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A TWO-SCALE 3D-FEM MODEL FOR ANISOTROPIC HEPATIC LOBULE PERFUSION AND CELL METABOLISM

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In this talk we present a continuum mechanical model for the coupled description of function (metabolism) and blood perfusion in the liver. The metabolism takes place in the liver cells, the hepatocytes, which are arranged in hexagonal functional segments, the liver lobules. The liver lobes are substructures in sinusoids which are micro-vessels and the smallest repetitive functional sub-elements in the liver lobes. The perfusion of the sinusoids is modelled by a homogenized multiphasic approach based on the theory of porous media. In order to simulate the biochemical reactions between the nutrients in the blood and the hepatocytes a 0D system of ordinary differential equations (ODE) is imbedded into the FEM program calculating reaction rates of each substance. The boundary conditions of the ODE-system are calculated in the overlying FEM scale and contain information about external glucose and lactate concentrations that are solved and carried in the blood whereas the glycogen is stored stationary in the hepatocytes.

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