Project Title: Modeling and assessment of dynamic effects of artery stenosis on blood flow through fluid-structure-interactions between composite artery wall and physiological blood flows.

Supervisor's Name:

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Co-Supervisor(s): *(if already known)*

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Sources of Fund: *(if any)*

Presently no funding on this project, Department lab facility will be used. A proposal on this topic is in process to be submitted.

Research Field(s):

Summary and Problem Statement:

Atherosclerosis or artery stenosis is an artery disease that causes artery constriction due to the decomposition of smooth muscle cells and lipids in the artery and forms plaque at the artery wall. These plaques grow gradually with time and block the flow path. The hemodynamic effects of artery stenosis are far reaching beyond the reduction of artery cross-section, and dictates normal- and shear-stress distribution and formation of low-pressure zones near the constricted region. The atherosclerosis plaque forms in the high shear region; therefore, it necessitates the investigation of the dynamic effects of artery constriction on the blood flow before and after the formation of atherosclerotic lesions. By increasing or decreasing their cross-sectional area, the arteries that are far from the inert tubes adapt to changing pressure and blood flow conditions to accommodate the hemodynamic demands which exerts stresses on the artery walls. It is important to study the blood flow in arteries with physiological conditions, where the blood flow pressure changes under disease conditions, and to predict the stress level to avoid any unwanted circumstances (McDonald, 1955; Deplano and Siou, 1999; Chakravarty, S., 1994; Liao et al., 2004; Mekheimer and El Kot, 2012; Chiastra et al., 2017; Halder et al., 2017).

The proposal is directed to address the current issues related to formation of artery stenosis through fluid-structure-interactions analysis.

Keywords: Blood flow, coronary artery disease, artery stenosis, physiological flows, non-Newtonian flows, Numerical modeling, Fluid-structure-interaction

Objectives:

The main aims of the proposed research is the development of realistic numerical model for blood flow through artery stenosis and constrictions. The data obtained from the human artery will form the basis of geometric modelling while wall interactions of the blood flow will be modelled through a commercial FSI solver. A non-Newtonian flow with physiological boundary conditions that represent blood flow in arteries will be developed and implemented.

Tentative Methods of Approach:

Numerical Modeling with supporting human artery data.

Required backgrounds and skills

Backgrounds:

Fluid mechanics, Numerical methods,

Computing Skills:

Pre-knowledge of any commercial flow and structure solver can greatly help.

Other requirements:

References:

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