

Interfacing Java for orbit propagation - application to orbits in the Mars-Phobos system

Alain LAMY

CNES (French Space Agency)

Scilab has been used at CNES for many years for space mechanics mission analyses. CelestLab and other tools developed by CNES have already been presented at previous Scilabtec meetings.

In general, everything is written in Scilab language. But it is sometimes useful to interface code written in other languages, either for efficiency purposes or simply to be sure that the code is 100% compliant with the original. Java has been chosen at CNES as the language for operational flight dynamics software, and specific open source libraries such as Patrius have been developed for that purpose. That's why interfacing Java and Scilab (and Patrius in particular) can be useful for some specific applications.

One example which is the subject of this talk is orbit propagation for which we use the ability of Scilab to directly call Java code.

The propagator which is written in Java language is quite generic. It can propagate orbits around the Earth but also other planets (or the Sun). We use it at the moment for the study of trajectories in the Mars-Phobos system. Phobos is one of the two Martian satellites. One particularity is that it is rather close to Mars: less than 2 Mars radii from Mars surface. It also has an irregular shape that has to be taken into account for accurate orbit propagation.

So the objective here is to show:

- the Scilab interfaces that have been designed for orbit propagation: either to extrapolate the orbits or to compute the acceleration on a given reference trajectory,
- how the Java code is called,
- simple use cases in Scilab that illustrate how easy it is to use the available features,
- examples of applications that make use of the low level functions described above: simple or multiple orbit adjustment using the Jacobian matrices that are also computed by the Java code,
- some concrete results of trajectories around Phobos.