.
- ∼StructureIntegratedDynBody () override

  Destructor.
- void collect_forces_and_torques () override

  Compute the rotational and translational accelerations that result from the collected forces and torques acting on the vehicle.
- void set_solver (DynBodyConstraintsSolver &solver_in)

  Set the solver to be used to solve contraints.
- void add_constraint (DynBodyConstraint ∗constraint)

  Add a constraint to the constraints solver.
- virtual void solve_constraints ()

  Solve for constraint forces and torques acting on the vehicle and apply them to the vehicle.
- void compute_vehicle_point_derivatives (const BodyRefFrame &frame, FrameDerivs &derivs) override

  Compute the state derivatives at a vehicle point.
- bool detach (DynBody &other_body) override

  Break the logical connectivity between parent and child.

Data Fields

- BodyWrenchCollect effector_wrench_collection

  Collection of effector wrenches.

Protected Member Functions

- void attach_update_properties (const double offset_pstr_cstr_pstr[3], const double T_pstr_cstr[3][3], DynBody &child) override

  Set the relation between parent and child and update the mass properties.
- const VehicleProperties & get_vehicle_properties () const

  Get the vehicle properties as a const reference.
- er7_utils::IntegratorResult trans_integ (double dyn_dt, unsigned int target_stage) override

Integrate the translational state of a StructureIntegratedDynBody.

- er7_utils::IntegratorResult rot_integ (double dyn_dt, unsigned int target_stage) override

  Integrate the rotational state of a StructureIntegratedDynBody.
- void collect_local_forces_and_torques ()

  Collect the local forces and torques that directly act on the vehicle.
- void PropagateForcesAndTorques ()

  Propagate forces and torques up the kinematic chain.
- void compute_inertial_torque ()

  Compute the inertial torque.
- void compute_rotational_acceleration ()

  Compute the body- and structure-referenced rotational acceleration.
- void compute_translational_acceleration ()

  Compute the inertial-referenced translational acceleration vector.
- void complete_translational_acceleration ()

  Finalize computation of the inertial-referenced translational acceleration vector.

Protected Attributes

- DynBodyConstraintsSolver ∗ constraints_solver

  The solver for constraint forces and torques, if there are any.
- Wrench effector_wrench

  Wrench into which the effector wrenches are accumulated.
- FrameDerivs struct_derivs

  Translational/rotational accelerations of the structural frame.
- VehicleProperties vehicle_properties

  Various properties of the vehicle, for the constraints solver.
- VehicleNonGravState non_grav_state

  Rotational and translational behaviors, for the constraints solver.
- double inertial_accel_struct_omega [3]

  Structure-referenced inertial acceleration at the structure frame origin due to vehicle angular velocity.
- double inertial_accel_struct_omega_dot [3]

  Structure-referenced inertial acceleration at the structure frame origin due to vehicle angular acceleration.
- double inertial_accel_struct [3]

  Structure-referenced inertial acceleration at the structure frame origin.
- double inertial_accel_inrtl [3]

  Inertial-referenced inertial acceleration at the structure frame origin.

Private Member Functions

- StructureIntegratedDynBody (const StructureIntegratedDynBody &)

  Not implemented.
- StructureIntegratedDynBody & operator= (const StructureIntegratedDynBody &)

  Not implemented.

Friends

- class InputProcessor
- class DynBodyConstraintsSolver
- void init_attrjeod__StructureIntegratedDynBody ()

8.15.1 Detailed Description

Extends DynBody to integrate an object's structural reference frame as opposed to its center of mass.

In addition to structure integration, this class introduces two new concepts, wrenches and constrained objects. A wrench encapsulates a force applied at a point and a torque, with the torque induced by the force due to an off-centerline force direction automatically calculated by JEOD. A constrained object is an object that lies outside the DynBody system boundary that exchanges translational and/or rotational momentum with the DynBody and that is somehow constrained by the translation and/or rotational behavior of the DynBody.

These new concepts might be migrated up the DynBody inheritance chain in subsequent releases of JEOD.

Definition at line 91 of file structure_integrated_dyn_body.hh.

8.15.2 Constructor & Destructor Documentation

8.15.2.1 jeod::StructureIntegratedDynBody::StructureIntegratedDynBody ( )

Constructor.

Definition at line 36 of file structure_integrated_dyn_body.cc.

References jeod::DynBody::integrated_frame, and jeod::DynBody::structure.

8.15.2.2 jeod::StructureIntegratedDynBody::∼StructureIntegratedDynBody ( ) [override]

Destructor.

Definition at line 59 of file structure_integrated_dyn_body.cc.

8.15.2.3 jeod::StructureIntegratedDynBody::StructureIntegratedDynBody (const **StructureIntegratedDynBody** &) [private]

Not implemented.

8.15.3 Member Function Documentation

8.15.3.1 void jeod::StructureIntegratedDynBody::add_constraint (DynBodyConstraint ∗ *constraint*)

Add a constraint to the constraints solver.

Note

> Both the constraint and the solver must be non-null.

Parameters

constraint	The constraint to be added to the solver.

Definition at line 125 of file structure_integrated_dyn_body_solve.cc.

References constraints_solver, and jeod::DynBodyMessages::invalid_body.

8.15.3.2 void jeod::StructureIntegratedDynBody::attach_update_properties (const double *offset_pstr_cstr_pstr[3]*, const double *T_pstr_cstr[3][3]*, **DynBody** & *child*) [override], [protected], [virtual]

Set the relation between parent and child and update the mass properties.

Parameters

in	*offset_pstr_cstr-_pstr*	Location of the child body's structural origin with respect to the parent body's structural origin, specified in structural coordinates of the parent body.
in	*T_pstr_cstr*	Transformation matrix from the parent body's structural frame to the child body's structural frame.
in,out	*child*	The child body being attached to this body.

Reimplemented from jeod::DynBody.

Definition at line 37 of file structure_integrated_dyn_body_solve.cc.

References jeod::DynBody::attach_update_properties(), constraints_solver, jeod::DynBodyMessages::invalid_attachment, jeod::DynBody::name, and vehicle_properties.

8.15.3.3 void jeod::StructureIntegratedDynBody::collect_forces_and_torques ( ) [override], [virtual]

Compute the rotational and translational accelerations that result from the collected forces and torques acting on the vehicle.

This function should be called as a derivative class job, with a moderately high phase number. Functions that calculate the gravitational acceleration and the effector, environmental, and non-transmitted forces and torques should be called as scheduled jobs or as lower phase derivative class jobs.

Reimplemented from jeod::DynBody.

Definition at line 77 of file structure_integrated_dyn_body_collect.cc.

References jeod::DynBody::collect, collect_local_forces_and_torques(), compute_inertial_torque(), compute_rotational_acceleration(), compute_translational_acceleration(), jeod::DynBody::derivs, jeod::DynBody::dyn_children, jeod::DynBody::dyn_parent, jeod::BodyForceCollect::effector_forc, jeod::BodyForceCollect::effector_torq, effector_wrench, jeod::BodyForceCollect::environ_forc, jeod::BodyForceCollect::environ_torq, jeod::BodyForceCollect::extern_forc_inrtl, jeod::BodyForceCollect::extern_forc_struct, jeod::BodyForceCollect::extern_torq_body, jeod::BodyForceCollect::extern_torq_struct, jeod::Wrench::get_force(), jeod::Wrench::get_torque(), jeod::BodyForceCollect::inertial_torq, jeod::DynBody::mass, jeod::BodyForceCollect::no_xmit_forc, jeod::BodyForceCollect::no_xmit_torq, jeod::FrameDerivs::non_grav_accel, PropagateForcesAndTorques(), jeod::FrameDerivs::rot_accel, jeod::DynBody::rotational_dynamics, struct_derivs, jeod::FrameDerivs::trans_accel, jeod::Wrench::transform_to_point(), and jeod::DynBody::translational_dynamics.

8.15.3.4 void jeod::StructureIntegratedDynBody::collect_local_forces_and_torques ( ) [protected]

Collect the local forces and torques that directly act on the vehicle.

Definition at line 180 of file structure_integrated_dyn_body_collect.cc.

References jeod::BodyWrenchCollect::accumulate(), jeod::accumulate_forces(), jeod::accumulate_torques(), jeod::DynBody::collect, jeod::BodyForceCollect::collect_effector_forc, jeod::BodyForceCollect::collect_effector_torq, jeod::BodyForceCollect::collect_environ_forc, jeod::BodyForceCollect::collect_environ_torq, jeod::BodyForceCollect::collect_no_xmit_forc, jeod::BodyForceCollect::collect_no_xmit_torq, jeod::BodyForceCollect::effector_forc, jeod::BodyForceCollect::effector_torq, effector_wrench, effector_wrench_collection, jeod::BodyForceCollect::environ_forc, jeod::BodyForceCollect::environ_torq, jeod::BodyForceCollect::no_xmit_forc, jeod::BodyForceCollect::no_xmit_torq, jeod::Wrench::reset_force_and_torque(), jeod::DynBody::rotational_dynamics, and jeod::DynBody::translational_dynamics.

