266b Numerical Simulation of Mixing in Micro-Channels Packed with Spherical Beads

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Particles held fixed in a microfluidic channel disturb the otherwise unidirectional fluid velocity field and can be used to assist mixing. We use the lattice-Boltzmann method to determine the complex fluid flow in micro-channels with packed spherical beads. We study the mixing of two passive tracer species by computing the trajectories of many tracer particles that are convected by the fluid velocity field and undergo a random diffusive motion. We explore a variety of packed bed configurations to determine the structures that mix the fluid most efficiently. In particular, we consider the influence of the bed length divided by the channel width, the ratio of the bead diameter to the channel width, the Peclet number, the packing volume fraction, and the polydispersity of the bed particles.