ACMS Applied Math Seminar

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Thurs, Apr 2
127 Hayes-Healy
4:00 PM

Modeling interaction between a fluid, elastic structure, and poroelastic material with applications to blood flow

The interaction between a fluid, elastic structure, and poroelastic material plays a fundamental role in many biomedical applications. Examples of such applications are the interaction between the blood, blood vessel, and blood clot, as well as the blood flow through dissected artery, where the partially thrombosed false lumen can be modeled as a poroelastic material. This multi-physics problem features three different types of coupling: fluid-elastic structure coupling, fluid-poroelastic material coupling, and elastic structure-poroelastic material coupling. The resulting system is a non-linear, moving boundary problem. As a consequence, numerical algorithms that split the fluid dynamics, structure mechanics, and poroelastic structure dynamics are a natural choice.

We present a partitioned algorithm to solve the coupled problem. Using this algorithm we investigate the effects of the material properties of the poroelastic medium on the fluid flow. Our findings indicate that the flow patterns highly depend on the storativity of the poroelastic material and cannot be captured by considering fluid-structure interaction only.

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