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A theoretical relationship between porosity and permeability J.M. MCDONOUGH, TINGTING TANG, University of Kentucky — The equations of fluid motion for flow in porous media typically contain the physical parameters porosity and permeability. The first of these is simply a ratio of fluid volume to overall flow-region volume and is easily estimated. Permeability, on the other hand, is more difficult to predict and must usually be calculated using correlations from laboratory experiments for specific porous materials. A well-known example is the Kozeny–Carmen relationship (see, e.g., Carmen, *Flow of Gases Through Porous Media*, 1956) expressing permeability in terms of porosity for flow in packed beds of solids. In general, there is not a one-to-one permeability-porosity relationship, and this causes difficulties when simulating flows in domains of widely differing porosity. Here we present the derivation of a formula relating these two quantities. We assume validity of using entropy generation rate maximization to set the stable state in non-equilibrium phenomena (Glansdorff and Prigogine, *Physica*, 1970). This leads to a first-order ordinary differential equation for porosity in terms of permeability which can be solved exactly, resulting in the desired formula for permeability in terms of porosity (as well as strain rates and temperature from the entropy generation formula).

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