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Optimal mode decomposition for unsteady and turbulent flows ANDREW WYNN, DAVID PEARSON, Imperial College London, UK, BHARATHRAM GANAPATHISUBRAMANI, University of Southampton, UK, PAUL GOULART, ETH, Zurich — A new method, which we refer to as Optimal Mode Decomposition (OMD), to identify a linear model for the evolution of a fluid flow is presented. The method enables an ensemble of snapshot data to be used to estimate the linear dynamics of a flow by identifying a low order subspace of the flow and constructing dynamics on that low order subspace. An iterative procedure is used to find the optimal combination of linear model and subspace that minimises the system residual error. The OMD method is shown to be a generalisation of Dynamic Mode Decomposition (DMD), in which the subspace is not optimised but rather fixed to be the one spanned by the POD modes. A comparison between OMD and DMD is made using both a synthetic waveform and an experimental data set. The OMD technique is shown to have lower residual errors than DMD and is shown on a synthetic waveform to provide more accurate estimates of the system eigenvalues. This new method can be used with experimental and numerical data to calculate the 'optimal' low-order model with a user-defined rank that best captures the system dynamics of unsteady and turbulent flows.

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