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Low Dimensional Modeling of Transient Flow Fields Using Double Proper Orthogonal Decomposition STEFAN SIEGEL, KELLY COHEN, JUERGEN SEIDEL, SELIN ARADAG, THOMAS MCLAUGHLIN, US Air Force Academy — Proper Orthogonal Decomposition (POD) has been demonstrated in the past as a powerful tool for low dimensional modeling of periodic flow fields. When applied to transient flows, though, the method leads to spatial modes that have to span the different flow states at the beginning and end of the transient. Thus, the spatial modes tend to loose their association with physical phenomena in the flow. Here, we present an extension to POD that remedies this problem, by using POD based expansion of the physical modes present in each cycle of the transient flow behavior. This is done using a double POD (DPOD) decomposition: First, all individual shedding cycles within a transient flow field are modeled using POD. This leads to an ensemble of similar, albeit—due to the transient effects—slightly varying sets of POD modes. A second POD decomposition is then used to represent this set of modes and their changes in time, completing the DPOD procedure. We demonstrate the performance of DPOD by applying it to transient wake flow data.

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