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# MULTI-SCALE TECHNIQUES TO PROBLEMS OF SCALAR TRANSPORT THROUGH POROUS MEDIA FOR PAPER-BASED MICROFLUIDICS

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**Abstract.** In this work, multiscale techniques to model scalar transport in porous materials with paper-like microstructures are studied and applied. The multiscale technique is based on the definition of a representative volume element (RVE) of the material to be modeled. In this case, the microstructure is built from connected channels where the fluid moves inside the void of the porous material (microscale). The fluid dynamic problem is solved under incompressible flow conditions in the Stokes regime, in order to calculate the effective permeability corresponding to the microstructure, as it was presented in a previous work of this series. The microscale problem involves solving an advection-diffusion equation, while the macroscale problem entails solving an advection-diffusion-dispersion problem. The velocity required for the advective term at the macroscale is obtained from the fluid dynamic solution at the microscale. To validate the dispersion results, a comparison is made with experimental results for materials commonly used in microfluidics such as Whatman paper #1. This study aims to investigate the limitations of this methodology and identify necessary modifications that should be made to the assumptions and formulations for accurate flow and transport modeling in paper-based microfluidic applications.