

Abstract Submitted
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Dynamics of Episodic POD DIETMAR REMPFER, PARITOSH MOKHASI, IIT, Chicago — In this talk we will discuss the derivation of evolution equations, which take the form of discrete maps, for the modes of episodic POD. The method of episodic POD is an extension of standard POD that leads to the construction of spatio-temporal POD eigenfunctions called “episodic modes.” In contrast to standard POD, this method produces dynamical structures that evolve in space and time. Classical methods of low-dimensional modeling rely on decomposing flow-fields into a set of spatial functions and temporal coefficients. By substituting the expansion into the governing equations, one obtains a finite-dimensional system of ODEs. However, for the case of the Navier-Stokes equations, this method requires finesse, not only because of the nonlinearity of the equations, but also because of the intricacies of the pressure term. Conventional schemes suggest eliminating the pressure term using a vorticity formulation, or a model for the pressure term. In the method of episodic POD, the need for pressure modeling can be eliminated by using the pressure term as a constraint on the expansion coefficients of two consecutive episodes, ensuring spatio-temporal continuity. This method has the advantage that the formulation leads to a non-linear system of algebraic equations. The formulation also enables us to progress over contiguous chunks of time rather than computing the velocity state at every instance in time. Fluid dynamical examples are presented that validate this method.

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