Abstract Submitted
for the DFD20 Meeting of
The American Physical Society

Wavelet adaptive POD for large scale flow data PHILIPP KRAH, Tech Univ Berlin, THOMAS ENGELS, Univ Rostock, KAI SCHNEIDER, Aix-Marseille Universite, JULIUS REISS, Tech Univ Berlin — The proper orthogonal decomposition (POD) is a powerful classical tool in fluid mechanics used for instance for model reduction and extraction of coherent flow features. However its applicability to high resolution 3D DNS data is limited due to its computational complexity. Here we propose a wavelet-based adaptive POD, called wPOD, which overcomes this limitation. The size of the analyzed data is reduced by exploiting the compression properties of wavelets with error control, which yields a sparse flow representation. Numerical analysis shows that wavelet compression and POD truncation errors can be balanced and massive 3d high resolution data sets can thus be efficiently handled. A validation of the method will be given for 2D wake flow data. Examples will then be presented for 3D high resolution DNS data of flapping insect flight in turbulence. A comparison with the randomized singular value decomposition illustrates the efficiency and the precision of the wPOD method.

Philipp Krah
Tech Univ Berlin

Date submitted: 31 Jul 2020 Electronic form version 1.4