Referenced by collect_forces_and_torques().

8.15.3.5 void jeod::StructureIntegratedDynBody::complete_translational_acceleration ( ) [protected]

Finalize computation of the inertial-referenced translational acceleration vector.

Definition at line 417 of file structure_integrated_dyn_body_collect.cc.

References jeod::DynBody::derivs, jeod::DynBody::grav_interaction, inertial_accel_inrtl, inertial_accel_struct, inertial_accel_struct_omega, inertial_accel_struct_omega_dot, jeod::DynBody::mass, jeod::FrameDerivs::non_grav_accel, jeod::FrameDerivs::rot_accel, struct_derivs, jeod::DynBody::structure, and jeod::FrameDerivs::trans_accel.

Referenced by compute_translational_acceleration(), and solve_constraints().

8.15.3.6 void jeod::StructureIntegratedDynBody::compute_inertial_torque ( ) [protected]

Compute the inertial torque.

Definition at line 330 of file structure_integrated_dyn_body_collect.cc.

References jeod::DynBody::collect, jeod::BodyForceCollect::inertial_torq, jeod::DynBody::mass, and jeod::DynBody::structure.

Referenced by collect_forces_and_torques().

8.15.3.7 void jeod::StructureIntegratedDynBody::compute_rotational_acceleration ( ) [protected]

Compute the body- and structure-referenced rotational acceleration.

Definition at line 355 of file structure_integrated_dyn_body_collect.cc.

References jeod::DynBody::collect, jeod::DynBody::derivs, jeod::BodyForceCollect::extern_torq_body, jeod::BodyForceCollect::extern_torq_struct, jeod::BodyForceCollect::inertial_torq, jeod::DynBody::mass, jeod::FrameDerivs::rot_accel, and struct_derivs.

Referenced by collect_forces_and_torques().

8.15.3.8 void jeod::StructureIntegratedDynBody::compute_translational_acceleration ( ) [protected]

Compute the inertial-referenced translational acceleration vector.

Definition at line 387 of file structure_integrated_dyn_body_collect.cc.

References jeod::DynBody::collect, complete_translational_acceleration(), jeod::DynBody::derivs, jeod::BodyForceCollect::extern_forc_inrtl, jeod::BodyForceCollect::extern_forc_struct, inertial_accel_struct_omega, jeod::DynBody::mass, jeod::FrameDerivs::non_grav_accel, and jeod::DynBody::structure.

Referenced by collect_forces_and_torques().

8.15.3.9 void jeod::StructureIntegratedDynBody::compute_vehicle_point_derivatives (const **BodyRefFrame** & *frame*, **FrameDerivs** & *derivs*) [override], [virtual]

Compute the state derivatives at a vehicle point.

Parameters

frame	The vehicle point, as a BodyRefFrame, at which derivatives are to be calculated.
derivs	The calculated derivatives.

Reimplemented from jeod::DynBody.

Definition at line 33 of file structure_integrated_dyn_body_pt_accel.cc.

References jeod::DynBody::composite_body, jeod::DynBody::get_root_body(), jeod::DynBody::grav_interaction, jeod::DynBodyMessages::invalid_frame, jeod::DynBody::mass, jeod::BodyRefFrame::mass_point, jeod::DynBody::name, jeod::FrameDerivs::non_grav_accel, jeod::FrameDerivs::Qdot_parent_this, jeod::FrameDerivs::rot_accel, struct_derivs, jeod::DynBody::structure, and jeod::FrameDerivs::trans_accel.

8.15.3.10 bool jeod::StructureIntegratedDynBody::detach (DynBody & *other_body*) [override], [virtual]

Break the logical connectivity between parent and child.

Parameters

in,out	*other_body*	The other body to detach from

Reimplemented from jeod::DynBody.

Definition at line 70 of file structure_integrated_dyn_body_solve.cc.

References constraints_solver, detach(), jeod::DynBody::detach(), jeod::DynBody::get_parent_body(), jeod::DynBodyMessages::invalid_attachment, jeod::DynBody::name, and vehicle_properties.

Referenced by detach().

8.15.3.11 const VehicleProperties& jeod::StructureIntegratedDynBody::get_vehicle_properties ( ) const [inline], [protected]

Get the vehicle properties as a const reference.

Definition at line 269 of file structure_integrated_dyn_body.hh.

References vehicle_properties.

8.15.3.12 StructureIntegratedDynBody& jeod::StructureIntegratedDynBody::operator= (const StructureIntegratedDynBody &) [private]

Not implemented.

8.15.3.13 void jeod::StructureIntegratedDynBody::PropagateForcesAndTorques ( ) [protected]

Propagate forces and torques up the kinematic chain.

Definition at line 236 of file structure_integrated_dyn_body_collect.cc.

References jeod::DynBody::collect, jeod::DynBody::composite_body, jeod::DynBody::dyn_parent, jeod::BodyForceCollect::effector_forc, jeod::BodyForceCollect::effector_torq, effector_wrench, jeod::BodyForceCollect::environ_forc, jeod::BodyForceCollect::environ_torq, jeod::DynBody::mass, jeod::DynBody::rotational_dynamics, jeod::DynBody::structure, jeod::Wrench::transform_to_parent(), and jeod::DynBody::translational_dynamics.

Referenced by collect_forces_and_torques().

8.15.3.14 er7_utils::IntegratorResult jeod::StructureIntegratedDynBody::rot_integ (double *dyn_dt*, unsigned int *target_stage*) [override], [protected], [virtual]

Integrate the rotational state of a StructureIntegratedDynBody.

Parameters

in	*dyn_dt*	Dynamic time step, in dynamic time seconds.
in	*target_stage*	The stage of the integration process that the integrator should try to attain.

Returns

The status (time advance, pass/fail status) of the integration.

Reimplemented from jeod::DynBody.

Definition at line 52 of file structure_integrated_dyn_body_integration.cc.

References jeod::DynBody::derivs, jeod::FrameDerivs::Qdot_parent_this, jeod::FrameDerivs::rot_accel, jeod::DynBody::rot_integrator, struct_derivs, and jeod::DynBody::structure.

8.15.3.15 void jeod::StructureIntegratedDynBody::set_solver (DynBodyConstraintsSolver & *solver_in*)

Set the solver to be used to solve contraints.

Definition at line 108 of file structure_integrated_dyn_body_solve.cc.

References constraints_solver, jeod::DynBodyMessages::invalid_body, and jeod::DynBody::name.

8.15.3.16 void jeod::StructureIntegratedDynBody::solve_constraints ( ) [virtual]

Solve for constraint forces and torques acting on the vehicle and apply them to the vehicle.

This function should be called as a derivative class job, with a very high phase number. Functions that calculate the constraints should be called as derivative class jobs with a phase intermediate between that of collect_forces_and_torques and of this function.

Definition at line 142 of file structure_integrated_dyn_body_solve.cc.

References jeod::VehicleNonGravState::accel_struct, jeod::DynBody::collect, complete_translational_acceleration(), jeod::DynBody::composite_body, constraints_solver, jeod::DynBody::derivs, jeod::DynBody::dyn_parent, jeod::BodyForceCollect::extern_forc_struct, jeod::BodyForceCollect::inertial_torq, jeod::VehicleNonGravState::inertial_torque_struct, jeod::DynBodyMessages::invalid_body, jeod::DynBody::mass, jeod::FrameDerivs::non_grav_accel, non_grav_state, jeod::VehicleNonGravState::omega_body, jeod::VehicleNonGravState::omega_dot_body, jeod::VehicleNonGravState::omega_dot_struct, jeod::VehicleNonGravState::omega_struct, jeod::FrameDerivs::rot_accel, jeod::DynBody::rotational_dynamics, struct_derivs, jeod::DynBody::structure, jeod::DynBody::translational_dynamics, and vehicle_properties.

8.15.3.17 er7_utils::IntegratorResult jeod::StructureIntegratedDynBody::trans_integ (double *dyn_dt,* unsigned int *target_stage*) [override], [protected], [virtual]

Integrate the translational state of a StructureIntegratedDynBody.

Parameters

in	*dyn_dt*	Dynamic time step, in dynamic time seconds.
in	*target_stage*	The stage of the integration process that the integrator should try to attain.

Returns

The status (time advance, pass/fail status) of the integration.

Reimplemented from jeod::DynBody.

Definition at line 38 of file structure_integrated_dyn_body_integration.cc.

References struct_derivs, jeod::DynBody::structure, jeod::FrameDerivs::trans_accel, and jeod::DynBody::trans_integrator.

8.15.4 Friends And Related Function Documentation

8.15.4.1 friend class DynBodyConstraintsSolver [friend]

Definition at line 95 of file structure_integrated_dyn_body.hh.

8.15.4.2 void init_attrjeod__StructureIntegratedDynBody ( ) [friend]

8.15.4.3 friend class InputProcessor [friend]

Definition at line 93 of file structure_integrated_dyn_body.hh.

8.15.5 Field Documentation

8.15.5.1 DynBodyConstraintsSolver* jeod::StructureIntegratedDynBody::constraints_solver [protected]

The solver for constraint forces and torques, if there are any.

