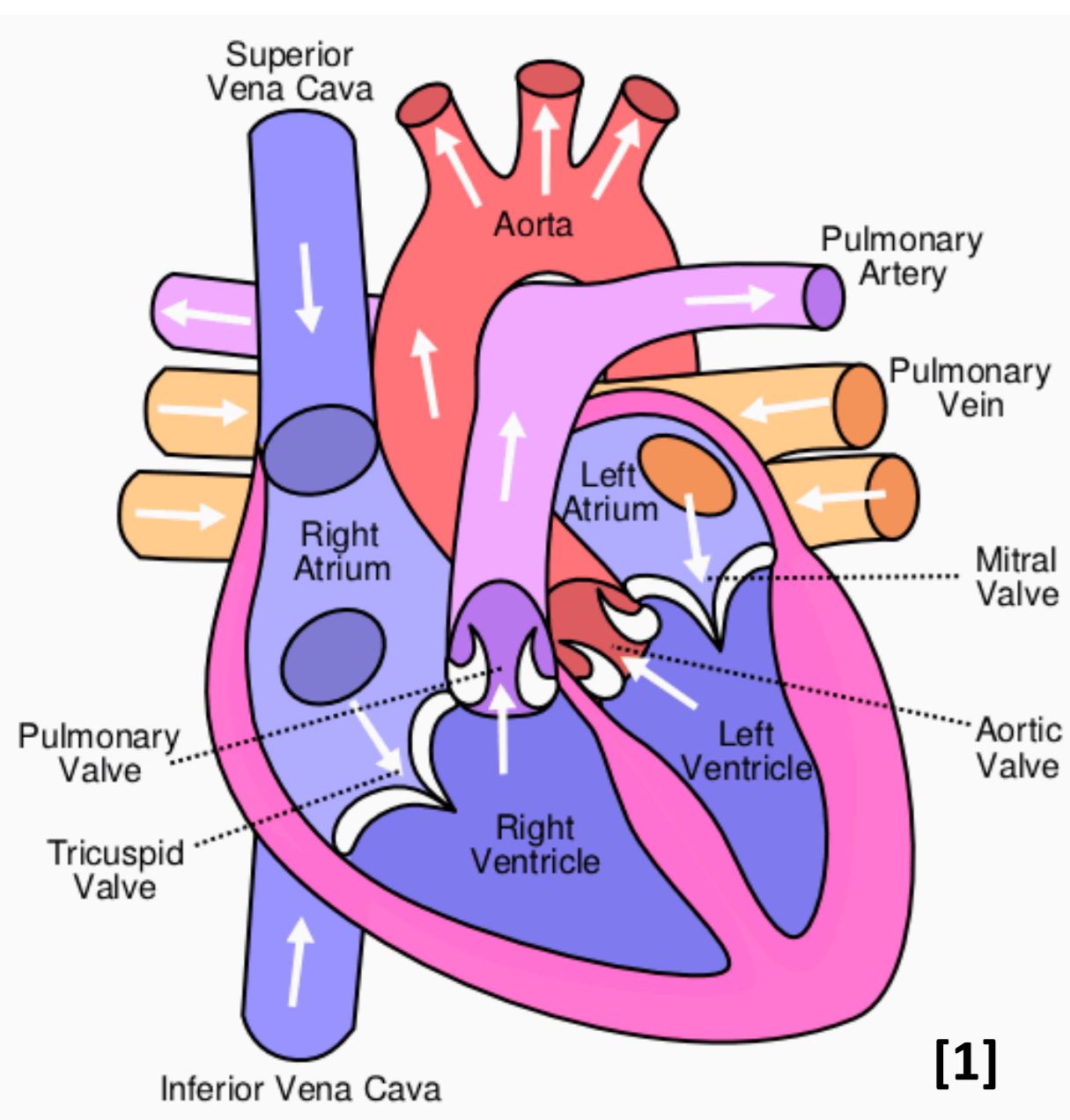


# A Mathematical Modeling Approach to Cardiovascular Health and Interventions

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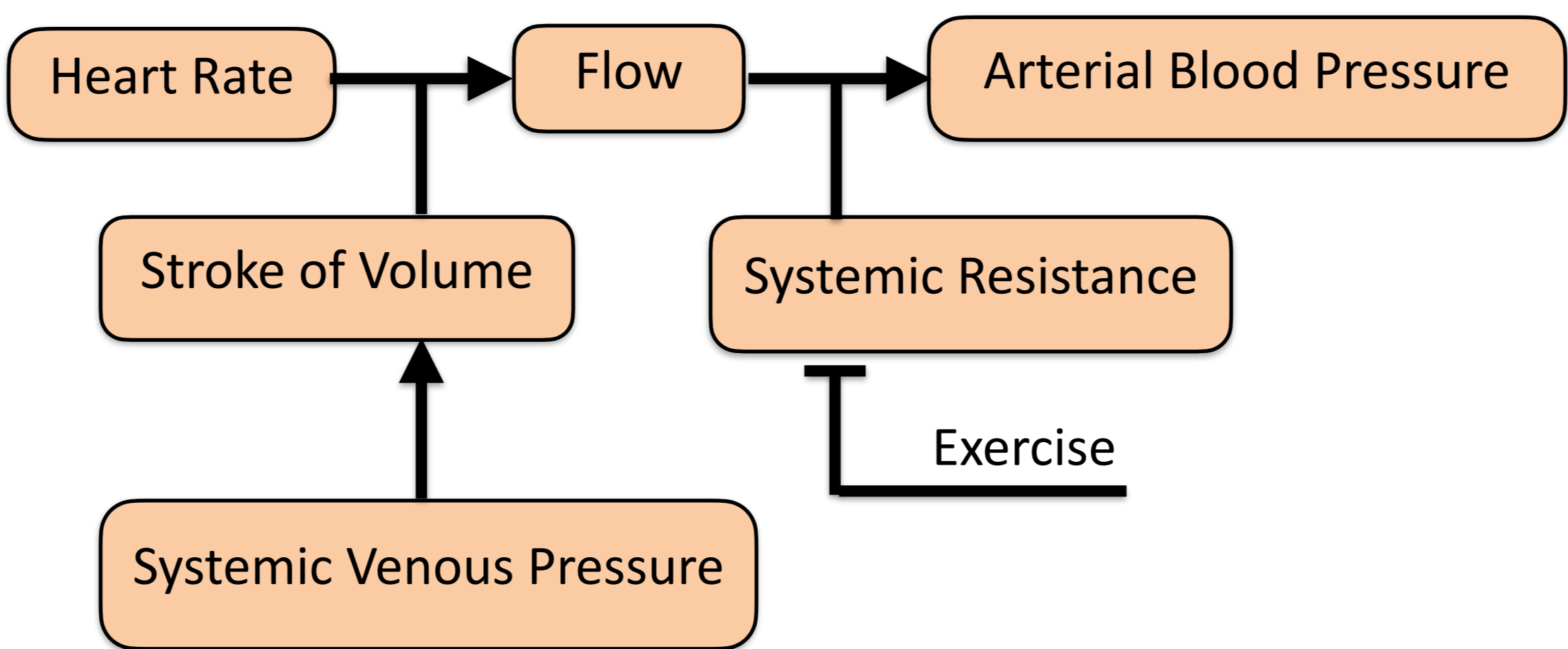


## Research Motivation



- The leading cause of death in the United States is heart disease. [2]
- Mitral Stenosis is the narrowing of the mitral valve, resisting blood flow through the left side of the heart. [3]
- Pharmaceuticals are often used to help reduce the resistance in blood vessels.
- Exercise has been shown to be beneficial in reducing symptoms for various diseases.

