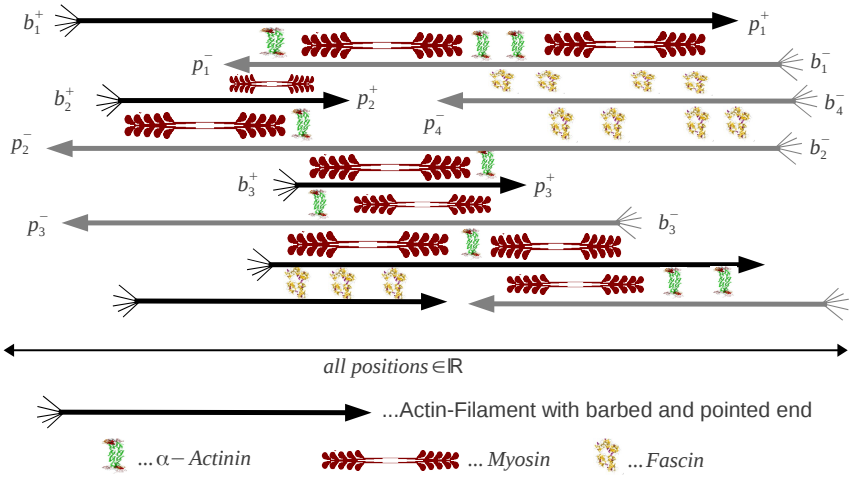
Dietmar Oelz, Mathematical Biology Group, Johann Radon Institute for Computational and Applied Mathematics (RICAM), Vienna, AUSTRIA

Modelling contractility and antiparallel flows in actomyosin bundles.

I present a mathematical model in 1-D for an actomyosin bundle featuring antiparallel flows of antiparallel F-Actin. The model is able to relate these flows to the effect of cross-linking and bundling proteins and to the forces due to myosin II filaments and to stretching forces at the extreme tips of the bundle.
The modelling is based on a coarse graining approach starting with a microscopic model which includes the description of chemical bonds as elastic springs and the force contribution of myosin filaments.



In a second step we consider the asymptotic regime where the filament lengths are small compared to the overall bundle length and restrict to the highest order contributions. There, it becomes appearent that bundling proteins provide the viscosity of the filemant gel and are reasponsible for force transmission. Myosin filaments generate forces which are partly compensated by drag forces due to cross-linking proteins.
The model is able to explain how the bundle of comparatively short Actin filaments interspersed with myosin II filaments can effectively contract the two tips of the actomyosin bundle. It gives a quantitative description of these forces and of the antiparallel flows of the two phases of antiparallel F-Actin.