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Acceleration feature points of unsteady shear flows[1] JENS KASTEN, University of Leipzig, Germany, JAN REININGHAUS, IST, Austria, INGRID HOTZ, HANS-CHRISTIAN HEGE, ZIB, Germany, BERND R. NOACK, GUILLAUME DAVILLER, PIERRE COMTE, Institute PPRIME, France, MAREK MORZYŃSKI, Poznan University of Technology, Poland — We generalize velocity topology with centers (vortices) and saddle points in a Galilean-invariant manner. In particular, a computationally robust (derivative-free) framework for their extraction of two-dimensional unsteady flows is presented. The key enabler is the definition of feature points based on the acceleration magnitude. The extracted feature points are tracked over time resulting in corresponding trajectories. Using homological persistence and lifetime of features, a spatiotemporal importance measure for vortex core lines is introduced that enables a hierarchical filtering. As example, homological persistence is shown to discriminate between hydrodynamic and aeroacoustic flow structures. Our framework is applied to analytic examples as well as simulations of a cylinder wake, of a two-dimensional mixing layer and of a jet.

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Bernd R. Noack
Institute PPRIME, France

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