This needs to be assigned prior to initialization time in simulations that invoke member function solve_constraints() during runtime. This can be left unassigned (null) in simulations that do not have vehicular constraints.trick_units(–)

Definition at line 200 of file structure_integrated_dyn_body.hh.

Referenced by add_constraint(), attach_update_properties(), detach(), set_solver(), and solve_constraints().

8.15.5.2 Wrench jeod::StructureIntegratedDynBody::effector_wrench [protected]

Wrench into which the effector wrenches are accumulated.

trick_units(–)

Definition at line 205 of file structure_integrated_dyn_body.hh.

Referenced by collect_forces_and_torques(), collect_local_forces_and_torques(), and PropagateForcesAndTorques().

8.15.5.3 BodyWrenchCollect jeod::StructureIntegratedDynBody::effector_wrench_collection

Collection of effector wrenches.

The effector wrenches are assembled into the collection at the S_define level via

```
vcollect containing_body.effector_wrench_collection.collect_wrench {
    pointer_to_wrench1,
    ...
    pointer_to_wrench_n
};
```

The collected effector wrenches are processed by the collect_forces_and_torques member function.

Note: For completion, there probably should be collected environmental and non-transmitted wrenches as well as effector wrenches.trick_units(–)

Definition at line 118 of file structure_integrated_dyn_body.hh.

Referenced by collect_local_forces_and_torques().

8.15.5.4 double jeod::StructureIntegratedDynBody::inertial_accel_inrtl[3] [protected]

Inertial-referenced inertial acceleration at the structure frame origin.

trick_units(m/s2)

Definition at line 242 of file structure_integrated_dyn_body.hh.

Referenced by complete_translational_acceleration().

8.15.5.5 double jeod::StructureIntegratedDynBody::inertial_accel_struct[3] [protected]

Structure-referenced inertial acceleration at the structure frame origin.

trick_units(m/s2)

Definition at line 237 of file structure_integrated_dyn_body.hh.

Referenced by complete_translational_acceleration().

8.15.5.6 double jeod::StructureIntegratedDynBody::inertial_accel_struct_omega[3] [protected]

Structure-referenced inertial acceleration at the structure frame origin due to vehicle angular velocity.

trick_units(m/s2)

Definition at line 226 of file structure_integrated_dyn_body.hh.

Referenced by complete_translational_acceleration(), and compute_translational_acceleration().

8.15.5.7 double jeod::StructureIntegratedDynBody::inertial_accel_struct_omega_dot[3] [protected]

Structure-referenced inertial acceleration at the structure frame origin due to vehicle angular acceleration.

trick_units(m/s2)

Definition at line 232 of file structure_integrated_dyn_body.hh.

Referenced by complete_translational_acceleration().

8.15.5.8 VehicleNonGravState jeod::StructureIntegratedDynBody::non_grav_state [protected]

Rotational and translational behaviors, for the constraints solver.

trick_units(–)

Definition at line 220 of file structure_integrated_dyn_body.hh.

Referenced by solve_constraints().

8.15.5.9 FrameDerivs jeod::StructureIntegratedDynBody::struct_derivs [protected]

Translational/rotational accelerations of the structural frame.

trick_units(–)

Definition at line 210 of file structure_integrated_dyn_body.hh.

Referenced by collect_forces_and_torques(), complete_translational_acceleration(), compute_rotational_acceleration(), compute_vehicle_point_derivatives(), rot_integ(), solve_constraints(), and trans_integ().

8.15.5.10 VehicleProperties jeod::StructureIntegratedDynBody::vehicle_properties [protected]

Various properties of the vehicle, for the constraints solver.

trick_units(–)

Definition at line 215 of file structure_integrated_dyn_body.hh.

Referenced by attach_update_properties(), detach(), get_vehicle_properties(), and solve_constraints().

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

- structure_integrated_dyn_body.hh
- structure_integrated_dyn_body.cc
- structure_integrated_dyn_body_collect.cc
- structure_integrated_dyn_body_integration.cc
- structure_integrated_dyn_body_pt_accel.cc
- structure_integrated_dyn_body_solve.cc

8.16 jeod::Torque Class Reference

A Torque represents a Newtonian torque that acts on a DynBody.

`#include <torque.hh>`

Public Member Functions

- Torque ()

  Torque default constructor.
- virtual ∼Torque ()

  Torque destructor.
- double & operator[] (const unsigned int index)

  Access a torque element, non-const version.
- double operator[] (const unsigned int index) const

  Access a torque element, const version.

Data Fields

- bool active

  Is this torque active?
- double torque [3]

  Torque vector.

Private Member Functions

- Torque (const Torque &)

  Not implemented.
- Torque & operator= (const Torque &)

  Not implemented.

8.16.1 Detailed Description

A Torque represents a Newtonian torque that acts on a DynBody.

The class encapsulates an active flag and a 3-vector that contains the torque components. Torques are collected in one of a DynBody object's torque collection STL vectors. The torque vector is expressed in the structural frame of that DynBody object.

The Torque class is the recommended mechanism for representing torques in JEOD. While 3-vectors can also be collected into a collect STL vector, theee is is no way to turn off these collected 3-vectors. Even worse, there is no way to tell whether a collected 3-vector does indeed represent a torque, or even if it is a 3-vector. In comparison, Torque objects can be turned on and off, and more importantly, they are type-safe.

Definition at line 82 of file torque.hh.

8.16.2 Constructor & Destructor Documentation

8.16.2.1 jeod::Torque::Torque (void)

Torque default constructor.

Definition at line 44 of file torque.cc.

References torque.

8.16.2.2 jeod::Torque::∼Torque (void) [virtual]

Torque destructor.

Definition at line 56 of file torque.cc.

8.16.2.3 jeod::Torque::Torque (const Torque &) [private]

Not implemented.

8.16.3 Member Function Documentation

8.16.3.1 Torque& jeod::Torque::operator= (const Torque &) [private]

Not implemented.

8.16.3.2 double & jeod::Torque::operator[] (const unsigned int *index*) [inline]

Access a torque element, non-const version.

Returns

Torque component at specified index
Units: NM

Parameters

in	*index*	Index number

Definition at line 76 of file torque_inline.hh.

References torque.

8.16.3.3 double jeod::Torque::operator[] (const unsigned int *index*) const [inline]

Access a torque element, const version.

Returns

Torque component at specified index
Units: NM

Parameters

in	*index*	Index number

Definition at line 89 of file torque_inline.hh.

References torque.

8.16.4 Field Documentation

8.16.4.1 bool jeod::Torque::active

Is this torque active?

trick_units(–)

Definition at line 97 of file torque.hh.

8.16.4.2 double jeod::Torque::torque[3]

Torque vector.

trick_units(N∗m)

Definition at line 101 of file torque.hh.

Referenced by operator[](), and Torque().

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

- torque.hh
- torque_inline.hh
- torque.cc

8.17 jeod::VehicleNonGravState Class Reference

Encapsulates various aspects of a vehicle's state with respect to inertial.

```
#include <vehicle_non_grav_state.hh>
```

Data Fields

- double omega_body [3]

  Vehicle angular velocity with respect to inertial, in root body body frame coordinates.
- double omega_struct [3]

  Vehicle angular velocity with respect to inertial, in root body structural frame coordinates.
- double omega_dot_body [3]

  Vehicle angular acceleration with respect to inertial, in root body body frame coordinates.
- double omega_dot_struct [3]

  Vehicle angular acceleration with respect to inertial, in root body structural frame coordinates.
- double inertial_torque_struct [3]

  Vehicle inertial torque (w x Iw) in root body structural coordinates.
- double accel_struct [3]

  Vehicle non-gravitational translational acceleration at the center of mass, in root body structural frame coordinates.

Friends

- class InputProcessor
- void init_attrjeod__VehicleNonGravState ()

8.17.1 Detailed Description

Encapsulates various aspects of a vehicle's state with respect to inertial.

Definition at line 67 of file vehicle_non_grav_state.hh.

8.17.2 Friends And Related Function Documentation

8.17.2.1 void init_attrjeod__VehicleNonGravState ( ) [friend]

8.17.2.2 friend class InputProcessor [friend]

Definition at line 69 of file vehicle_non_grav_state.hh.

8.17.3 Field Documentation

8.17.3.1 double jeod::VehicleNonGravState::accel_struct[3]

Vehicle non-gravitational translational acceleration at the center of mass, in root body structural frame coordinates.

trick_units(m/s^2)

Definition at line 106 of file vehicle_non_grav_state.hh.

Referenced by jeod::StructureIntegratedDynBody::solve_constraints().

8.17.3.2 double jeod::VehicleNonGravState::inertial_torque_struct[3]

Vehicle inertial torque (w x Iw) in root body structural coordinates.

trick_units(N∗m)

Definition at line 100 of file vehicle_non_grav_state.hh.

Referenced by jeod::StructureIntegratedDynBody::solve_constraints().

8.17.3.3 double jeod::VehicleNonGravState::omega_body[3]

Vehicle angular velocity with respect to inertial, in root body body frame coordinates.

trick_units(1/s)

Definition at line 77 of file vehicle_non_grav_state.hh.