## Background

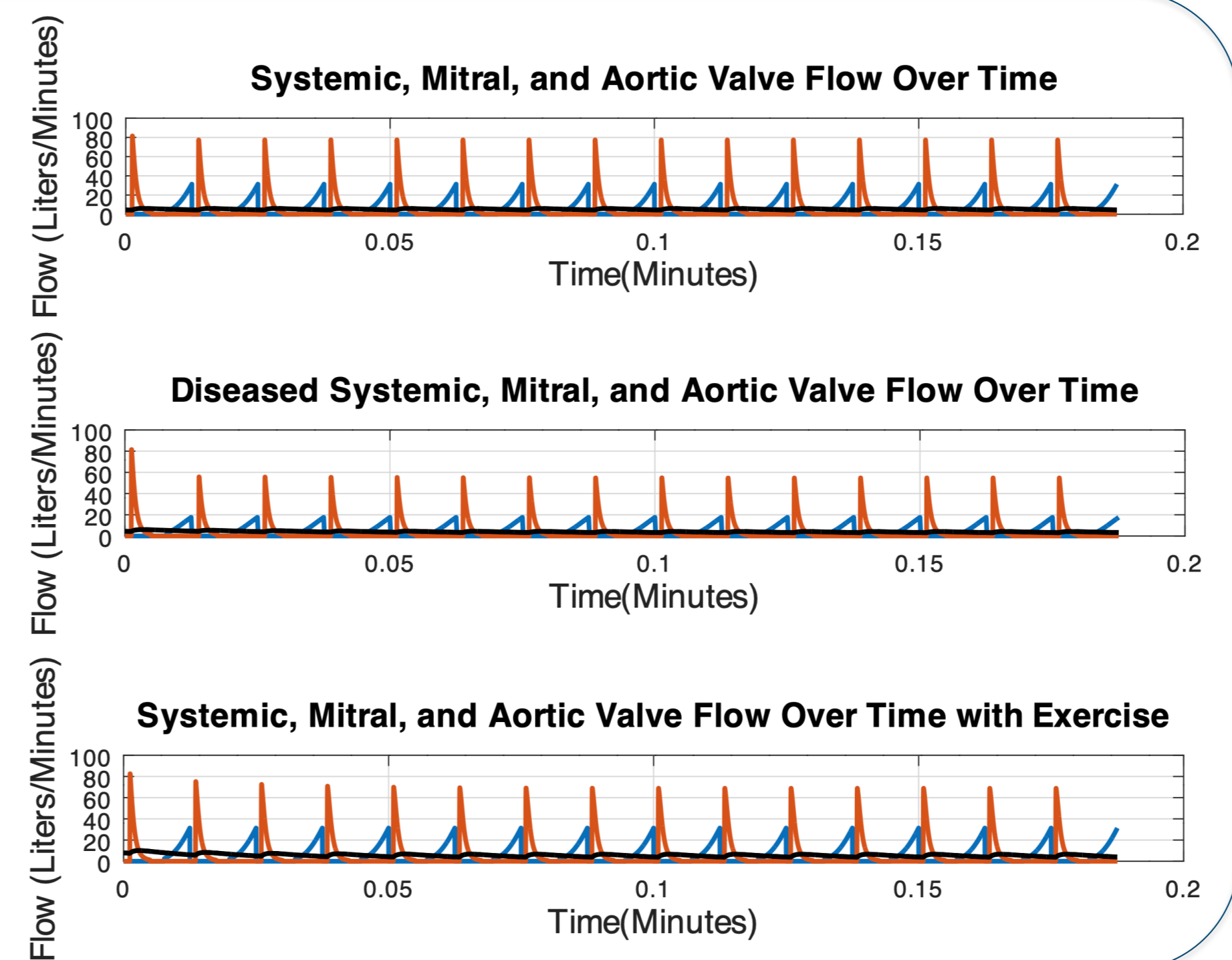
