

Model and Simulation of Actin-dependent Cell Movement

Several types of cells use a sheet-like structure called lamellipodium for movement. The main structural components, actin filaments, are connected via cross-linking proteins. Adhesions allow for a connection with the substrate and the contraction agent myosin helps pulling the cell body forward. Excluded volume effects and charges on the filaments also lead to forces between the filaments. Additionally the cell has to regulate its filament number locally by nucleation (via branching) of new filaments and degradation (via capping and severing) of existing ones.

A continuous model of this structure including the forces created by these molecular players will be presented. This non-linear model is approximated using the finite element method. The simulation can reproduce stationary and moving steady states, describe the transition between the two, mimic chemotaxis and simulate turning cells.