

# User Manual 4.13 Orbital parameters

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## 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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