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The electrode shape optimization method for cell sorting applications based on dielectrophoresis

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Abstract

This research provides the electrode shape optimization method to move a target particle subjected to the dielectrophoresis force to the desired position in fluid. The goal of the method is to minimize a distance between the end position of target particle and the desired position. The target particle is subjected to forces such as dielectrophoresis, gravity, and drag. The dielectrophoresis force affects dielectrically polarizable particles in the nonuniform electric field. We consider not only the dielectrophoresis force but also the drag force and the gravity force because the particle moves in a fluid. We calculate the electric field by the finite element method and the particle motion by a numerical method. The optimization method is the genetic algorithm, since it is difficult to find a mathematical relationship between the end position of the particle and the electrode. To show the validity of the proposed method, some numerical examples are presented.