

Abstract Submitted
for the DFD20 Meeting of
The American Physical Society

Modeling a turbulent flow using periodic orbits NAZMI BURAK BUDANUR, GÖKHAN YALNIZ, BJÖRN HOF, IST Austria — We show that turbulence in simulations of the sinusoidally-driven Navier–Stokes equations in three dimensions can be decomposed into a series of shadowing events wherein the dynamics can be transiently approximated by a periodic orbit. Based on its shadowing decomposition, we generate a low-dimensional model of the turbulent flow as a Markov chain with nodes corresponding to the periodic orbits. We show that the invariant measure of the Markov chain provides periodic orbit weights that capture the flow statistics. Our results suggest that the neighborhoods of periodic orbits yield an approximation to the natural measure of the turbulent flow.

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Date submitted: 03 Aug 2020

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