

A Free Boundary Value Problem for Acto-Myosin Bundles

Acto-Myosin bundles are macroscopic structures within a cell that are used for various processes such as transport of nutrients and mechanical stability of the cell. Dietmar Ölz developed a model relating the flows of F-Actin to the effects of cross-link and bundling proteins, the forces generated by myosin-II filaments as well as external forces at the tips of the bundle.

In the asymptotic regime where actin filaments are assumed to be short compared to the length of the bundle, a fixed and a free boundary value problem can be derived. In the free boundary value problem the force at the tips is prescribed and the position of the tips can be computed. The model consists of transport equations for the density of actin filaments coupled to elliptic equations for the velocities of these filaments, as well as an ODE for the tip of the bundle. In order to solve this system (which is a work in progress), fixed point arguments are employed, a strategy which proved successful in solving the corresponding problem with fixed boundary (where the positions of the tips are known, and the force can be computed by post-processing).