# Operator-Stable Densities and Solute Transport in Fractured Media

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Numerical simulations of fluid flow and solute transport through synthetic fracture networks, generated according to physically realistic statistics that describe distributions of fracture length, transmissivity, orientation and values of fracture set density, were used to explore the wide range of advective transport characteristics that fractures may impart on a ground water flow system. A subset of network types with infinite-variance distributions of fracture length and low-to-moderate fracture densities exhibit characteristics of operator-stable densities, including power-law leading edge concentration profiles and super-Fickian growth rates. For these network types, a multiscaling fractional advection-dispersion equation (MFADE) provides a model of multidimensional solute transport where different rates of power-law particle motion are defined along multiple directions. The MFADE model is parameterized by a scaling matrix to describe the super-Fickian growth process, in which eigenvectors correspond to fracture group orientation and eigenvalues code fracture length and transmissivity. All fracture networks show long-term particle retention, so that coupling of the MFADE equation of motion with a continuous time random walk or multirate mobile/immobile model will increase accuracy near the source.