Validation of Brinkman Equation for a simple shear driven flow over porous media. AIDAN RINEHART, UGIS LACIS, SHERVIN BAGHERI, KTH Royal Inst of Tech — The Brinkman equation has found wide popularity in modeling porous media as it overcomes the strict requirements necessary to model exact porous geometries. However there remains conflicting literature on what the Brinkman viscosity should be as well as the physical domains where the Brinkman equation can be a reasonable model. We investigate the accuracy of the Brinkman equation in porous media subjected to an overlying shear flow. This is accomplished through exact solutions of geometry resolved regular porous structures. Several porous structures are considered with cylinders of various cross section geometries and solid volume fractions. The Brinkman equation is then used to obtain velocity profiles that best fit the exact solutions using the Brinkman viscosity as a free parameter. We find that the Brinkman equation can provide excellent matches for the interior portion of the porous domain, but struggles to consistently model the interfacial region of the porous domain. We provide some guidelines for expected values of the Brinkman viscosity. Additionally we report the error between the exact and Brinkman velocity profile providing a quantitative evaluation of the Brinkman equation's ability to faithfully model the flow through the porous media.

Aidan Rinehart
KTH Royal Inst of Tech