Derivation and analysis of a Stokes-transport system modeling thermoregulation in human skin

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Abstract

We consider a Stokes flow coupled with advective-diffusive transport in an evolving domain with boundary conditions allowing for inflow and outflow. The evolution of the domain is induced by the transport process, leading to a fully coupled problem.
Our approach aims to model the thermal control of blood flow in human skin and the underlying physiological processes. To this end, the model takes into account the temperature-dependent production of biochemical substances, the subsequent dilation of blood vessels, and the resulting changes in convective heat transfer.
The talk will give insights into the main analytical challenges that arise in proving the existence of weak solutions for the system of PDEs. In particular, I will present a fixed point method that allows us to treat the nonlinear coupling.
This is joint work with Maria Neuss-Radu.

Keywords: Stokes equations, heat transport, free boundary problem, coupled problem, vasodilation