Referenced by jeod::StructureIntegratedDynBody::solve_constraints().

8.17.3.4 double jeod::VehicleNonGravState::omega_dot_body[3]

Vehicle angular acceleration with respect to inertial, in root body body frame coordinates.

trick_units(1/s^2)

Definition at line 89 of file vehicle_non_grav_state.hh.

Referenced by jeod::StructureIntegratedDynBody::solve_constraints().

8.17.3.5 double jeod::VehicleNonGravState::omega_dot_struct[3]

Vehicle angular acceleration with respect to inertial, in root body structural frame coordinates.

trick_units(1/s^2)

Definition at line 95 of file vehicle_non_grav_state.hh.

Referenced by jeod::StructureIntegratedDynBody::solve_constraints().

8.17.3.6 double jeod::VehicleNonGravState::omega_struct[3]

Vehicle angular velocity with respect to inertial, in root body structural frame coordinates.

trick_units(1/s)

Definition at line 83 of file vehicle_non_grav_state.hh.

Referenced by jeod::StructureIntegratedDynBody::solve_constraints().

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

- vehicle_non_grav_state.hh

8.18 jeod::VehicleProperties Class Reference

Captures pointers to various vehicle properties that are commonly used in the constraint concept.

```
#include <vehicle_properties.hh>
```

Public Member Functions

- VehicleProperties ()

  Default constructor, for use by Trick only.
- VehicleProperties (SolverTypes::Vector3RefT parent_to_structure_offset_in, SolverTypes::Matrix3x3RefT parent_to_structure_transform_in, double &mass_in, SolverTypes::Vector3RefT structure_to_body_offset_in, SolverTypes::Matrix3x3RefT inertia_in, SolverTypes::Matrix3x3RefT structure_to_body_transform_in, double &inverse_mass_in, SolverTypes::Matrix3x3RefT inverse_inertia_in)

  Non-default constructor that sets all elements.
- SolverTypes::ConstDecayedVector3T get_parent_to_structure_offset () const
- SolverTypes::ConstMatrix3x3RefT get_parent_to_structure_transform () const
- double get_mass () const
- SolverTypes::ConstDecayedVector3T get_structure_to_body_offset () const
- SolverTypes::ConstMatrix3x3RefT get_inertia () const
- SolverTypes::Matrix3x3RefT get_structure_to_body_transform () const
- double get_inverse_mass () const
- SolverTypes::Matrix3x3RefT get_inverse_inertia () const

Private Attributes

- SolverTypes::Vector3PointerT parent_to_structure_offset

  Pointer to the vehicle's structure_point.position vector.
- SolverTypes::Matrix3x3PointerT parent_to_structure_transform

  Pointer to the vehicle's structure_point.T_parent_this matrix.
- double ∗ mass

  Pointer to the vehicle's composite_properties.mass member.
- SolverTypes::Vector3PointerT structure_to_body_offset

  Pointer to the vehicle's composite_properties.position vector.
- SolverTypes::Matrix3x3PointerT inertia

  Pointer to the vehicle's composite_properties.inertia tensor.
- SolverTypes::Matrix3x3PointerT structure_to_body_transform

  Pointer to the vehicle's composite_properties.T_parent_this matrix.
- double ∗ inverse_mass

  Pointer to the vehicle's inverse_mass member.
- SolverTypes::Matrix3x3PointerT inverse_inertia

  Pointer to the vehicle's inverse_inertia member.

Friends

- class InputProcessor
- void init_attrjeod__VehicleProperties ()

8.18.1 Detailed Description

Captures pointers to various vehicle properties that are commonly used in the constraint concept.

As this is potentially quite dangerous, access to the captured members is limited to const getters.

This class is not designed for extensibility.

Definition at line 73 of file vehicle_properties.hh.

8.18.2 Constructor & Destructor Documentation

8.18.2.1 jeod::VehicleProperties::VehicleProperties ( ) [inline]

Default constructor, for use by Trick only.

Definition at line 89 of file vehicle_properties.hh.

8.18.2.2 jeod::VehicleProperties::VehicleProperties (SolverTypes::Vector3RefT *parent_to_structure_offset_in,* SolverTypes::Matrix3x3RefT *parent_to_structure_transform_in,* double & *mass_in,* SolverTypes::Vector3RefT *structure_to_body_offset_in,* SolverTypes::Matrix3x3RefT *inertia_in,* SolverTypes::Matrix3x3RefT *structure_to_body_transform_in,* double & *inverse_mass_in,* SolverTypes::Matrix3x3RefT *inverse_inertia_in*) [inline]

Non-default constructor that sets all elements.

Parameters

parent_to_structure_offset_in	Reference to the vehicle's structure_point.position vector.
parent_to_structure_transform_in	Reference to the vehicle's structure_point.T_parent_this matrix.
mass_in	Reference to the vehicle's composite_properties.mass member.
structure_to_body_offset_in	Reference to the vehicle's composite_properties.position vector.
inertia_in	Reference to the vehicle's composite_properties.inertia tensor.
structure_to_body_transform_in	Reference to the vehicle's composite_properties.T_parent_this matrix.
inverse_mass_in	Reference to the vehicle's inverse_mass member.
inverse_inertia_in	Reference to the vehicle's inverse_inertia member.

Definition at line 121 of file vehicle_properties.hh.

8.18.3 Member Function Documentation

8.18.3.1 SolverTypes::ConstMatrix3x3RefT jeod::VehicleProperties::get_inertia ( ) const [inline]

Returns

Const reference to the vehicle's inertia tensor, in vehicle body frame coordinates.

Definition at line 190 of file vehicle_properties.hh.

References inertia.

8.18.3.2 SolverTypes::Matrix3x3RefT jeod::VehicleProperties::get_inverse_inertia ( ) const [inline]

Returns

Const reference to the inverse of the vehicle's inertia tensor, in vehicle body frame coordinates.

Definition at line 216 of file vehicle_properties.hh.

References inverse_inertia.

8.18.3.3 double jeod::VehicleProperties::get_inverse_mass ( ) const [inline]

Returns

The multiplicative inverse of the vehicle's mass.

Definition at line 207 of file vehicle_properties.hh.

References inverse_mass.

8.18.3.4 double jeod::VehicleProperties::get_mass ( ) const [inline]

Returns

The vehicle mass.

Definition at line 171 of file vehicle_properties.hh.

References mass.

8.18.3.5 SolverTypes::ConstDecayedVector3T jeod::VehicleProperties::get_parent_to_structure_offset ( ) const [inline]

Returns

Const reference to the offset from the parent vehicle's structural frame origin to this vehicle's structural origin, in parent structural coordinates.

Definition at line 154 of file vehicle_properties.hh.

References parent_to_structure_offset.

8.18.3.6 SolverTypes::ConstMatrix3x3RefT jeod::VehicleProperties::get_parent_to_structure_transform ( ) const [inline]

Returns

Const reference to the transformation matrix from the parent vehicle's structural frame to this vehicle's structural frame.

Definition at line 163 of file vehicle_properties.hh.

References parent_to_structure_transform.

8.18.3.7 SolverTypes::ConstDecayedVector3T jeod::VehicleProperties::get_structure_to_body_offset ( ) const [inline]

Returns

Const reference to the offset from the origin of the vehicle's structural frame to the vehicle's center of mass, in vehicle structural coordinates.

Definition at line 181 of file vehicle_properties.hh.

References structure_to_body_offset.

8.18.3.8 SolverTypes::Matrix3x3RefT jeod::VehicleProperties::get_structure_to_body_transform ( ) const [inline]

Returns

Const reference to the transformation matrix from the vehicle's structural frame to its body frame.

Definition at line 199 of file vehicle_properties.hh.

References structure_to_body_transform.

8.18.4 Friends And Related Function Documentation

8.18.4.1 void init_attrjeod__VehicleProperties ( ) [friend]

8.18.4.2 friend class InputProcessor [friend]

Definition at line 79 of file vehicle_properties.hh.

8.18.5 Field Documentation

8.18.5.1 SolverTypes::Matrix3x3PointerT jeod::VehicleProperties::inertia [private]

Pointer to the vehicle's composite_properties.inertia tensor.

trick_units(m^2∗kg)

Definition at line 248 of file vehicle_properties.hh.

Referenced by get_inertia().

8.18.5.2 SolverTypes::Matrix3x3PointerT jeod::VehicleProperties::inverse_inertia [private]

Pointer to the vehicle's inverse_inertia member.

trick_units(1/kg/m^2)

Definition at line 263 of file vehicle_properties.hh.

Referenced by get_inverse_inertia().

8.18.5.3 double∗ jeod::VehicleProperties::inverse_mass [private]

Pointer to the vehicle's inverse_mass member.

trick_units(1/kg)

Definition at line 258 of file vehicle_properties.hh.

Referenced by get_inverse_mass().

8.18.5.4 double∗ jeod::VehicleProperties::mass [private]

Pointer to the vehicle's composite_properties.mass member.

trick_units(kg)

Definition at line 238 of file vehicle_properties.hh.

