

# Mathematics and Cardiology: Partners for the Future

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The speaker will talk about several projects that are taking place in an interdisciplinary endeavor between the researchers in the Mathematics Department at the University of Houston, the Texas Heart Institute, Baylor College of Medicine, the Mathematics Department at the University of Zagreb, and the Mathematics Department of the University of Lyon 1. The projects are related to non-surgical treatment of aortic abdominal aneurysm and coronary artery disease using endovascular prostheses called stents and stent-grafts. Through a collaboration between mathematicians, cardiovascular specialists and engineers we have developed a novel mathematical model to study blood flow in compliant (viscoelastic) arteries treated with stents and stent-grafts. The mathematical tools used in the derivation of the effective, reduced equations utilize asymptotic analysis and homogenization methods for porous media flows. The existence of a unique solution to the resulting fluid-structure interaction model is obtained, and a numerical method, based on the finite element approach, was developed. Experimental measurements based on ultrasound and Doppler methods were performed at the Cardiovascular Research Laboratory located at the Texas Heart Institute. Excellent agreement between the experiment and the numerical solution was obtained.

This year marks a giant step forward in the development of medical devices and in the development of the partnership between mathematics and medicine: the FDA (the United States Food and Drug Administration) is getting ready to, for the first time, require mathematical modeling and numerical simulations to be used in the development of cardiovascular devices.

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