Abstract Submitted
for the DFD16 Meeting of
The American Physical Society

Prediction of local losses of low Re flows in elastic porous media
SID BECKER, University of Canterbury, STEFAN GASOW, Technical University of Hamburg — An isotropic elastic porous structure whose pore scale geometry is regular (periodically uniform) will experience non-uniform deformation when a viscous fluid flows through the matrix under the influence of an externally applied pressure difference. In such a case, the flow field will experience a non uniform pressure gradient whose magnitude increases in the direction of bulk flow. In this study, a method is presented that predicts local losses of the flow through a porous matrix whose geometry varies in the direction of flow. Employing an asymptotic expansion about the deformation provides an expression relating local hydraulic permeability to local pore geometry. In this way the pressure field is able to be determined without requiring the explicit solution of the flow field. In this study a test case is presented showing that the local pressure losses are predicted to be within 0.5% those of the solution to the Navier-Stokes Equations. The approach can be used to simplify the coupled fluid-solid problem of flow through elastic porous media by replacing the need to explicitly solve the flow field.

Sid Becker
University of Canterbury

Date submitted: 30 Sep 2016 Electronic form version 1.4