Referenced by get_mass().

8.18.5.5 SolverTypes::Vector3PointerT jeod::VehicleProperties::parent_to_structure_offset [private]

Pointer to the vehicle's structure_point.position vector.

trick_units(m)

Definition at line 228 of file vehicle_properties.hh.

Referenced by get_parent_to_structure_offset().

8.18.5.6 SolverTypes::Matrix3x3PointerT jeod::VehicleProperties::parent_to_structure_transform [private]

Pointer to the vehicle's structure_point.T_parent_this matrix.

trick_units(–)

Definition at line 233 of file vehicle_properties.hh.

Referenced by get_parent_to_structure_transform().

8.18.5.7 SolverTypes::Vector3PointerT jeod::VehicleProperties::structure_to_body_offset [private]

Pointer to the vehicle's composite_properties.position vector.

trick_units(m)

Definition at line 243 of file vehicle_properties.hh.

Referenced by get_structure_to_body_offset().

8.18.5.8 SolverTypes::Matrix3x3PointerT jeod::VehicleProperties::structure_to_body_transform [private]

Pointer to the vehicle's composite_properties.T_parent_this matrix.

trick_units(–)

Definition at line 253 of file vehicle_properties.hh.

Referenced by get_structure_to_body_transform().

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

- vehicle_properties.hh

8.19 jeod::Wrench Class Reference

A wrench comprises a torque and a force applied at a point on a DynBody.

```
#include <wrench.hh>
```

Public Member Functions

- Wrench (bool active_in=true)

  Default constructor.
- Wrench (const double torque_in[3], const double force_in[3], const double point_in[3], bool active_in=true)

  Non-default constructor that sets all elements of the wrench.
- Wrench (const double point_in[3], bool active_in=true)

  Non-default constructor that sets the point and active flag.
- virtual ∼Wrench ()=default

  Destructor.
- Wrench (const Wrench &)=default

  Copy constructor.
- Wrench & operator= (const Wrench &)=default

  Copy assignment operator.
- Wrench (Wrench &&)=default

  Move constructor.
- Wrench & operator= (Wrench &&)=default

  Move assignment operator.
- Wrench & operator+= (const Wrench &other)

  Increment this wrench by the other, but only if both are active.
- void activate ()

  Mark this wrench as active.
- void deactivate ()

  Mark this wrench as inactive.
- bool is_active () const

  Is this wrench active?
- void reset_force_and_torque ()

  Set the force and torque to zero.
- void reset_torque ()

  Set the torque to zero.
- void reset_force ()

  Set the force to zero.
- void reset_point ()

  Set the point to zero.
- void set (const double torque_in[3], const double force_in[3], const double point_in[3])

  Set all vector elements of the wrench.
- void set_torque (const double torque_in[3])

  Set the torque to the specified value.
- void set_force (const double force_in[3])

  Set the force to the specified value.
- void set_force (const double force_in[3], const double point_in[3])

  Set the force and the point of application to the specified values.
- void set_point (const double point_in[3])

  Set the point of application to the specified value.
- void scale_torque (double scale)

  Scale the torque by the specified value.
- void scale_force (double scale)

  Scale the force by the specified value.
- const double ∗ get_torque () const

  Const getter of the torque vector.
- const double ∗ get_force () const

Const getter of the force vector.

- const double ∗ get_point () const

  Const getter of the point vector.
- Wrench & accumulate (const std::vector< Wrench ∗ > &collection)

  Accumulate the wrenches in the collection to form a combined wrench about the current wrench point, which remains unchanged.
- Wrench & accumulate (const std::vector< Wrench ∗ > &collection, const double new_point[3])

  Accumulate the wrenches in the collection to form a combined wrench about the specified wrench point.
- Wrench transform_to_point (const double new_point[3]) const

  Construct an equivalent Wrench about the specified point.
- Wrench transform_to_parent (const MassPointState &point_state) const

  Construct an equivalent Wrench about the current point, but in a different reference frame.

Private Attributes

- double torque [3]

  The torque exerted on the DynBody by the force/torque agent, expressed in structural coordinates.
- double force [3]

  The force exerted on the DynBody by the force/torque agent, expressed in structural coordinates.
- double point [3]

  The structural coordinates of the point at which the force is applied.
- bool active

  Indicated whether the wrench is active (true) or inactive (false).

Friends

- class InputProcessor
- void init_attrjeod__Wrench ()

8.19.1 Detailed Description

A wrench comprises a torque and a force applied at a point on a DynBody.

The torque should not include the torque due to the application of the force.

A Trick simulation issues vcollect statements such as

```
vcollect vehicle.dyn_body.collect_wrench.collection
{
    wrench_model1.wrench,
    wrench_model2.wrench
};
```

Definition at line 81 of file wrench.hh.

8.19.2 Constructor & Destructor Documentation

8.19.2.1 jeod::Wrench::Wrench (bool *active_in* = `true`) [inline], [explicit]

Default constructor.

The wrench is marked as active, and the torque, force, and point vectors are all initialized to zero. This constructor can also be used as a non-default constructor that marks the wrench as inactive by calling it with one argument (a boolean) whose value is false.

Parameters

active_in	True (default) indicates the wrench is active.

Definition at line 97 of file wrench.hh.

References force, point, and torque.

8.19.2.2 jeod::Wrench::Wrench (const double *torque_in[3]*, const double *force_in[3]*, const double *point_in[3]*, bool *active_in* = true) [inline], [explicit]

Non-default constructor that sets all elements of the wrench.

Parameters

torque_in	The intrinsic torque for this wrench.
force_in	The force applied at the point.
point_in	The point at which forces are applied.
active_in	True (default) indicates the wrench is active.

Definition at line 114 of file wrench.hh.

References force, point, and torque.

8.19.2.3 jeod::Wrench::Wrench (const double *point_in[3]*, bool *active_in* = true) [inline], [explicit]

Non-default constructor that sets the point and active flag.

The torque and force and initialized to zero.

Parameters

point_in	The point at which forces are applied.
active_in	True (default) indicates the wrench is active.

Definition at line 133 of file wrench.hh.

References force, point, and torque.

8.19.2.4 virtual jeod::Wrench::∼Wrench ( ) [virtual], [default]

Destructor.

8.19.2.5 jeod::Wrench::Wrench (const Wrench &) [default]

Copy constructor.

8.19.2.6 jeod::Wrench::Wrench (Wrench &&) [default]

Move constructor.

8.19.3 Member Function Documentation

8.19.3.1 Wrench& jeod::Wrench::accumulate (const std::vector< Wrench ∗ > & *collection*) [inline]

Accumulate the wrenches in the collection to form a combined wrench about the current wrench point, which remains unchanged.

Parameters

collection	The wrenches to be accumulated.

Definition at line 372 of file wrench.hh.

References reset_force_and_torque().

Referenced by jeod::BodyWrenchCollect::accumulate(), and accumulate().

8.19.3.2 Wrench& jeod::Wrench::accumulate (const std::vector< Wrench ∗ > & *collection*, const double *new_point[3]*) [inline]

Accumulate the wrenches in the collection to form a combined wrench about the specified wrench point.

Parameters

collection	The wrenches to be accumulated.
new_point	The point about which the wrenches to be accumulated.

Definition at line 390 of file wrench.hh.

References accumulate(), and set_point().

8.19.3.3 void jeod::Wrench::activate ( ) [inline]

Mark this wrench as active.

Definition at line 198 of file wrench.hh.

References active.

8.19.3.4 void jeod::Wrench::deactivate ( ) [inline]

Mark this wrench as inactive.

Definition at line 207 of file wrench.hh.

References active.

8.19.3.5 const double∗ jeod::Wrench::get_force ( ) const [inline]

Const getter of the force vector.

Definition at line 352 of file wrench.hh.

References force.

Referenced by jeod::StructureIntegratedDynBody::collect_forces_and_torques().

8.19.3.6 const double∗ jeod::Wrench::get_point ( ) const [inline]

Const getter of the point vector.

Definition at line 361 of file wrench.hh.

References point.

8.19.3.7 const double∗ jeod::Wrench::get_torque ( ) const [inline]

Const getter of the torque vector.

Definition at line 343 of file wrench.hh.

References torque.

Referenced by jeod::StructureIntegratedDynBody::collect_forces_and_torques().

8.19.3.8 bool jeod::Wrench::is_active (void) const [inline]

Is this wrench active?

Definition at line 216 of file wrench.hh.

References active.

8.19.3.9 Wrench& jeod::Wrench::operator+= (const Wrench & *other*) [inline]

Increment this wrench by the other, but only if both are active.

The other wrench is effectively reseated to this wrench's point prior to incrementing.

Parameters

other	Wrench with which this wrench is to be incremented.

Returns

∗this.

Definition at line 180 of file wrench.hh.

References active, force, point, and torque.

8.19.3.10 Wrench& jeod::Wrench::operator= (const Wrench &) [default]

Copy assignment operator.

8.19.3.11 Wrench& jeod::Wrench::operator= (Wrench &&) [default]

Move assignment operator.

