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Numerical investigation of the non-stationary nature of turbulence in porous media VISHAL SRIKANTH, CHING-WEI HUANG, ANDREY KUZNETSOV, North Carolina State University — Microscale turbulence in porous media constitutes a new physical phenomenon that exhibits dual properties of both classical internal and external turbulent flows. The flow field consists of both swirling micro-vortices generated behind the solid obstacles and coherent eddies in the primary flow. There is a need to characterize the dynamics of these flow structures in order to understand how to model the resulting inhomogeneous flow field. We use LES to simulate turbulent flow in porous media, represented by a homogenous array of circular cylinder solid obstacles. We observe that the spatial two-point velocity auto-correlation function inside the porous medium shows correlation behind each solid obstacle in the vicinity of the micro-vortices. The statistical similarity suggests that vortex shedding in porous media with a periodic structure is not a wholly random process, but is characterized in part by a harmonic nature. Thus, the re-correlation behind each solid obstacle is an indication of non-stationarity of the flow. We vary the porosity and the Reynolds number to show that this flow behavior is repeatable.

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