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Systems-level analysis of AC microfluidics and the problem of trapped gas bubbles SØREN VEDEL, Dept. of Micro- and Nanotechnology, Technical University of Denmark, DTU Nanotech Bldg. 345 East, DK-2800 Kongens Lyngby, LAURITS HØJGAARD OLESEN, Device Research and Technology, Novo Nordisk A/S, Brennum Park, DK-3400 Hillerød, Denmark, HENRIK BRUUS, Dept. of Micro- and Nanotechnology, Technical University of Denmark, DTU Nanotech Bldg. 345 East, DK-2800 Kongens Lyngby, Denmark — Using pulsatile pressure and flow rate, we extend the equivalent circuit (EC) approach for systems-level analysis of microfluidic systems to also include dynamic, transient effects such as inertia and compliance. The dynamic time scales of microfluidics are typically on the order of millisecond, or equivalently frequencies in the low kHz regime. A novel pressure source has been developed and successfully tested for the experimental generation of flow under these conditions for two microfluidic setups. Good agreement was found between the experimental observations and the results of corresponding systems-level EC model [1]. Trapped air bubbles in the microfluidic system severely influences its performance, while also leading to erroneous predictions from the systems-level analysis. We present theoretical analysis of the physics of bubble adhesion to the system walls, leading to insights to their removal.
[1] S. Vedel, L.H. Olesen, H. Bruus, Lab Chip (submitted 2009), http://arxiv.org/abs/0907.2679

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