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Transition to turbulence in randomly packed porous media: scale evolution of vortical structures REZA M. ZIAZI, JAMES LIBURDY, Oregon State University — Vortical structures are the driving mechanism behind the process of transition to turbulence in randomly structured porous media that is observed in many natural processes; natural canopy forest fires and biological systems such as cardiovascular and respiratory. The investigation of vortex evolution during the onset of turbulence is performed by using time-resolved PIV to identify the flow structures, and measure the scale and energy of swirling structures as related to pore- and macro-scale Reynolds numbers. Objective local region-type (λ_{ci}) versus non-local (Γ_2) vortex identification methods are employed to detect the asymptotic scales at larger Re during transition from 100 to 1000. The direct measure of the size, strength, and number density of vortical structures are observed to show a similar trend and asymptote to turbulent scales at higher pore-scale Reynolds numbers. The shear and rotational contribution of vortical structures are influenced differently from pore- versus macro-scale Reynolds numbers which interprets the scale evolution during transition process.

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