Cardiovascular Fluid Mechanics

OBJECTIVE:
Learn basic principles of fluid mechanics and computational fluid dynamics and how they can be applied in cardiovascular research and medicine.

ACTIVITIES:

9:20 AM → Introductions (5 min)

9:30 AM → Introduction to fluid mechanics

- What is a fluid? Examples of fluids (air, water, blood)
- Fluids in motion
    - Flow in a pipe: Flow vs. pipe diameter
    - Bernoulli

9:50 AM → Introduction to computational fluid dynamics (CFD)

- What is CFD?
- Examples from aerospace to sports performance, and clinical applications of CFD.

9:10 AM → How are fluid mechanics and CFD used to diagnose and treat cardiovascular disease?

- Examples:
    Coronary artery disease (CFD, FFR-CT)
    Aortic valve stenosis (Bernoulli)
    Predicting clot formation (CFD)

10:20 AM → Break

10:30 AM → Introduction to Simvascular: an open-source software for cardiovascular modeling.

Hands-on tutorial to walk the students through the process of cardiovascular modeling from medical image data to simulation results.

- *Creating Geometric Models from Medical Imaging Data: Path Planning and Segmentation*. We will construct a model of the aorta and femoral arteries based on computer tomography image data.
- *Generating the Mesh*
- *Setting Simulation Parameters*
- *Looking at the Results*