8.19.3.12 void jeod::Wrench::reset_force ( ) [inline]

Set the force to zero.

The torque and point remain unaltered.

Definition at line 244 of file wrench.hh.

References force.

8.19.3.13 void jeod::Wrench::reset_force_and_torque ( ) [inline]

Set the force and torque to zero.

The point remains unaltered.

Definition at line 225 of file wrench.hh.

References force, and torque.

Referenced by accumulate(), and jeod::StructureIntegratedDynBody::collect_local_forces_and_torques().

8.19.3.14 void jeod::Wrench::reset_point ( ) [inline]

Set the point to zero.

The torque and force remain unaltered.

Definition at line 253 of file wrench.hh.

References point.

8.19.3.15 void jeod::Wrench::reset_torque ( ) [inline]

Set the torque to zero.

The force and point remain unaltered.

Definition at line 235 of file wrench.hh.

References torque.

8.19.3.16 void jeod::Wrench::scale_force (double *scale*) [inline]

Scale the force by the specified value.

The torque and point of application remain unchanged.

Definition at line 334 of file wrench.hh.

References force.

8.19.3.17 void jeod::Wrench::scale_torque (double *scale*) [inline]

Scale the torque by the specified value.

The force and point of application remain unaltered.

Definition at line 324 of file wrench.hh.

References torque.

8.19.3.18 void jeod::Wrench::set (const double *torque_in[3],* const double *force_in[3],* const double *point_in[3]*) [inline]

Set all vector elements of the wrench.

Parameters

torque_in	The intrinsic torque for this wrench.
force_in	The force applied at the point.
point_in	The point at which forces are applied.

Definition at line 265 of file wrench.hh.

References force, point, and torque.

8.19.3.19 void jeod::Wrench::set_force (const double *force_in[3]*) [inline]

Set the force to the specified value.

The torque and point of application remain unchanged.

Definition at line 290 of file wrench.hh.

References force.

8.19.3.20 void jeod::Wrench::set_force (const double *force_in[3],* const double *point_in[3]*) [inline]

Set the force and the point of application to the specified values.

The torque remain unchanged.

Definition at line 300 of file wrench.hh.

References force, and point.

8.19.3.21 void jeod::Wrench::set_point (const double *point_in[3]*) [inline]

Set the point of application to the specified value.

The force and torque remain unchanged.

Definition at line 313 of file wrench.hh.

References point.

Referenced by jeod::BodyWrenchCollect::accumulate(), and accumulate().

8.19.3.22 void jeod::Wrench::set_torque (const double *torque_in[3]*) [inline]

Set the torque to the specified value.

The force and point of application remain unaltered.

Definition at line 280 of file wrench.hh.

References torque.

8.19.3.23 Wrench jeod::Wrench::transform_to_parent (const MassPointState & *point_state*) const [inline]

Construct an equivalent Wrench about the current point, but in a different reference frame.

Parameters

point_state	Contains the position and orientation of the current frame in the parent frame.

Returns

Equivalent wrench in the parent frame.

Definition at line 421 of file wrench.hh.

References force, point, and torque.

Referenced by jeod::StructureIntegratedDynBody::PropagateForcesAndTorques().

8.19.3.24 Wrench jeod::Wrench::transform_to_point (const double *new_point[3]*) const [inline]

Construct an equivalent Wrench about the specified point.

Parameters

new_point	The point about which this is to be represented.

Returns

Equivalent wrench about the specified point.

Definition at line 404 of file wrench.hh.

References active, force, point, and torque.

Referenced by jeod::StructureIntegratedDynBody::collect_forces_and_torques().

8.19.4 Friends And Related Function Documentation

8.19.4.1 void init_attrjeod__Wrench ( ) [friend]

8.19.4.2 friend class InputProcessor [friend]

Definition at line 83 of file wrench.hh.

8.19.5 Field Documentation

8.19.5.1 bool jeod::Wrench::active [private]

Indicated whether the wrench is active (true) or inactive (false).

inactive wrenches are not collected.trick_units(--)

Definition at line 466 of file wrench.hh.

Referenced by activate(), deactivate(), is_active(), operator+=(), and transform_to_point().

8.19.5.2 double jeod::Wrench::force[3] [private]

The force exerted on the DynBody by the force/torque agent, expressed in structural coordinates.

trick_units(N)

Definition at line 455 of file wrench.hh.

Referenced by get_force(), operator+=(), reset_force(), reset_force_and_torque(), scale_force(), set(), set_force(), transform_to_parent(), transform_to_point(), and Wrench().

8.19.5.3 double jeod::Wrench::point[3] [private]

The structural coordinates of the point at which the force is applied.

trick_units(m)

Definition at line 460 of file wrench.hh.

Referenced by get_point(), operator+=(), reset_point(), set(), set_force(), set_point(), transform_to_parent(), transform_to_point(), and Wrench().

8.19.5.4 double jeod::Wrench::torque[3] [private]

The torque exerted on the DynBody by the force/torque agent, expressed in structural coordinates.

This torque should not include the torque that results from the force not passing through the center of mass. A typical thruster, for example, should have the torque set to zero. On the other hand, a Hall effect thruster will have a non-zero torque due to the swirling of the exhaust.trick_units(N∗m)

Definition at line 449 of file wrench.hh.

Referenced by get_torque(), operator+=(), reset_force_and_torque(), reset_torque(), scale_torque(), set(), set_torque(), transform_to_parent(), transform_to_point(), and Wrench().

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

- wrench.hh

Chapter 9

File Documentation

9.1 aux_classes.cc File Reference

Define base methods for various small JEOD DynBody classes.

```
#include "utils/math/include/vector3.hh"
#include "../include/body_force_collect.hh"
#include "../include/frame_derivs.hh"
```

Namespaces

- jeod

  Namespace jeod.

9.1.1 Detailed Description

Define base methods for various small JEOD DynBody classes.

Definition in file aux_classes.cc.

9.2 body_force_collect.hh File Reference

Define the class BodyForceCollect.

```
#include "utils/container/include/pointer_vector.hh"
#include "utils/memory/include/jeod_alloc.hh"
#include "force.hh"
#include "torque.hh"
```

Data Structures

- class jeod::JPVCollectForce

  This is a derived version of the template class JeodPointerVector<CollectForce>::type with an implementation of the method perform_cleanup_action which frees and clears stale data following a restore.
- class jeod::JPVCollectTorque

  This is a derived version of the template class JeodPointerVector<CollectTorque>::type with an implementation of the method perform_cleanup_action which frees and clears stale data following a restore.

- class jeod::BodyForceCollect

  Serves as the collection point for forces and torques that act on a vehicle.

Namespaces

- jeod

  Namespace jeod.

Functions

- template<class CollectType >
  void jeod::release_vector (CollectType &vec)

  Release JEOD-allocated memory in the collect vector.
- template<typename CollectType , typename value_type >
  void jeod::collect_insert (CollectType &collect_in, value_type &elem)
- template<typename CollectType , typename value_type >
  void jeod::collect_push_back (CollectType &collect_in, value_type &elem)

9.2.1 Detailed Description

Define the class BodyForceCollect.

Definition in file body_force_collect.hh.

9.3 body_ref_frame.hh File Reference

Define the class BodyRefFrame.

```
#include <cstddef>
#include "dynamics/mass/include/class_declarations.hh"
#include "utils/sim_interface/include/jeod_class.hh"
#include "utils/ref_frames/include/ref_frame.hh"
#include "utils/ref_frames/include/ref_frame_items.hh"
```

Data Structures

- class jeod::BodyRefFrame

  Extend RefFrame to add coupling between the reference frame tree and the mass tree and to keep track of which state items have been set.

Namespaces

- jeod

  Namespace jeod.

9.3.1 Detailed Description

Define the class BodyRefFrame.

Definition in file body_ref_frame.hh.

9.4 body_wrench_collect.cc File Reference

Define BodyWrenchCollect member functions.

```
#include "../include/body_wrench_collect.hh"
#include "utils/memory/include/jeod_alloc.hh"
```

Namespaces

- jeod

  Namespace jeod.

9.4.1 Detailed Description

Define BodyWrenchCollect member functions.

Definition in file body_wrench_collect.cc.

9.5 body_wrench_collect.hh File Reference

Defines the class BodyWrenchCollect.

```
#include "wrench.hh"
#include "utils/container/include/pointer_vector.hh"
```

Data Structures

- class jeod::BodyWrenchCollect

  Serves as the collection point for wrenches that act on a vehicle.

Namespaces

- jeod

  Namespace jeod.

9.5.1 Detailed Description

Defines the class BodyWrenchCollect.

Definition in file body_wrench_collect.hh.

9.6 class_declarations.hh File Reference

Forward declarations of classes defined in dyn_body.hh.

Namespaces

- jeod

  Namespace jeod.

9.6.1 Detailed Description

Forward declarations of classes defined in dyn_body.hh.

Definition in file class_declarations.hh.

