Notes

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July 8, 2025

Collection of running notes for each reference under review.

Contents

1 Introduction

Current methods for predicting coronary artery stenosis are rudimentary; and often prediction does mean coronary artery stenosis obstruction. (ref)

Are we merely intrested in predicting an obstruction, or, are we interested in predicting the risk associated with the obstruction? TODO: continue to define research problem(s) of interest.

We perform a literature survey of arterial blood flow using known methods from the literature, with the hope of understanding the computational challenges and tradeoffs of various *mathematical models*.

The human cardiovascular system supplys the human organs with blood, also known as the circulatory system. We study various mathematical models describing the dynamics of the circularty system. The principal quantities of our models are the bloods velocity $\boldsymbol{u}$ and pressure $\boldsymbol{p}$, and throughout it will be assumed that we are modeling a segment of the circulatory sytem restrict corresponding to an arterial region. Knowing the pressure and velocity for a portion of time allows us to compute stresses to which an arterial wall is subjected to due to the blood movement.

Note, our arterial boundary $\partial\Omega$ is a surface in $\mathbb{R}^3$ that evolves in time which we refer to as the interface. Note, an explicit representation of $\partial\Omega$ maps $(t, \theta, r, \theta, z) \mapsto (x, y, z)$. At times, it may be advantagoues to consider $\partial\Omega$ as an implicit interface, where the isocontors of our boundary represent the interface... .

This is a bit weird, look into the cylindrical coordinates implicit dynamical surface representations of our arterory

The region enclosed our interface is Ω, and we aim to model the velocity and pressure fields on Ω; which also is evolving in time.

Make some comment about "correct terminology for describing the types of coronary arterial stenosis is "coronary artery steno-

2 Literature Review

2.1 Review of Modeling Blood Flow in Human Circulatory System

We start by simulating a cut region, i.e., an arterial segment. We perform numerical simulations of various models to understand the following:

Suppose there are n stenotic regions within our arterial segment and j regions are determined to be high risk. Standard protocol suggests to remove the j regions regions; but in what order? Also, how are the blood flow dynamics effected at each step of cardiologists intervention. Additionally, consider the first step of intervention, which region should be focused on first? How does the removal of the first stenotic region effect the remaining $n-1$ regions (it may release debry to only get blocked in a later region). What is the best by-pass configuration?

2.2 Extended 1d model for blood flow within a stenotic artery

3 Apendix

References

Code Listings

Optional Space for sumplementary code listings of computations done while investigating

Code 1: Algorithm 16.5

```
function foo()
    println("Hello World)
end
```