

Numerical Study on an Autonomous Microfluidic Capillary Flow

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In microfluidic devices as stand-alone-laboratory card, the microfluidic networks as conduits play an integral role. Many efforts have been made to construct a microfluidic network system that autonomously transports liquids by means of capillary phenomena. In this work, we perform both 2D and 3D simulations and examine the transient nature of the capillary flow development. Analytical solutions are also derived for simple cases and compared with numerical results. Numerical and analytical predictions in this work agree well with the experimental findings reported elsewhere and essential information on the capillary system design are brought out. Our efforts and initial success in numerical description of the microfluidic capillary flows enhance the fundamental understanding of the autonomous capillary flow and will eventually pave the road for full-scale, computer-aided design of microfluidic networks.