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Modelling of advection-diffusion transport in liver tissue using the homogenization approach

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The blood microcirculation in the liver (in perfused tissues) is tightly related to important physiological processes, which are driven by the transport of oxygen and nutrients. Its assessment is usually based on imaging techniques which monitor the time-space distribution of a contrast fluid transported with the blood. The liver tissue can be approximated as a (locally) periodic lobular structure [3]. The present paper contributes to the development of a complex multiscale hierarchical model of the tissue perfusion by two aspects: **a)** The homogenization-based models of the microcirculation derived previously [1, 2] are revised and adapted for a new interface condition coupling the flow in precapillary networks and in the capillary porosity described by the Biot model; **b)** We derive a homogenized model of the contrast fluid (CF) transport in the vasculature of the liver lobules. This yields a problem for the CF saturation which is transported due to advection along with the blood. For this, the multiscale advection velocity fields are given by the perfusion model which is decoupled. While in the larger (precapillary) vasculature, the diffusion is very small and provides rather the model regularization, in the sinusoidal porosity it is used to account for the CF penetration to the space of Disse through the capillary wall fenestration. Furthermore, it is shown how the homogenized models of the liver perfusion and the CF transport are coupled with the multi-compartment Darcy flow model describing the upper hierarchies of the vascular trees. [4].

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