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A universal visco-inertial flow model in geologic porous media

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Fluid flow though geologic fractured/porous media tends to become non-Dacian as a result of the competition between viscous and inertial forces and the effect of pore geometry variation. The Forchheimer equation has been widely shown to apply in these situations, in which the coefficient of viscous permeability (kv) is largely predictable, but this is not so for the coefficient of inertial permeability (ki). Synthesizing thousands of pore-scale flow models and field and laboratory observations, we show that ki can be predicted from kv via the equation ki~(kv)^(3/2) across twelve and sixteen orders of magnitude in ki and kv, respectively. kv is thus sufficient for predicting flow across viscous-to-inertial regimes for most geologic media.

References

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