Modelling and Simulation of Filter Media Deformation in Connection with Filtration Problems
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There are many filtration problems for which the deflection of the filtering media plays important, or even crucial role. The interaction between the fluid and the filtering medium can have a substantial impact on the performance of the filter element - in some cases even for rather small deformations. In view of these facts one can state that there is an increasing demand for the integration of poroelastic effects into the simulation of the performance of filter elements.

Computer simulation of this Fluid-Porous-Structure Interaction (FPSI) requires the numerical solution of a coupled problem. In particular, one has to identify a proper poroelasticity model for filtering media. As a starting point, the classical Biot model was considered, which is three-dimensional in space. For suitable geometries plate and shell models allow for faster solution. Our recent developments in this area will be presented.

Numerical tests show a good agreement of the results obtained for the plate models with both the full 3D model and analytical solutions that are known for simple geometries. The method was also applied to real-world scenarios, where very promising results could be obtained.