

User Manual 3.4.1 Properties and models: Inertia

De Wiki

Aller à : [navigation](#), [rechercher](#)

[User Manual 3.4.1 Properties and models: Inertia](#)

Introduction

Scope

In this sections are presented the assembly's properties and models to get its inertia features : mass, mass center and inertia matrix.

Javadoc

The inertia models are available in the package [fr.cnes.sirius.patrius.assembly.models](#).

The associated properties are available in the package [fr.cnes.sirius.patrius.assembly.properties](#).

Links

None as of now.

Useful Documents

None as of now.

Package Overview

None as of now.

Features Description

Generalities about inertia models

The aim of inertia models is to return the (mass / center of mass / inertia matrix) information for the whole spacecraft. Two models are available : one that allows the user to fill directly those informations, one that computes it from the inertia of the different parts of the assembly.

Those models are under the "IInertiaModel" interface, that defines the following methods :

- Getter for the inertia matrix of the spacecraft, expressed with respect to the MASS CENTER in a given frame.

```
Matrix3D inertiaMatrixAtMassCenter = model.getInertiaMatrix(frame, date);
```

- Getter for the inertia matrix of the spacecraft, once expressed with respect to a point (expressed in the given frame) that can be different from the mass center.

```
Matrix3D matrix = model.getInertiaMatrix(frame, date, inertiaReferencePoint);
```

- getter for the mass center in a given frame

```
Vector3D massCenterInUserFrame = model.getMassCenter(frame, date);
```

- getter for the last computed mass

```
double globalMass = model.getTotalMass();
```

Simple inertia model

In the `InertiaSimpleModel`, the mass / mass center / inertia matrix are directly provided by the user. It does not need any assembly construction.

The inertia matrix can be defined :

- at the mass center point, in a given reference frame, with the following constructor

```
IInertiaModel model = new InertiaSimpleModel(mass, massCenter, inertiaMatrix,  
referenceFrame, "part");
```

- at another point, in a given reference frame, with the following constructor

```
IInertiaModel model = new InertiaSimpleModel(mass, massCenter, inertiaMatrix,  
inertiaReferencePoint, referenceFrame, "part");
```

Computed inertia model

The `InertiaComputedModel` computes those values from the part properties of an assembly. The concerned parts are the ones containing the `INERTIA` properties (cf. next paragraph).

It is built simply from the assembly :

```
IInertiaModel model = new InertiaComputedModel(assembly);
```

Inertia properties

The `INERTIA` property completes the `MASS` property to get a complete (mass / center of mass / inertia matrix) description of a part.

It shall be built providing the mass property that is associated to to the same part (so both properties will provide and work with the same mass value even if it changes in time).

Consequently, the property contains three informations :

- the mass value (get from the `MASS` property itself)
- the mass-center vector
- the inertia matrix at the mass center point


```

final Matrix3D inertiaMatrix = new Matrix3D(inertiaData);

// inertia property creation : the mass property is the one given to the same
part
final InertiaSimpleProperty inertiaProp = new
InertiaSimpleProperty(massCenter, inertiaMatrix, massProp);

// inertia property adding
assemblyBuilder.addProperty(inertiaProp, "part1");

```

Contents

Interfaces

Interface	Summary	Javadoc
IInertiaModel	Interface for inertia models.	...
IInertiaProperty	Interface for all inertia parts properties.	...

Classes

Class	Summary	Javadoc
InertiaSimpleModel	This class is a model to describe a construction's inertia : it does not need an assembly.	...
InertiaComputedModel	This class is a model to describe an assembly's inertia.	...
InertiaSimpleProperty	This class is a part property for the PATRIUS assembly. It allows to define an inertia property to a part, the mass center and inertia matrix at the mass center being provided by the user.	...
InertiaSphereProperty	This class is a part property for the PATRIUS assembly. It allows to define an inertia property to a part, the mass center and inertia matrix being computed for a spherical object.	...
InertiaParallelepipedProperty	This class is a part property for the PATRIUS assembly. It allows to define an inertia property to a part, the mass center and inertia matrix being computed for a parallelepiped object.	...
InertiaCylinderProperty	This class is a part property for the PATRIUS assembly. It allows to define an inertia property to a part, the mass center and inertia matrix being computed for a cylinder object.	...

Récupérée de

«

http://patrius.cnes.fr/index.php?title=User_Manual_3.4.1_Properties_and_models:_Inertia&oldid=1452 »

Catégorie :

- [User Manual 3.4.1 Spacecraft](#)

Menu de navigation

Outils personnels

- [52.14.252.16](#)
- [Discussion avec cette adresse IP](#)
- [Créer un compte](#)
- [Se connecter](#)

Espaces de noms

- [Page](#)
- [Discussion](#)

Variantes

Affichages

- [Lire](#)
- [Voir le texte source](#)
- [Historique](#)
- [Exporter en PDF](#)

Plus

Rechercher

PATRIUS

- [Welcome](#)

Evolutions

- [Main differences between V4.15 and V4.14](#)
- [Main differences between V4.14 and V4.13](#)
- [Main differences between V4.13 and V4.12](#)
- [Main differences between V4.12 and V4.11](#)
- [Main differences between V4.11 and V4.10](#)
- [Main differences between V4.10 and V4.9](#)

- [Main differences between V4.9 and V4.8](#)
- [Main differences between V4.8 and V4.7](#)
- [Main differences between V4.7 and V4.6.1](#)
- [Main differences between V4.6.1 and V4.5.1](#)
- [Main differences between V4.5.1 and V4.4](#)
- [Main differences between V4.4 and V4.3](#)
- [Main differences between V4.3 and V4.2](#)
- [Main differences between V4.2 and V4.1.1](#)
- [Main differences between V4.1.1 and V4.1](#)
- [Main differences between V4.1 and V4.0](#)
- [Main differences between V4.0 and V3.4.1](#)

User Manual

- [User Manual 4.15](#)
- [User Manual 4.14](#)
- [User Manual 4.13](#)
- [User Manual 4.12](#)
- [User Manual 4.11](#)
- [User Manual 4.10](#)
- [User Manual 4.9](#)
- [User Manual 4.8](#)
- [User Manual 4.7](#)
- [User Manual 4.6.1](#)
- [User Manual 4.5.1](#)
- [User Manual 4.4](#)
- [User Manual 4.3](#)
- [User Manual 4.2](#)
- [User Manual 4.1](#)
- [User Manual 4.0](#)
- [User Manual 3.4.1](#)
- [User Manual 3.3](#)

Tutorials

- [Tutorials 4.15](#)
- [Tutorials 4.14](#)
- [Tutorials 4.13.5](#)
- [Tutorials 4.12.1](#)
- [Tutorials 4.8.1](#)
- [Tutorials 4.5.1](#)
- [Tutorials 4.4](#)
- [Tutorials 4.1](#)
- [Tutorials 4.0](#)

Links

- [CNES freeware server](#)

Navigation

- [Accueil](#)
- [Modifications récentes](#)
- [Page au hasard](#)
- [Aide](#)

Outils

- [Pages liées](#)
- [Suivi des pages liées](#)
- [Pages spéciales](#)
- [Adresse de cette version](#)
- [Information sur la page](#)
- [Citer cette page](#)

- Dernière modification de cette page le 6 mars 2018 à 13:08.

- [Politique de confidentialité](#)
- [À propos de Wiki](#)
- [Avertissements](#)

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