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Filter-induced bifurcations of Navier–Stokes solutions J. M. MCDONOUGH, University of Kentucky, ALI NAGHI ZIAEI, NEDA SHEIKHREZAZADEH NIKOU, Ferdowsi University of Mashad, Iran — We study 3-D lid-driven cavity (LDC) flows at both laminar and turbulent Reynolds numbers (Re), employing LES as the solution technique, and demonstrate that application of filters (both explicit and implicit) can lead to computed solutions exhibiting features that are not even qualitatively correct, when compared with DNS and experiment, as a result of bifurcations associated with changing filter parameter values. We carry this out for two specific values of Re: 1000 for laminar (steady) flows and 10000 for turbulent flows, using a wide range of numerical grid spacings (both uniform and nonuniform) to permit assessment of accuracy and aliasing effects. No geometric smoothing is employed in corners of the impulsively-started, driven lid, leading to non-classical solutions to the equations of motion, and the need for mollification (filtering). Power-spectral analysis of time series is used to identify qualitative behaviors, and it is found that on coarse grids any of steady, periodic, quasiperiodic and chaotic states can be achieved by changing filter-parameter values such as the Smagorinsky constant and the Shuman filter parameter.

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