Abstract Submitted
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A Mixed Approach for Modeling Blood Flow in Brain Microcirculation[1] SYLVIE LORTHOIS, MYRIAM PEYROUNETTE, YOHAN DAVIT, MICHEL QUINTARD, Institut de Mcanique des Fluides de Toulouse : UMR CNRS INP UPS 5502, GROUPE D'ETUDE SUR LES MILIEUX POREUX TEAM — Consistent with its distribution and exchange functions, the vascular system of the human brain cortex is a superposition of two components. At small-scale, a homogeneous and space-filling mesh-like capillary network. At large scale, quasi-fractal branched veins and arteries. From a modeling perspective, this is the superposition of: (a) a continuum model resulting from the homogenization of slow transport in the small-scale capillary network; and (b) a discrete network approach describing fast transport in the arteries and veins, which cannot be homogenized because of their fractal nature. This problematic is analogous to fast conducting wells embedded in a reservoir rock in petroleum engineering. An efficient method to reduce the computational cost is to use relatively large grid blocks for the continuum model. This makes it difficult to accurately couple both components. We solve this issue by adapting the well model concept used in petroleum engineering to brain specific 3D situations. We obtain a unique linear system describing the discrete network, the continuum and the well model. Results are presented for realistic arterial and venous geometries. The mixed approach is compared with full network models including various idealized capillary networks of known permeability.

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