

Conference in Numerical Analysis 2014 (NumAn 2014)
September 2-5, 2014
Chania, Greece

An improved model of heart rate kinetics

Maria Zakynthinaki

Applied Mathematics and Computers Laboratory

Technical University of Crete

Chania, Greece

marzak@science.tuc.gr

Abstract

The heart rate in response to movement (exercise) is modeled as a dynamical system and its temporal evolution is given as the solution of a system of two coupled differential equations. The model assumes the heart rate kinetics to be a function of exercise intensity (which can also be time-dependent), blood lactate and the current cardiovascular condition of the individual. By means of numerical optimization the model can be fit to experimental heart rate time series data and provide important information regarding an individual's cardiovascular condition. Numerical simulations can also provide predictions for any given exercise intensity, even those that no data exist for. This is of great importance, not only for efficiently designing training sessions for healthy subjects, but also for providing a complete means of heart rate analysis in population groups for which direct heart rate recordings at intense exercises are not possible or not allowed, such as elderly or pregnant women. Examples of successful fit of the proposed model to recorded heart rate time series data, as well as heart rate kinetics simulations will be presented.

Key words: Cardiac dynamics, numerical models, numerical optimization, numerical simulation.