3D Bifurcating Artery (steady) - Pre-Analysis & Start-Up

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Pre-Analysis & Start-Up

Pre-Analysis

In the *Pre-Analysis* step, we'll review the following:

- **Governing Equations:** We will review the governing equations that need to be solved in this problem.
- **Boundary Conditions:** We will go into more details about the boundary conditions that are applied in this problem.

Governing Equations

Before starting a CFD simulation, it is always good to take a look at the governing equations underlying the physics. In this case, although we have additional complexities such as pulsatile flow and non-newtonian fluids, the governing equations are the same as any other fluids problem. The most fundamental governing equations are the continuity equation and the Navier-Stokes equations. Here, let's have a quick review of the equations.
Continuity Equation:

$$\frac{\partial \rho}{\partial t} + \nabla \cdot (\rho \mathbf{v}) = 0$$

However, since we are considering only the steady case, the time-dependent term is zero. Thus, the continuity equation above can be further simplified in the form below:

$$\nabla \cdot \mathbf{v} = 0$$

The Navier-Stokes Equation is written as follows:

$$\rho(\mathbf{v} \cdot \nabla \mathbf{v}) = -\nabla p + \mu \nabla^2 \mathbf{v} + \mathbf{f}$$

Boundary Conditions

Wall:

The easiest boundary condition to determine is the artery wall. We simply need to define the wall regions of this model and set it to “wall”. From a physical viewpoint, the “wall” condition dictates that the velocity at the wall is zero due to the no-slip condition.

Inlet:

Here our inlet velocity will be a constant 0.315 m/s. This was chosen to give us a Reynolds number of 600.

Outlets:
The systolic pressure of a healthy human is around 120 mmHg and the diastolic pressure of a healthy human is around 80 mmHg. Thus taking the average pressure of the two phases, we use 100 mmHg (around 13332 Pascal) as the static pressure at the outlets.

Go to Step 2: Geometry

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