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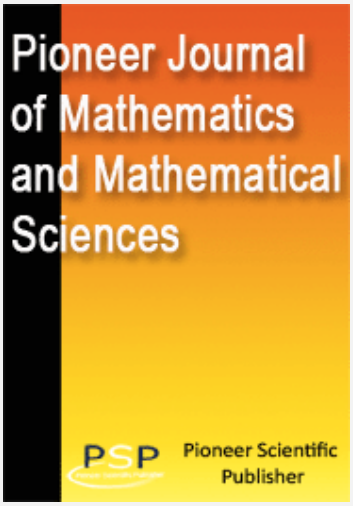

NUMERICAL SIMULATION OF OPTIMAL CONTROL OF A DELAY MATHEMATICAL MODEL OF THE HUMAN CARDIOVASCULAR AND RESPIRATORY SYSTEM

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Abstract

The main function of human cardiovascular system is to maintain adequate blood to different parts of the body. This function is based on the interaction of a number of factors which include cardiac output, partial pressures of carbon dioxide (CO_2) and oxygen (O_2). Blood flow through lungs and tissues is also important in the human respiratory system; it transposes oxygen to tissues while taking away carbon dioxide. This transport depends on two factors: cardiac output and blood flow. Although the natural state is affected during a physical effort, the autoregulation mechanism tries to maintain the cardiovascular-respiratory parameters to their natural physiological states. In this paper, we are interested in studying the autoregulation mechanism modeling by an optimal control problem of a delay bi-compartmental model of the human cardiovascular and respiratory system. We look for the control which allows us to reach the optimal systemic arterial and venous pressure, optimal heart rate and optimal alveolar ventilation. These optimal values are those which ensure better performance. Numerical simulations are performed and, seem to be in accordance with the reality.

Keywords and phrases: cardiovascular-respiratory system, optimal control, delay differential equations.