9.7 dyn_body.cc File Reference

Define base methods for the DynBody class.

```
#include <cstddef>
#include <algorithm>
#include "dynamics/dyn_manager/include/dyn_manager.hh"
#include "dynamics/dyn_manager/include/dynamics_integration_group.hh"
#include "utils/math/include/matrix3x3.hh"
#include "utils/math/include/vector3.hh"
#include "utils/memory/include/jeod_alloc.hh"
#include "../include/dyn_body.hh"
#include "../include/dyn_body_messages.hh"
```

Namespaces

- jeod

  Namespace jeod.

9.7.1 Detailed Description

Define base methods for the DynBody class.

Definition in file dyn_body.cc.

9.8 dyn_body.hh File Reference

Define the class DynBody.

```
#include <vector>
#include <list>
#include "body_ref_frame.hh"
#include "body_force_collect.hh"
#include "frame_derivs.hh"
#include "dyn_body_generic_rigid_attach.hh"
#include "dynamics/mass/include/mass.hh"
#include "environment/gravity/include/gravity_interaction.hh"
#include "utils/container/include/simple_checkpointable.hh"
#include "utils/integration/include/generalized_second_order_ode_technique.hh"
#include "utils/integration/include/restartable_state_integrator.hh"
#include "utils/sim_interface/include/jeod_class.hh"
#include "utils/ref_frames/include/ref_frame_interface.hh"
#include "er7_utils/integration/core/include/integrable_object.hh"
#include "er7_utils/integration/core/include/integrator_result.hh"
#include "er7_utils/integration/core/include/integrator_result_merger_container.hh"
```

Data Structures

- class jeod::DynBody

    Class DynBody is the base class for all dynamic bodies.

Namespaces

- jeod

    Namespace jeod.

9.8.1 Detailed Description

Define the class DynBody.

Definition in file dyn_body.hh.

9.9 dyn_body_attach.cc File Reference

Define DynBody attachment methods.

```
#include <cstddef>
#include <string>
#include <list>
#include "dynamics/dyn_manager/include/base_dyn_manager.hh"
#include "dynamics/mass/include/mass.hh"
#include "utils/math/include/matrix3x3.hh"
#include "utils/math/include/vector3.hh"
#include "utils/message/include/message_handler.hh"
#include "../include/dyn_body.hh"
#include "../include/dyn_body_messages.hh"
#include "../include/body_ref_frame.hh"
#include "../../dyn_manager/include/dynamics_integration_group.hh"
#include "environment/ephemerides/ephem_interface/include/ephem_ref_frame.-
hh"
#include "../../derived_state/include/relative_derived_state.hh"
```

Namespaces

- jeod

    Namespace jeod.

9.9.1 Detailed Description

Define DynBody attachment methods.

Definition in file dyn_body_attach.cc.

9.10 dyn_body_collect.cc File Reference

Define DynBody methods related to force and torque accumulation and propagation.

```
#include <cstddef>
#include "dynamics/dyn_manager/include/base_dyn_manager.hh"
#include "utils/math/include/matrix3x3.hh"
#include "utils/math/include/vector3.hh"
#include "../include/dyn_body.hh"
```

Namespaces

- jeod

  Namespace jeod.

Functions

- static void jeod::accumulate_forces (const JeodPointerVector< CollectForce >::type &vec, double ∗cumulation)

  Accumulate forces acting on a vehicle.

- static void jeod::accumulate_torques (const JeodPointerVector< CollectTorque >::type &vec, double ∗cumulation)

  Accumulate torques acting on a vehicle.

9.10.1 Detailed Description

Define DynBody methods related to force and torque accumulation and propagation.

Definition in file dyn_body_collect.cc.

9.11 dyn_body_detach.cc File Reference

Define DynBody detachment methods.

```
#include <cstddef>
#include <algorithm>
#include "dynamics/dyn_manager/include/dyn_manager.hh"
#include "utils/math/include/matrix3x3.hh"
#include "utils/math/include/vector3.hh"
#include "utils/message/include/message_handler.hh"
#include "utils/ref_frames/include/tree_links_iterator.hh"
#include "../include/dyn_body.hh"
#include "../include/dyn_body_messages.hh"
```

Namespaces

- jeod

  Namespace jeod.

9.11.1 Detailed Description

Define DynBody detachment methods.

Definition in file dyn_body_detach.cc.

9.12 dyn_body_find_body_frame.cc File Reference

Define DynBody::find_body_frame.

```
#include <cstddef>
#include "dynamics/dyn_manager/include/base_dyn_manager.hh"
#include "utils/message/include/message_handler.hh"
#include "utils/named_item/include/named_item.hh"
#include "../include/dyn_body.hh"
#include "../include/dyn_body_messages.hh"
```

Namespaces

- jeod

  Namespace jeod.

9.12.1 Detailed Description

Define DynBody::find_body_frame.

Definition in file dyn_body_find_body_frame.cc.

9.13 dyn_body_generic_rigid_attach.hh File Reference

Define the class Wrench.

```
#include "utils/sim_interface/include/jeod_class.hh"
#include "body_ref_frame.hh"
#include "../../mass/include/mass_point_state.hh"
```

Data Structures

- class jeod::DynBodyGenericFrameAttachment

  A wrench comprises a torque and a force applied at a point on a DynBody.

Namespaces

- jeod

  Namespace jeod.

9.13.1 Detailed Description

Define the class Wrench.

Definition in file dyn_body_generic_rigid_attach.hh.

9.14 dyn_body_initialize_model.cc File Reference

Define DynBody::initialize_model.

```
#include <cstddef>
#include "dynamics/dyn_manager/include/base_dyn_manager.hh"
#include "utils/message/include/message_handler.hh"
#include "../include/dyn_body.hh"
#include "../include/dyn_body_messages.hh"
```

Namespaces

- jeod

  Namespace jeod.

9.14.1 Detailed Description

Define DynBody::initialize_model.

Definition in file dyn_body_initialize_model.cc.

9.15 dyn_body_integration.cc File Reference

Define methods for frame switching.

```
#include <cstddef>
#include "er7_utils/integration/core/include/second_order_ode_integrator.-
hh"
#include "dynamics/dyn_manager/include/base_dyn_manager.hh"
#include "dynamics/dyn_manager/include/dynamics_integration_group.hh"
#include "environment/ephemerides/ephem_interface/include/ephem_ref_frame.-
hh"
#include "utils/math/include/matrix3x3.hh"
#include "utils/math/include/vector3.hh"
#include "utils/memory/include/jeod_alloc.hh"
#include "utils/message/include/message_handler.hh"
#include "utils/named_item/include/named_item.hh"
#include "utils/integration/include/jeod_integration_time.hh"
#include "utils/integration/include/generalized_second_order_ode_technique.-
hh"
#include "../include/dyn_body.hh"
#include "../include/dyn_body_messages.hh"
```

Namespaces

- jeod

  Namespace jeod.

9.15.1 Detailed Description

Define methods for frame switching.

Definition in file dyn_body_integration.cc.

9.16 dyn_body_messages.cc File Reference

Implement the class De4xxMessages.

```
#include "../include/dyn_body_messages.hh"
```

Namespaces

- jeod

  Namespace jeod.

Macros

- #define PATH "dynamics/dyn_body/"

9.16.1 Detailed Description

Implement the class De4xxMessages.

Definition in file dyn_body_messages.cc.

9.17 dyn_body_messages.hh File Reference

Define the class DynBodyMessages.

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

Data Structures

- class jeod::DynBodyMessages

  Specify the message IDs used in the DynBody model.

Namespaces

- jeod

  Namespace jeod.

9.17.1 Detailed Description

Define the class DynBodyMessages.

Definition in file dyn_body_messages.hh.

9.18 dyn_body_propagate_state.cc File Reference

Define DynBody state propagation / update methods.

```
#include <cstddef>
#include "utils/integration/include/jeod_integration_time.hh"
#include "utils/math/include/matrix3x3.hh"
#include "utils/math/include/vector3.hh"
#include "utils/message/include/message_handler.hh"
#include "../include/dyn_body.hh"
#include "../include/dyn_body_messages.hh"
```

Namespaces

- jeod

  Namespace jeod.

9.18.1 Detailed Description

Define DynBody state propagation / update methods.

Definition in file dyn_body_propagate_state.cc.

9.19 dyn_body_set_state.cc File Reference

Define methods related to setting aspects of a vehicle's state.

```
#include <cstddef>
#include "utils/ref_frames/include/ref_frame_items.hh"
#include "utils/math/include/vector3.hh"
#include "utils/message/include/message_handler.hh"
#include "../include/dyn_body.hh"
#include "../include/dyn_body_messages.hh"
```

Namespaces

- jeod

  Namespace jeod.

Functions

- static void jeod::check_frame_ownership (const BodyRefFrame &frame, const DynBody ∗dyn_body, const char ∗file, unsigned int line)

  Check that the dyn_body 'owns' the subject frame.

9.19.1 Detailed Description

Define methods related to setting aspects of a vehicle's state.

Definition in file dyn_body_set_state.cc.

