Contribution ID: **3** Type: **Keynote**

Calculating Lyapunov Exponents with nek5000

Tuesday, July 30, 2024 11:00 AM (40 minutes)

The calculation of Lyapunov Exponents by using the perturbation solver in nek5000 will be discussed. This work was started by Anand Jayaraman and Paul Fischer (Jayaraman, et.al., PRE 2006) and has been used over the years to better understand chaos and turbulence in Rayleigh-Benard convection. Leading order Lyapunov exponents were calculated for small systems and moderate Rayleigh number to prove that they are chaotic (JS and Cross, PRE 2006). They were also helpful for determining onset states for intermediate-sized systems (Yu, et.al, Phys. of Fluids 2017), The leading order Lyapunov eigenvector can also provide insight into the nature of the chaos. For example an analysis of the leading order Lyapunov eigenvector for constant heat-flux driven convection was used to support the supergranule aggregation phenomena observed in these systems (Vieweg, et.al, Phys Rev Research 2021).

Relevance for Nek [100 words max]

The perturbation solver is part of the nek5000 code, and people may find it interesting to see how it has been used in Rayleigh-Benard Convection and how it can be used in general.

Primary author: SCHEEL, Janet (Occidental College)

Presenter: SCHEEL, Janet (Occidental College)