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Heart failure diagnosis using generalized Langevin equation

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Abstract

The Jump-Diffusion equation is a generalization of the Langevin equation; it has been usually applied to reconstruct discontinuous stochastic processes. In this article, by using this equation, we investigate the electrocardiogram of the electric activity of the heart beat, for three groups of subjects with normal, atrial fibrillation and ventricular arrhythmia. At first, we demonstrate that the time series of electrocardiogram is a discontinuous process that can be modeled by the jump-diffusion equation. Then, by calculating the Kramers-Moyal coefficients related to this equation, we show that there is a significant difference between the heart dynamics of the normal subjects and the ones with heart failure exists. Finally, we introduce a measure that may be used for the diagnosis of heart failures.

Keywords: Langevin equation, heart failure, Kramers-Moyal coefficients, jump-diffusion model

For full article, refer to the Persian section