Sequential approximation of velocity fields using episodic POD

PARITOSH MOKHASI, DIETMAR REMPFER, IIT, Chicago — The problem of approximating velocity fields at future and past times based on information available at the current time is addressed. A novel method called "episodic POD" is described that enables us to achieve our objective. Application of episodic POD to an ensemble of flow data results in a set of spatio-temporal eigenfunctions and a set of coefficients associated with the eigenfunctions. From these eigenfunctions, we develop two models called the "forward model" and "inverse model" that enable us to approximate the velocity fields at future and past times based on information provided at the current time. A second set of models, the forward and inverse sequential models are also developed that enable the dynamic update of approximated velocity fields when new information is made available, making these models more adept at on-line estimation. Different examples are used to validate and highlight the proposed method. It is also shown that episodic POD outperforms the linear Kalman filters in the presence of noise.

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