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DEVELOPMENT AND USE OF BPSCI, AN OPEN-SOURCE AND ADAPTABLE DYNAMICS VISUALIZATION SOFTWARE

Abstract

The current and upcoming eras of engineering analysis do and will heavily utilize simulations systems known as digital twins, allowing the computer-based simulation of novel ideas that were previously difficult to implement physically. Such software already exists, but is generally proprietary and cost-prohibitive to students and researchers. These software generally consist of two parts; computational simulation and visualization. Since it is relatively straightforward to simulate systems with open-source code, focus turns to open source visualization solutions.

The author presents "bpsci", an open-source physical visualizer for models with up to six degrees of freedom in three dimensional space. While many open-source programs have built-in visualizers, they are generally for specific applications and cannot be used outside the scope of the original application to holistically view a system of systems. "bpsci" aims to create custom simulation visualizations for numerous applications from rotational and translational kinematic data for a diverse range of applications. These visualizations can be built from the general building blocks "bpsci" provides. The library is written such that frames of reference are hierarchical; all motion can be parented to different defined reference frames. Since the code is open-source, any number and category of visualization building blocks can easily be added.

bpsci is written in Python and is implemented as a PyPI installable library to Blender, an open-source three dimensional animation software. bpsci has been used to create orbital simulations and spacecraft attitude dynamics visualizations. Future plans include support for integrated animated plots, simulated instrumentation, and mathematical function graphing.

This paper will briefly discuss the emergence and use of digital twins in engineering (specifically aerospace), computational simulation, and focus on the creation, use, and future plans of a novel open-source visualization software ("bpsci"). This software fulfills the visualization aspect of the digital twin model, especially as it concerns students and researchers.