SPACE DEBRIS SYMPOSIUM (A6)
Measurements (1)

Author: Prof.Dr. Filipe Santos
University of Lisbon, Portugal

Dr. André Moitinho de Almeida
Portugal
Dr. Alberto Krone-Martins
University of Lisbon, Portugal

INTERACTIVE 3D VISUALIZATION OF LARGE ASTRONOMICAL AND SPACE DEBRIS DATASETS

Abstract

Visualization is essential for the understanding and interpretation of data and results - in science and in mission analysis and control alike. We have been developing a tool for Astronomy, where most of the data leading to new scientific discoveries are expected to come from massive online archives (petabytes) in the next few years. However, in this field no adequate visualization solutions are available for interactive 3D visualization and analysis of such amounts of complex datasets.

Although space data are multi-dimensional, with attributes such as coordinates, distances, sizes, orbital elements, to name a few, exploration is mostly done using 2D representations. But reduced dimensionality has a price: It easily hides features and relations in the data and can produce cluttered views. Multiple 2D panels are often used as a solution, but the linkage between data in different panels is frequently not clear.

Curiously, 3D visualization, with the gain of an extra visual dimension, is not widespread in space sciences, where most of the data are individual entities (stars, galaxies, asteroids, orbital debris). It is almost exclusively used in simulations of astrophysical fluids and fields, which are extended bodies. The reason is a lack of good tools for 3D selection and interaction with point clouds. This is also seen outside space sciences, where 3D interactive visualization is almost exclusively used in analysis of extended bodies, such as in medical, fluid dynamics and CAD applications.

The main objective of the work here presented is to develop enabling technologies for tackling three central challenges: interactively visualizing in 3D large amounts of data of discrete elements; performing complex selections in 3D environments; and support interoperability with data providers and services. Here we present demonstrators implementing astronomical Virtual Observatory interoperability standards with data from the Gaia Universe Model Snapshot (10^9 objects), and from space debris databases, such as DISCOS or Space-Track.