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Deformation, Breakup and transport of drops in MEMS devices¹ PUSHPENDRA SINGH, Department of Mechanical Engineering, New Jersey Institute of Technology, NADINE AUBRY, Department of Mechanical Engineering, Carnegie Mellon University — In recent approaches developed for laboratory-on-achip applications of microfluidic devices the fluids to be analyzed/manipulated are transported as drops. One of the possible techniques for transporting drops is by applying a non uniform electric field which has been successfully used in the past to transport rigid particles. A drop, however, not only experiences a net force which transports it, but also an electric stress on its surface which deforms it and can even break it into one or more droplets if the applied electric is sufficiently strong. We use the direct simulation approach to study this problem of deformation and transport of a dielectric drop in a non uniform electric field. Our technique is based on a finite element scheme in which the droplet and its surrounding fluid are moved using the fundamental equations of motion. The interface is tracked by the level set method and the electric forces are computed using the Maxwell stress tensor. The drop is assumed to be immiscible with the ambient fluid and its dielectric constant is different from that of the ambient fluid. The electric field is generated by placing electrodes at the bottom of the MEMS device.

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