Abstracts of talk

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Topic 1: Differential quadrature parallel algorithms for solving system of convection-diffusion-reaction models

In this study we introduced three numerical schemes based on differential quadrature formulations for solving the system of convection-diffusion-reaction models. The domain decomposition method is applied to divide the physical domain into several subdomains, and the mesh is generated locally in each subdomain. Then the schemes are formulated by employing various combinations of differential quadrature and finite difference methods for the spatial and temporal derivative approximations. The solutions in the subdomain interfaces are computed first, and then the solutions in subdomains are calculated independently by using this pseudo boundary values. The effect of grid refinement in the computational time and error are studied for a test example of two-component reaction-diffusion equation. The schemes are extended to solve system of Black-Scholes equations for pricing European options in regime-switching economy.

Topic 2: Numerical simulation of blood flow in the aorta

Mathematical modeling and numerical simulations are being used in biomedicine as a tool to study the physiology of the cardiovascular system. Computational hemodynamics now provides many instances in which the diagnosis of cardiovascular disease (CVD) can be assisted with sufficient accuracy and enables the clinicians to adopt optimal treatment methodologies. The present work aims to address and validate algorithms to efficiently predict the hemodynamics in arteries. In our numerical experiments, we used the Navier-Stokes equations as the governing equations of blood flow for the calculation of the velocity field and pressure distribution in the blood. The linear elastodynamics model is used for the description of the behavior of the arterial wall. The numerical algorithm rely on the finite element simulation of the fluid-structure interaction between blood flow and arterial wall deformation. Some preliminary results of our first numerical experiments are discussed.