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PIV measurements and lattice-Boltzmann modelling on pulsating flow in porous media

Secondary flow in laminar regimes induced by curvature of the pipes also enhanced by pulsating flow has been frequently studied due to its applications, particularly in mixing and heat transfer processes [1-4]. In presence of porous media, it is also shown that the pore-scale features may play a critical role in micro-scale flow behaviour, also governing the macroscopic transport regimes [5-6]. Here we characterise the flow pore-scale patterns in porous media subject to pulsating boundary conditions.

PIV measurements combined with lattice-Boltzmann simulations were conducted to investigate the influence of flow rate in combination to boundary conditions on pore-scale flow behaviour. The influence of pulsatng boundary conditions were explored. PIV measurements revealed how local flow behaviour can change from channelised to local counter-currents in effects of transient boundary conditions. Critical circumstances where non-steady conditions may occur are discussed. The test considerations are presented for the study of pore-flow behaviour, in particular, for the prospective natural applications. LBM is used to simulate the test problem and further investigate the mutual impacts of flow rate and boundary conditions. The possibility of the special conditions observed in the experiments in actual field cases is further discussed. Recommendations on special test conditions are provided to better represent the actual circumstances in nature.

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