

# Tutorials 4.5.1 Maneuvers

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## Standard Impulsive maneuvers

This kind of maneuver consists in modelizing a maneuver as an instantaneous modification of the velocity. So, to define it, we must set, at least:

1. an event that will determine that the maneuver will occur;
2. three components, corresponding to the velocity increment;
3. the specific impulse in order to be able to calculate the mass decrease due to the maneuver (we do not use here the [PropulsiveProperty](#));
4. as a consequence of the mass evolution, a [MassModel](#) and the part of this model where we will use ergols mass (here a specific tank).

Be careful that, when the maneuver direction is expressed in the vehicle frame, it will be mandatory to define an attitude when propagating the orbit !

In the example below, we will define a 20 m/s  $\Delta V$  activated at the apogee of the orbit.

### Code examples:

- [Impulsive maneuver defined versus a vehicle frame](#)
- [Impulsive maneuver defined versus a specific frame \(GCRF\)](#)
- [Impulsive maneuver defined versus a LOF frame \(TNW\)](#)

## Impulsive maneuvers using orbital increments

Since V4.5.1, **PATRIUS** allows to define impulsive maneuvers with some orbital increments as input rather than giving directly a Velocity increment. The three possibilities are:

- on semi-major axis
- on eccentricity (and semi-major axis eventually)
- on inclination (and semi-major axis eventually)

There is no specific tutorial on this page but we can see examples of such use in the [propagator page](#)

## Continuous maneuvers

This time, a continuous thrust maneuver is no more considered as an impulsive one but as a more realistic one with a given duration. So to define it, we must set, at least:

1. information about the start and the end of the maneuver
2. the thrust direction
3. the thrust level and the specific impulse via [PropulsiveProperty](#)
4. as a consequence of the mass evolution, a [MassModel](#) and the part of this model where we will use ergols mass (here a specific tank)

### Code examples:

- [Continuous maneuver defined in duration](#)
- [Continuous maneuver defined by events](#)

## Sequence of maneuvers

Such a sequence allows to group several maneuvers (impulsive or continuous ones) in a single object synthetizing a maneuver strategy. In fact, it is actually very simple to build it once each maneuver has been defined. We only have:

1. to set a value in seconds for the minimum allowed time between a continuous maneuver and the next maneuver
2. to set a value in seconds for the minimum allowed time between an impulse maneuver and the next maneuver
3. to add each maneuver by using the `add()` method

In the example below, we have taken the impulsive maneuver build in the [Impulsive maneuvers tutorial](#) and the continuous maneuver taken from the [Continuous maneuvers tutorial](#) , putting them together in a sequence.

### Code example: [Sequence of maneuvers](#)

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