

Abstract Submitted
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Online dynamic mode decomposition for time-varying systems¹

HAO ZHANG, CLARENCE ROWLEY, Princeton University, ERIC DEEM, LOUIS CATTAFESTA, Florida State University — Dynamic mode decomposition (DMD) is a popular technique for modal decomposition, flow analysis, and reduced-order modeling. In situations where a system is time varying, one would like to update the systems description online as time evolves. This work provides an efficient method for computing the DMD matrix in real time, updating the approximation of a systems dynamics as new data becomes available. The algorithm does not require storage of past data, and computes the exact DMD matrix using rank-1 updates. A weighting factor that places less weight on older data can be incorporated in a straightforward manner, making the method particularly well suited to time-varying systems. The efficiency of the method is compared against several existing DMD algorithms: for problems in which the state dimension is less than about 200, the proposed algorithm is the most efficient for real-time computation, and it can be orders of magnitude more efficient than the standard DMD algorithm. The method is demonstrated on several examples, including a time-varying linear system and a more complex example using data from a wind tunnel experiment.

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