

# User Manual 4.8 Orbital parameters

De Wiki

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

[User Manual 4.8 Orbital parameters](#)

## Introduction

### Scope

The "Orbital parameters" package contains classes to represent the orbital state of a space object. Several types of parameters are available (cartesian, keplerian, equinoctial... with different position angle definitions : true, mean, eccentric). Orbital parameters do not define a date nor a frame. To fully define an orbit, including date and frame, please refer to [FDY\_Orbits\_Home Orbits].

### Javadoc

The classes for orbital parameters description are available in the package `fr.cnes.sirius.patrius.orbits.orbitalparameters`.

#### Library

#### Javadoc

Patrius [Package fr.cnes.sirius.patrius.orbits.orbitalparameters](#)

### Links

None as of now.

### Useful Documents

None as of now.

### Package Overview

All different orbital parameters types extend the abstract class `AbstractOrbitalParameters` and implement the interface `IOrbitalParameters` (the following class package may not contain all classes extending `AbstractOrbitalParameters` class).



All conversions methods from one type to another are specifically handled by each type of orbital parameters, thus optimising conversions.

## Features Description

### Available parameters

The available parameters types are :

- Cartesian : X, Y, Z, Vx, Vy, Vz
- Keplerian : a, e, i, perigee argument, right ascension of ascending node, anomaly (in each position angle types)

- Equinoctial : a, ex, ey (eccentricity vector), hx, hy (inclination vector), longitude argument (in each position angle types)
- Alternate equinoctial : n (mean motion), ex, ey (eccentricity vector), hx, hy (inclination vector), longitude argument (in each position angle types but stored in mean)
- Stela Equinoctial : a, ex, ey (eccentricity vector), ix, iy (inclination vector), mean longitude argument
- Circular : a, ex, ey (eccentricity vector), i, right ascension of ascending node, latitude argument (in each position angle types)
- Apsis (using radius) : periapsis, apoapsis, i, perigee argument, right ascension of ascending node, anomaly (in each position angle types)
- Apsis (using altitude) : altitude of periapsis, altitude of apoapsis, i, perigee argument, right ascension of ascending node, anomaly (in each position angle types)
- Equatorial : a, e, longitude of the periapsis ( $\omega + \Omega$ ), ix (first component of inclination vector), iy (second component of inclination vector), anomaly (in each position angle types)
- Reentry : altitude, latitude, longitude, velocity norm, slope of velocity, azimuth of velocity

## Getting Started

Any orbital parameters can be defined using the chosen constructor. Here is an example using circular parameters and true anomaly:

```
final CircularParameters circularParameters = new CircularParameters(10000E3,
0.1, 0.2, 0.3, 0.4, 0.5, PositionAngle.TRUE, Constants.EGM96_EARTH_MU);
```

Then conversions to any orbital parameters type can directly be obtained using the conversion routines. Here is an example of conversion to equinoctial parameters:

```
final EquinoctialParameters equinoctialParameters = circularParameters
.getEquinoctialParameters();
```

## Contents

### Interfaces

None as of now.

### Classes

| Class                                 | Summary                                  | Javadoc             |
|---------------------------------------|--|---------------------|
| <b>CartesianParameters</b>            | Cartesian parameters object.             | <a href="#">...</a> |
| <b>KeplerianParameters</b>            | Keplerian parameters object.             | <a href="#">...</a> |
| <b>CircularParameters</b>             | Circular parameters object.              | <a href="#">...</a> |
| <b>EquinoctialParameters</b>          | Equinoctial parameters object.           | <a href="#">...</a> |
| <b>AlternateEquinoctialParameters</b> | Alternate Equinoctial parameters object. | <a href="#">...</a> |
| <b>StelaEquinoctialParameters</b>     | Stela equinoctial parameters object.     | <a href="#">...</a> |
| <b>EquatorialParameters</b>           | Equatorial parameters object.            | <a href="#">...</a> |
| <b>ApsisRadiusParameters</b>          | Apsis parameters object (using radius).  | <a href="#">...</a> |

**ApsisAltitudeParameters**      Apsis parameters object (using altitude). [...](#)

**ReentryParameters**      Reentry parameters object. [...](#)

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Catégorie :

- [User Manual 4.8 Flight Dynamics](#)

## Menu de navigation

### Outils personnels

- [18.216.70.205](#)
- [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 20 octobre 2021 à 14:00.
- [Politique de confidentialité](#)
- [À propos de Wiki](#)
- [Avertissements](#)
  
- 