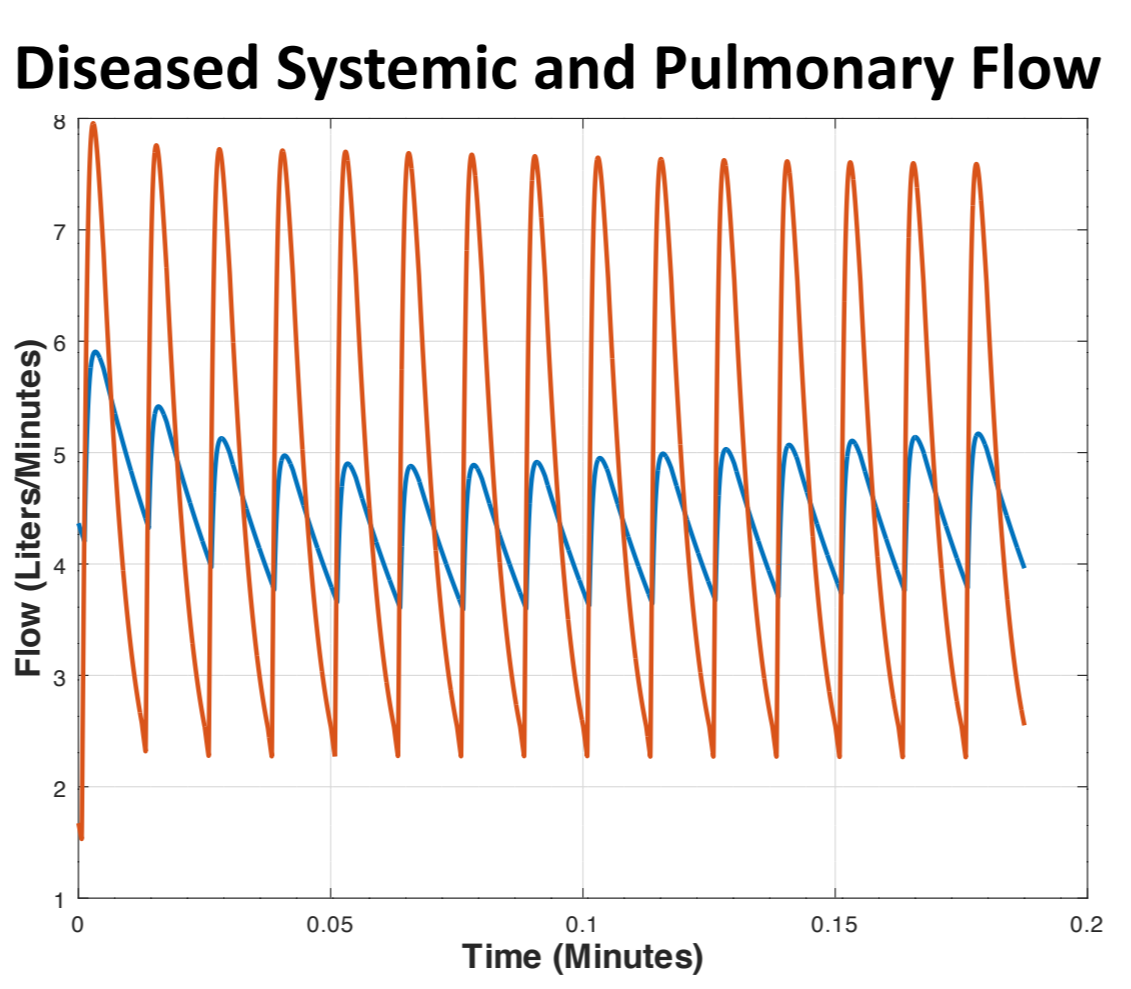
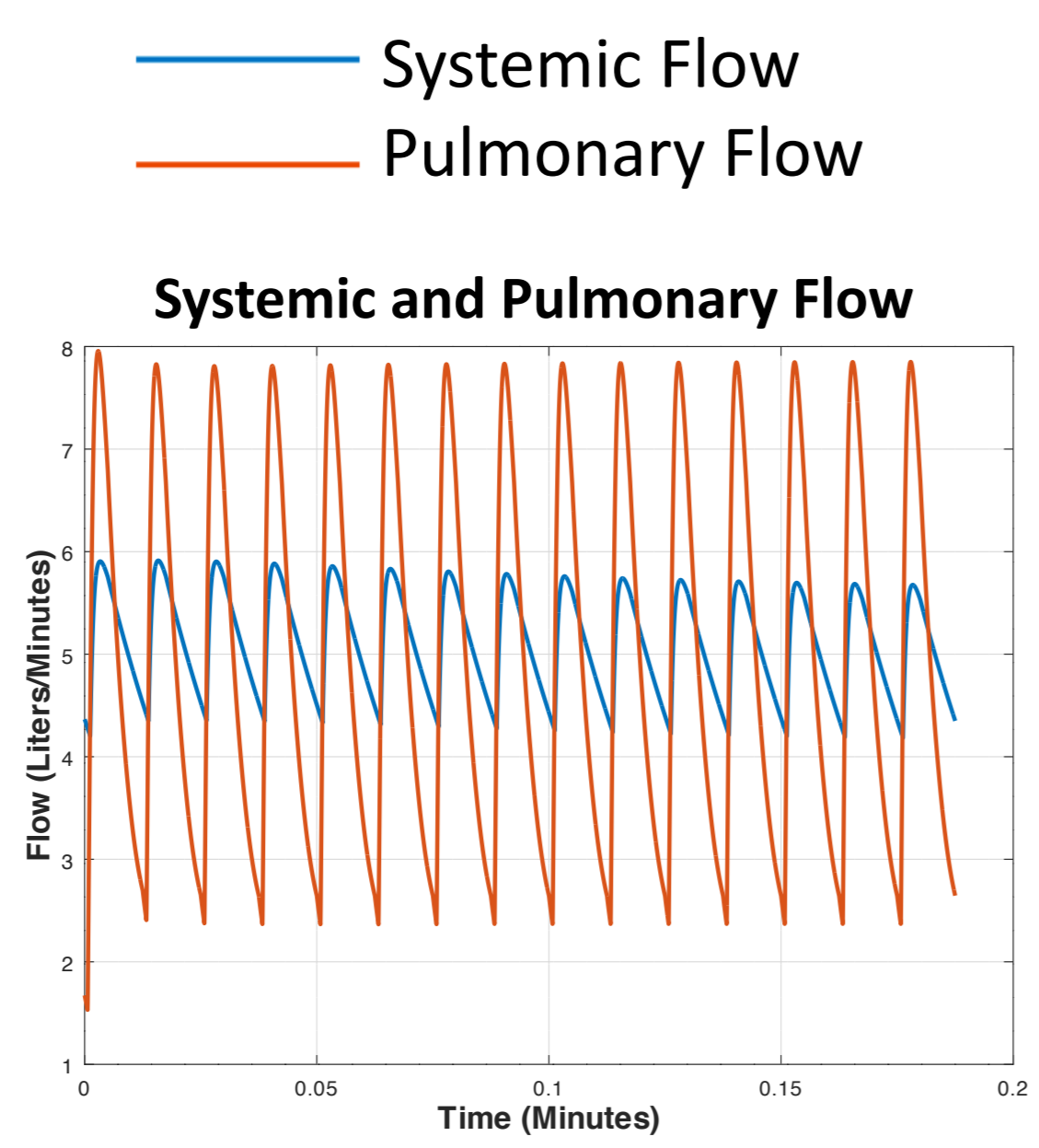
