# Mechanical Modeling of Edema Formation Applied to Bacterial Myocarditis

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## Abstract

Heart diseases are the number one cause of death in the world, i. e. the number of people dying annually due to problems related to heart is bigger than any other reason, according to World Health Organization (WHO). So, this study aims to investigate myocarditis, a heart disease caused by inflammation when occurred in the myocardium. There are several reasons that lead to myocarditis including infections caused by a virus, bacteria, protozoa, fungus, and others. Additionally, this inflammatory response is one of the consequences of an infection triggered by an immunological reaction. The most common symptoms found in infections are edema, redness, fever, and pain, indeed it is known as the four cardinal signs of inflammation. So, edema is one of the consequences of the inflammatory response which increases the capillary permeability leading to an excessive filtration. Finally, this exudate accumulates at the interstitium establishing the edema. One of the techniques used to visualize myocardial edema is the cardiovascular magnetic resonance of myocardial tissue. Using this imaging exam it is possible to visualize hypointense cores within the edematous zone. Thus, this research aims to solve a plasma flow model due to a bacterial infection in a heart short-axis two-dimensional domain and compare with data found from literature. This mathematical model consists of partial differential equations (PDEs) using the theory of poroelasticity mechanics of a fluid-saturated porous media applied to living tissue coupled with an immune system model. Thus, the mathematical model used in this study is basically divided into two parts: one modeling the immune system response due to a bacterial infection, represented by neutrophils; and another representing the hydro-mechanical problem.

## References

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