9.20 dyn_body_vehicle_point.cc File Reference

Define methods that support vehicle points.

```
#include <cstddef>
#include "dynamics/dyn_manager/include/base_dyn_manager.hh"
#include "environment/ephemerides/ephem_interface/include/ephem_ref_frame.-
hh"
#include "utils/math/include/matrix3x3.hh"
#include "utils/math/include/vector3.hh"
#include "utils/memory/include/jeod_alloc.hh"
#include "utils/message/include/message_handler.hh"
#include "utils/named_item/include/named_item.hh"
#include "utils/quaternion/include/quat.hh"
#include "../include/dyn_body.hh"
#include "../include/dyn_body_messages.hh"
```

Namespaces

- jeod

    Namespace jeod.

9.20.1 Detailed Description

Define methods that support vehicle points.

Definition in file dyn_body_vehicle_point.cc.

9.21 force.cc File Reference

Define force model member functions.

```
#include <cstddef>
#include "utils/math/include/vector3.hh"
#include "utils/memory/include/jeod_alloc.hh"
#include "../include/force.hh"
```

Namespaces

- jeod

    Namespace jeod.

9.21.1 Detailed Description

Define force model member functions.

Definition in file force.cc.

9.22 force.hh File Reference

Define the JEOD force model.

```
#include "force_inline.hh"
```

Data Structures

- class jeod::Force

  A Force represents a Newtonian force that acts on a DynBody.
- class jeod::CollectForce

  A CollectForce represents a collected force that acts on a vehicle.
- class jeod::CInterfaceForce

  This class is deprecated.

Namespaces

- jeod

  Namespace jeod.

9.22.1 Detailed Description

Define the JEOD force model.

Definition in file force.hh.

9.23 force_inline.hh File Reference

Inline functions for the JEOD force model.

```
#include "force.hh"
#include <cstddef>
```

Namespaces

- jeod

  Namespace jeod.

9.23.1 Detailed Description

Inline functions for the JEOD force model.

Definition in file force_inline.hh.

9.24 frame_derivs.hh File Reference

Define the FrameDerivs class.

```
#include "utils/quaternion/include/quat.hh"
```

Data Structures

- class jeod::FrameDerivs

  Contains translational and rotational second derivatives.

Namespaces

- jeod

  Namespace jeod.

9.24.1 Detailed Description

Define the FrameDerivs class.

Definition in file frame_derivs.hh.

9.25 structure_integrated_dyn_body.cc File Reference

Define base member functions for StructureIntegratedDynBody.

```
#include "../include/structure_integrated_dyn_body.hh"
#include "utils/memory/include/jeod_alloc.hh"
#include <cstddef>
```

Namespaces

- jeod

  Namespace jeod.

9.25.1 Detailed Description

Define base member functions for StructureIntegratedDynBody.

Definition in file structure_integrated_dyn_body.cc.

9.26 structure_integrated_dyn_body.hh File Reference

Define the class StructureIntegratedDynBody, which integrates a DynBody object's structural state.

```
#include "body_wrench_collect.hh"
#include "vehicle_properties.hh"
#include "vehicle_non_grav_state.hh"
#include "dynamics/dyn_body/include/dyn_body.hh"
#include "utils/sim_interface/include/jeod_class.hh"
```

Data Structures

- class jeod::StructureIntegratedDynBody

  Extends DynBody to integrate an object's structural reference frame as opposed to its center of mass.

Namespaces

- jeod

  Namespace jeod.

9.26.1 Detailed Description

Define the class StructureIntegratedDynBody, which integrates a DynBody object's structural state.

Definition in file structure_integrated_dyn_body.hh.

9.27 structure_integrated_dyn_body_collect.cc File Reference

Define StructureIntegratedDynBody methods related to force and torque accumulation and propagation.

```
#include "../include/structure_integrated_dyn_body.hh"
#include "dynamics/dyn_manager/include/base_dyn_manager.hh"
#include "utils/math/include/matrix3x3.hh"
#include "utils/math/include/vector3.hh"
#include <cstddef>
```

Namespaces

- jeod

  Namespace jeod.

Functions

- static void jeod::accumulate_forces (const JeodPointerVector< CollectForce >::type &vec, double *cumulation)

  Accumulate forces acting on a vehicle.
- static void jeod::accumulate_torques (const JeodPointerVector< CollectTorque >::type &vec, double *cumulation)

  Accumulate torques acting on a vehicle.

9.27.1 Detailed Description

Define StructureIntegratedDynBody methods related to force and torque accumulation and propagation.

Definition in file structure_integrated_dyn_body_collect.cc.

9.28 structure_integrated_dyn_body_integration.cc File Reference

Define StructureIntegratedDynBody member functions related to state integration.

```
#include "../include/structure_integrated_dyn_body.hh"
#include "dynamics/dyn_body/include/dyn_body_messages.hh"
#include "utils/math/include/vector3.hh"
#include "utils/memory/include/jeod_alloc.hh"
#include "utils/message/include/message_handler.hh"
#include "utils/ref_frames/include/ref_frame_items.hh"
#include "er7_utils/integration/core/include/second_order_ode_integrator.-
```

```
hh"
#include <cstddef>
#include <cmath>
```

Namespaces

- jeod

  Namespace jeod.

9.28.1 Detailed Description

Define StructureIntegratedDynBody member functions related to state integration.

Definition in file structure_integrated_dyn_body_integration.cc.

9.29 structure_integrated_dyn_body_pt_accel.cc File Reference

Define StructureIntegratedDynBody::compute_vehicle_point_derivatives.

```
#include "../include/structure_integrated_dyn_body.hh"
#include "dynamics/dyn_body/include/dyn_body_messages.hh"
#include "utils/math/include/vector3.hh"
#include "utils/message/include/message_handler.hh"
#include <cstring>
#include <cstdio>
```

Namespaces

- jeod

  Namespace jeod.

9.29.1 Detailed Description

Define StructureIntegratedDynBody::compute_vehicle_point_derivatives.

Definition in file structure_integrated_dyn_body_pt_accel.cc.

9.30 structure_integrated_dyn_body_solve.cc File Reference

Define StructureIntegratedDynBody methods related to force and torque accumulation and propagation.

```
#include "../include/structure_integrated_dyn_body.hh"
#include "../include/dyn_body_messages.hh"
#include "utils/message/include/message_handler.hh"
#include "utils/math/include/vector3.hh"
#include "experimental/constraints/include/dyn_body_constraints_solver.hh"
```

Namespaces

- jeod

  Namespace jeod.

9.30.1 Detailed Description

Define StructureIntegratedDynBody methods related to force and torque accumulation and propagation.

Definition in file structure_integrated_dyn_body_solve.cc.

9.31 torque.cc File Reference

Define torque model member functions.

```
#include <cstddef>
#include "utils/math/include/vector3.hh"
#include "utils/memory/include/jeod_alloc.hh"
#include "../include/torque.hh"
```

Namespaces

- jeod

  Namespace jeod.

9.31.1 Detailed Description

Define torque model member functions.

Definition in file torque.cc.

9.32 torque.hh File Reference

Define the JEOD torque model.

```
#include "torque_inline.hh"
```

Data Structures

- class jeod::Torque

  A Torque represents a Newtonian torque that acts on a DynBody.
- class jeod::CollectTorque

  A CollectTorque represents a collected torque that acts on a vehicle.
- class jeod::CInterfaceTorque

  This class is deprecated.

Namespaces

- jeod

  Namespace jeod.

9.32.1 Detailed Description

Define the JEOD torque model.

Definition in file torque.hh.

9.33 torque_inline.hh File Reference

Define the JEOD torque model.

```
#include "torque.hh"
#include <cstddef>
```

Namespaces

- jeod

  Namespace jeod.

9.33.1 Detailed Description

Define the JEOD torque model.

Definition in file torque_inline.hh.

9.34 vehicle_non_grav_state.hh File Reference

Define the class VehicleNonGravState.

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

Data Structures

- class jeod::VehicleNonGravState

  Encapsulates various aspects of a vehicle's state with respect to inertial.

Namespaces

- jeod

  Namespace jeod.

9.34.1 Detailed Description

Define the class VehicleNonGravState.

Definition in file vehicle_non_grav_state.hh.

9.35 vehicle_properties.hh File Reference

Define the class VehicleProperties.

```
#include "experimental/math/include/solver_types.hh"
#include "utils/sim_interface/include/jeod_class.hh"
```

Data Structures

- class jeod::VehicleProperties

    Captures pointers to various vehicle properties that are commonly used in the constraint concept.

Namespaces

- jeod

    Namespace jeod.

9.35.1 Detailed Description

Define the class VehicleProperties.

Definition in file vehicle_properties.hh.

9.36 wrench.hh File Reference

Define the class Wrench.

```
#include "dynamics/mass/include/mass_point_state.hh"
#include "utils/math/include/vector3.hh"
#include "utils/sim_interface/include/jeod_class.hh"
#include <vector>
```

Data Structures

- class jeod::Wrench

    A wrench comprises a torque and a force applied at a point on a DynBody.

Namespaces

- jeod

    Namespace jeod.

9.36.1 Detailed Description

Define the class Wrench.

Definition in file wrench.hh.

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