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Time-resolved turbulent velocity field reconstruction using a long short-term memory (LSTM)[1] ZHIWEN DENG, Shanghai Jiao Tong University and Pusan National University, YINGZHENG LIU, Shanghai Jiao Tong University, KYUNG CHUN KIM, Pusan National University — This paper focuses on the time-resolved turbulent flow reconstruction from discrete point measurements and non-time-resolved PIV measurements using an artificial intelligence framework based on LSTM. To this end, an LSTM-based proper orthogonal decomposition (POD) model is proposed to establish the relationship between velocity signals and time-varying POD coefficients obtained from non-TR-PIV measurements. An inverted flag flow at Re=6,200 was experimentally measured using TR-PIV for the construction of training and testing datasets and for validation. Two different time-step configurations were employed to investigate the robustness and learning ability of the LSTM-based POD model: a single-time-step structure and a multi-time-step structure. The results demonstrate that the LSTM-based POD model has great potential for time-series reconstruction since it can successfully recover the temporal revolution of POD coefficients with remarkable accuracy, even in high-order POD modes. In addition, a relative error reconstruction analysis was conducted to compare the performance of different time-step configurations further, and the results demonstrated that the POD model with multi-time-step structure provided better reconstruction of the flow fields.

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