Mathematics and CS Seminar

GeomTop Seminar: Detecting recurrences in high-dimensional flows from persistence

Nazmi Burak Budanur

Host:

In recent years, numerical discoveries of unstable time-periodic solutions in various shear flow simulations have sparked hopes of developing a chaos-theoretical understanding of turbulence. For many cases of interest, however, the standard tools of chaos theory, such as Poincar sections, were not sufficient for uncovering a complete description of turbulence due to its high dimensionality of the dynamics. As a result, the discoveries of periodic orbits in turbulent flows have remained at an illustrative level with no obvious paths towards their utilization in turbulence modeling and control. One simple question one might ask is whether the turbulent dynamics transiently approximate periodic solutions, and if so, how frequently? We argue that a systematic study of this problem requires a method for unsupervised identification of geometric similarities between periodic orbits and turbulent trajectory segments in the system's state space. We will demonstrate with examples that a topological data analysis-based approach can be employed for this purpose.

Wednesday, July 31, 2019 01:00pm - 02:15pm

Mondi Seminar Room 3, Central Building