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Koopman decomposition of Burgers equation: What can we learn? JACOB PAGE, RICH KERSWELL, University of Bristol — Burgers equation is a well known 1D model of the Navier-Stokes equations and admits a selection of equilibria and travelling wave solutions. A series of Burgers trajectories are examined with Dynamic Mode Decomposition (DMD) to probe the capability of the method to extract coherent structures from "run-down" simulations. The performance of the method depends critically on the choice of observable. We use the Cole-Hopf transformation to derive an observable which has linear, autonomous dynamics and for which the DMD modes overlap exactly with Koopman modes. This observable can accurately predict the flow evolution beyond the time window of the data used in the DMD, and in that sense outperforms other observables motivated by the nonlinearity in the governing equation. The linearizing observable also allows us to make informed decisions about often ambiguous choices in nonlinear problems, such as rank truncation and snapshot spacing. A number of rules of thumb for connecting DMD with the Koopman operator for nonlinear PDEs are distilled from the results. Related problems in low Reynolds number fluid turbulence are also discussed.

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