

2018 Research Interest/Project Ideas

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Interactive multi-scale exploration of Poincaré maps

Mechanical systems in which energy is conserved exhibit a periodic dynamical behavior. This periodicity in turn can be effectively analyzed using so-called Poincaré maps (or return maps), whereby system trajectories are studied through their successive intersections with a reference plane or surface. These maps are an example of area preserving discrete dynamical system and they exhibit a fractal topology that is intertwined with chaotic regions. The goal of this research project is to create a method that will allow for the on-demand refinement of the visualization in regions of particular interest, thereby precisely steering the computation needed to characterize the topology of such systems.

Applications in mission design and orbit optimization for spatial exploration.

Other potential projects:

- * **Project Idea #3:** *Pattern detection and analysis in granular materials*
- * **Project Idea #4:** *High-quality reconstruction of very large scale unstructured datasets*
- * **Project Idea #5:** *Scalable visualization of dynamic networks*