

Heliocentric motion visualisation

Requirements:

Use a P4 or equivalent, 1+ GHZ, preferably 256MB+ RAM.
Recommended operating systems: Windows NT or XP

Description

Double click on the executable: 'Visualisation.exe'. The program starts by loading data and opening a small window named 'Interplanetary Transfer Visualisation Tool'. After a few seconds data is loaded and a second, larger Window loads

This form is used to load trajectory data and to start and control the simulation.

First, select the file containing trajectory data from the file view windows. These are from a list of pre-generated transfers from Earth to Various planets

Then check the viewpoint required. This is either inertial or spacecraft related.

An inertially fixed 3 Degree Of Freedom perspective viewpoint is selected by checking 'Inertial Viewpoint'. This is inertially fixed, but can be modified by

- Left, Right Up, Down keys for rotation
- Zoom in/out by using F1 and F2

A spacecraft fixed 3 Degree Of Freedom perspective viewpoint is selected by checking 'GLSpacecraft related viewpoint'. This viewpoint is constantly modified to point at the spacecraft

- Left, Right Up, Down keys for rotation
- Zoom in/out by using F1 and F2

Simulation control

Having selected the appropriate formatted data file and the viewpoint, then use 'Begin Solar System Simulation' to start simulation

The simulation window loads and the spacecraft is initially stationary. Motion is started and then speeded up by pressing the space bar once (to start) or repeatedly to speed up. Slow down is achieved by pressing backspace. Backward propagation is not supported.

The simulation will stop on reaching the end of the data, or can be halted by pressing Esc on the keyboard.

On reaching the end of the data, the control keys may still be used to examine the trajectory.

The Esc (Escape) key must be pressed before the viewing form can then be closed.

On closing the window the remaining windows may be closed, or further simulations performed. These can be re-runs of the currently selected case or alternative transfer data files can be loaded.

Using other data

Any trajectory can in principle be visualised using the software, by generating a datafile with the same format as the example.

This means Heliocentric Cartesian position and velocity co-ordinates in the first 6 columns. Then this is followed by the elapsed time (in seconds, with respect to some arbitrary reference time, ie the combination of reference time and elapsed time gives the true epoch. For example, zero can be used for the start of the simulation). The true epoch is in the last column in MJD:hours:minutes:secs (ie MJD = JD-240000.5).

Datafiles provided

A range of interplanetary transfer files are provided. These are for missions using impulsive propulsive manoeuvres (spacecraft Delta-Vs are generally small). These illustrate a variety of efficient interplanetary transfer options.

The datafiles to be loaded by the simulation tool are contained in the 'SimulationFiles' folder. The files are labelled as follows:

Description+SimulationAnimation.dat

This folder also contains a series of sub-folders, containing details of the trajectories. These are as follows:

MercuryMissions
JupiterMissions
SaturnMissions
OuterPlanetMissions
JupiterToSaturnViaGravitationalEscapeandCapture

The datafiles in these folders are of two types:

Description+trajectorydata.dat

Description+planetdata.dat

The first file type contains a time history of the transfer trajectory (X,Y,Z heliocentric position components) with a fixed time step size. The second file type contains a history of the planet heliocentric positions (1 to 9, ie Mercury to Pluto) at the same time intervals as the trajectorydata file. The folders also contain copies of the respective 'SimulationAnimation' files plus a descriptive note.