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Inverse problems for active matter

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Many processes in cells are driven by the interaction of multiple proteins, for example cell contraction, division or migration. Two important types of proteins are actin filaments and myosin motors. Myosin is able to bind to and move along actin filaments with its two ends, leading to the formation of a dynamic actomyosin network, in which stresses are generated and patterns may form. Droplets containing an actomyosin network serve as a strongly simplified model for a cell, which are used to study elemental mechanisms. We are interested in determining the parameters that characterize this active matter, i.e., active forces that cause the dynamics of an actomyosin network, represented by the flow inside the actomyosin droplet, as well as the local viscosity. We use the Stokes equation with a spatially varying viscosity to model the flow caused by the activity (active forces) of the actomyosin network. A goal in biophysics is the identification of such active forces from measurements of the resulting flow field, leading to a parameter identification problem for the Stokes equation that is discussed in this talk in connection to the experimental setup.

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