Blood rheology modeling and simulations

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Experimental studies over many years have shown that blood flow exhibits non-Newtonian characteristics such as shear-thinning, viscoelasticity, yield stress and thixotropy. The complex rheology of blood is influenced by numerous factors including plasma viscosity, hematocrit and in particular, the ability of erythrocytes to form aggregates when at rest or at low shear rates and to deform at high shear rates, storing and releasing energy. Hemodynamic analysis of blood flow in vascular beds and prosthetic devices requires the rheological behavior of blood to be characterized by phenomenological constitutive equations relating the stress to the rate of deformation and flow.

In this talk we present a short overview of some macroscopic constitutive models that can mathematically characterize the rheology of blood and describe their known phenomenological properties. Some test cases formulated in idealized and anatomically realistic vessels will be considered to investigate the impact of the most significant non-Newtonian characteristics of blood on its flow behavior, based on numerical simulations of different blood constitutive equations under given sets of physiological flow conditions.

This is a joint work with Tomáš Bodnár from Czech Technical University in Prague.

References

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