

# User Manual 4.5 Slew

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## Introduction

### Scope

A slew performs the transition between two attitude laws.

### Javadoc

The attitude objects linked to slews are available in the package `fr.cnes.sirius.patrius.attitudes`.

#### Library

#### Javadoc

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

### Links

None as of now.

### Useful Documents

None as of now.

### Package Overview

The slew conception is split into two features:

- The slew computation. Classes *computing* the slew are provided in PATRIUS.
- The slew realization. All classes realizing a slew implements the `Slew` interface. Slews are mainly of two types:
  - Analytical slews (such as `ConstantSpinSlew`)
  - Pre-computed slews stored in a `TabulatedSlew`. In this case, a slew *computer* will compute the tabulated ephemeris of the slew.

A slew is bounded in time and as a result inherits the `[ATT_LEG_Home AttitudeLeg]` interface.

## Features

### Constant spin slew

The constant spin slew is a basic slew maneuver type. Between the initial quaternion and the final one, a spherical linear interpolation describes the behavior of the spacecraft. Two constraint types are available:

- Duration constraint: spin is computed to match constraint.

```
final Slew slew = new ConstantSpinSlew(firstAttitude, secondAttitude);
```

- Angular velocity constraint: initial slew date or final slew date is computed to match constraint.
  - Initial slew date is known:

```
final Slew slew = new  
ConstantSpinSlewComputer(angularConstraint).compute(pvProvider, initialLaw,  
initialDate, finalLaw, null);
```

- Final slew date is known:

```
final Slew slew = new  
ConstantSpinSlewComputer(angularConstraint).compute(pvProvider, initialLaw,  
null, finalLaw, finalDate);
```

## Spin bias slew

The two spin bias slew is a slew maneuver type. The velocity depends on the value of the slew angle.

In order to compute properly the slew, the user must specify the initial and final laws, the parameters of the two angular velocity fields, plus the stabilisation margin:

```
final TwoSpinBiasSlewComputer computer = new TwoSpinBiasSlewComputer(  
    step, theta_max, tau, epsInRall, omega2, theta, epsOutRall, omega1,  
    dtStab);
```

Once the slew maneuver is defined, the computation can be performed on an orbital state using the following method:

```
final TabulatedSlew slew = computer.compute(startLaw, initialDate, finalLaw,  
null);
```

The slew is then represented by a generic `TabulatedSlew` which stores the slew under a tabulated ephemeris.

## ISIS Spin bias slew

This spin bias slew is a slew with a trapezoidal angular velocity profile: - Constant acceleration phase - Constant angular velocity phase (zero acceleration phase) - Constant deceleration phase



This slew can be computed using methods:

- `IsisSpinBiasSlewComputer.computeAnalytical`: this class provides an analytical solution to the slew
- `IsisSpinBiasSlewComputer.computeNumerical`: this class provides an numerical solution to the slew The two classes returns close results ( $< 1E-2$  rad), though analytical solution is more accurate.

The slews can be used in two ways:

- Provide an initial law, an initial date and a target final law
- Provide an final law, a final date and a target initial law

**Warning:** slew computed in both ways will never be exactly the same depending on user-chosen convergence threshold and maximum number of iterations (result will be exactly the same if convergence threshold is lower than machine precision and number of allowed iterations high enough to support convergence).

The slew has then to be calculated using method `compute()`. The slew is then represented by a generic `TabulatedSlew` which stores the slew under a tabulated ephemeris. Finally the slew can be used like any other slew.

## Getting Started

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### Interfaces

Interface	Summary	Javadoc
<b>AttitudeLeg</b>	This interface extends the <code>AttitudeProvider</code> interface and adds the time interval of validity notion to the attitude laws.	<a href="#">AttitudeLeg</a>
<b>Slew</b>	This interface implements a generic slew model set.	<a href="#">Slew</a>

### Classes

As of 4.5, some classes have been deprecated and should therefore not be used any more.

Class	Summary	Javadoc
<b>AbstractSlew</b>	This abstract class implements slew maneuvers (deprecated). <a href="#">AbstractSlew</a>	
<b>ConstantSpinSlew</b>	This class implements the constant spin slew maneuver profile (current usage is deprecated, not the class itself). <a href="#">ConstantSpinSlew</a>	
<b>TwoSpinBiasSlew</b>	This class implements the spin bias slew profile with two available spin profiles (deprecated). <a href="#">TwoSpinBiasSlew</a>	
<b>IsisAnalyticalSpinBiasSlew</b>	This class implements the ISIS spin bias slew profile (constant acceleration/decceleration phases - Analytical solution) (deprecated). <a href="#">IsisAnalyticalSpinBiasSlew</a>	

<b>IsisNumericalSpinBiasSlew</b>	This class implements the ISIS spin bias slew profile (constant acceleration/deceleration phases - Numerical solution) (deprecated).	<a href="#">IsisNumericalSpinBiasSlew</a>
<b>TabulatedSlew</b>	This class implements a generic tabulated slew, once computed with one of the computer classes.	<a href="#">TabulatedSlew</a>
<b>AngularVelocitiesPolynomialSlew</b>	This class implements a generic angular velocities polynomial slew.	<a href="#">AngularVelocitiesPolynomialSlew</a>
<b>ConstantSpinSlewComputer</b>	This class computes a constant spin slew into a ConstantSpinSlew.	<a href="#">ConstantSpinSlewComputer</a>
<b>TwoSpinBiasSlewComputer</b>	This class computes a two spin bias slew into a TabulatedSlew.	<a href="#">TwoSpinBiasSlewComputer</a>
<b>IsisSpinBiasSlewComputer</b>	This class computes an ISIS spin bias slew into a TabulatedSlew.	<a href="#">IsisSpinBiasSlewComputer</a>

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