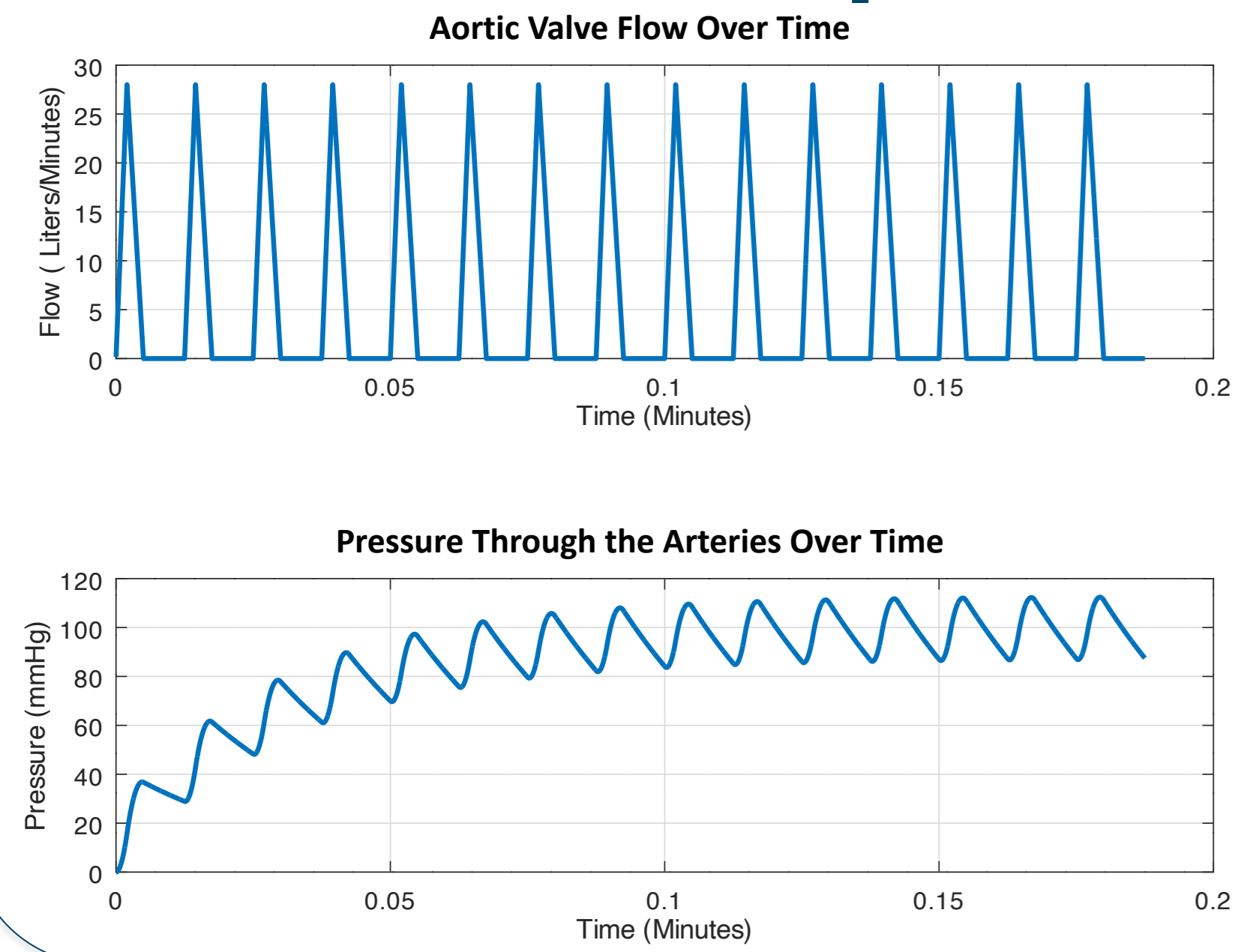


