

Patient Specific Cardiovascular Blood Flow Modelling: Theory and Applications

Dr Carlos Alberto Figueroa
Biomedical Engineering, Kings College London

Advances in numerical methods and three-dimensional imaging techniques have enabled the quantification of cardiovascular mechanics in subject specific anatomic and physiologic models. Patient-specific models are being used to guide cell culture and animal experiments and test hypotheses related to the role of biomechanical factors in vascular diseases. Furthermore, biomechanical models based on noninvasive medical imaging could provide invaluable data on the in vivo service environment where cardiovascular devices are employed and on the effect of the devices on physiologic function. Finally, patient-specific modeling has enabled an entirely new application of cardiovascular mechanics, namely predicting outcomes of alternate therapeutic interventions for individual patients. In the first part of this talk, we present an overview of a number of methods used to create anatomic and physiologic models, obtain properties, assign boundary conditions, and solve the equations governing blood flow and vessel wall dynamics. In the second part of the talk, we demonstrate a few applications of patient-specific cardiovascular modeling in the areas of medical device design and evaluation, arterial wall growth & remodeling and cardiovascular disease research.