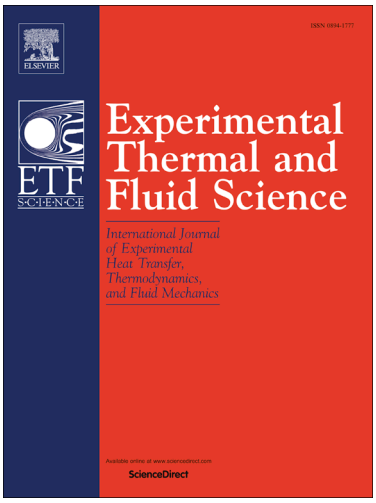

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Higher order dynamic mode decomposition of noisy experimental data: the flow structure of a zero-net-mass-flux jet

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Abstract

A method is presented to treat complex experimental flow data resulting from PIV. The method is based on an appropriate combination of higher order singular value decomposition (which cleans the data along the temporal dimension and the various space dimensions) and higher order dynamic mode decomposition (HODMD), a recent extension of standard dynamic mode decomposition that treats the data in a sliding window. The performance of the method is tested using experimental data obtained in the near field of a zero-net-mass-flux (ZNMF) jet. The better performance of HODMD is put in evidence making this technique suitable to both, cleaning the experimental noise using a limited number of snapshots and obtaining robust and sufficiently accurate results that elucidate the spatio-temporal structure of the flow. The results show that this ZNMF jet is temporally periodic in the near field, where the flow results from the interaction of a large number harmonics. These harmonics involve large scale spatial flow structures, identified as spatially growing instabilities, which are associated with the flow transition to turbulence in the far field.

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