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## Developing a numerical model for study of a capsule in a microfluidic intracellular delivery platform

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Cell Squeeze is a microfluidic intracellular delivery platform in which a suspension containing cells of interest and the target cargo (DNA, RNA, proteins, genes, quantum dots, CNTs) are pumped through a parallel network of microfluidic channels. The mechanical stress on the cell, while rapidly flowing through a single or multiple narrow constrictions, causes temporary pore formation on the cell membrane. This opens a window for wide variety of non-targeted and non-specific cargo transfer into different types of cell. Developing a numerical model for the cell squeezing process can facilitate in device design optimization and to understand the mechanics of the cell being deformed. In our current work, we present a finite sized dissipative particle dynamics (FDPD) model to simulate the dynamics of a capsule flowing through a narrow constriction in a microchannel. The capsule is modelled as a closed bead-spring chain. The total energy of the capsule is associated with linear spring forces and the constraint of fixed area. By performing detailed simulations we study strain localizations on the capsule while flowing through channels with varying constriction width. The strain was found to be high for a capsule flowing through a channel with constriction width 50% smaller than the diameter of the capsule, in comparison to a narrower and a wider channel. We have also developed a method to quantify pore density based on the strain observed in the capsule as a result of flowing through the constriction.

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