- Preexisting models demonstrate the function of the human heart. [3]
- To see if exercise can play a role in reducing the effect of Mitral Stenosis, we have extended current models to include exercise and Mitral Valve disfunction.

## Mathematical Model [4]

- Systemic Valve Flow:
 
$$Q_S = \frac{P_{sa}}{R_s}$$
- Mitral Valve Flow:
 
$$Q_{Mi} = \frac{S_{Mi}(P_{LA} - P_{LV})}{R_{Mi}}$$
- Aortic Valve Flow:
 
$$Q_{Ao} = \frac{S_{Ao}(P_{LV} - P_{sa})}{R_{Ao}}$$
- Left Ventricle Differential Equation :
 
$$\frac{d(C_{LV} - P_{LV})}{dt} = \frac{S_{Mi}(P_{LA} - P_{LV})}{R_{Mi}} - \frac{S_{Ao}(P_{LV} - P_{sa})}{R_{Ao}}$$

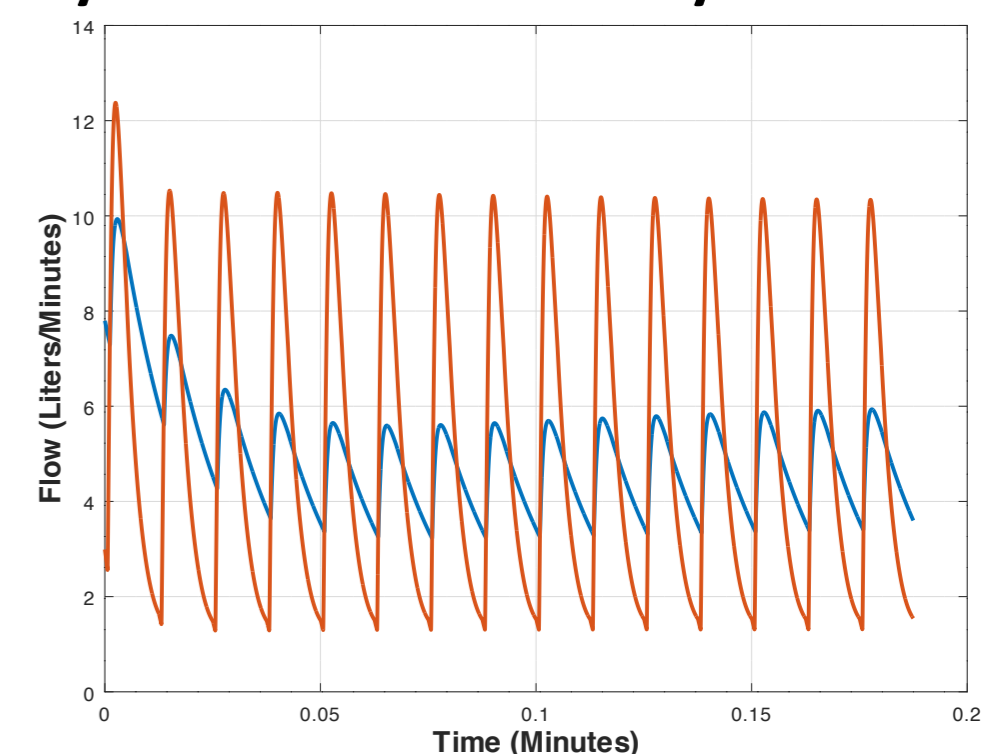
## Software Implementation & Results



## Next Steps

- Couple the effects of exercise and Mitral Stenosis
- Comprehensively analyze the role of cardiac pressure in the mathematical model when exercising

Diseased Systemic and Pulmonary Flow with Exercise



## References

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