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A new simple model for cardiac alternans HECTOR VELASCO PEREZ, FLAVIO FENTON, Georgia Institute of Technology — Cardiac electrical models are designed to represent features of a system. In most cases, they will represent the dynamics of the voltage action potential (AP). Most modelling efforts are focused on accurately matching the shape of the AP signal. This approach does not guarantee that the AP will behave correctly under other parametrizations. More specifically, these models struggle to represent the dynamics of a system in a wide range of parameter values and external perturbations (far and close of bifurcation points). In order to overcome this problem, we developed a new phenomenological cardiac electrical model that is inspired on the well-known Fitzhugh-Nagumo (FN) model for neuron excitation. The model is composed of two nonlinear polynomial equations that describe the intracellular voltage signal in a cardiac myocyte. But contrary to the FN model, ours is able to generate realistic AP signals that can be matched to experimental observations. Moreover, the model can produce alternans in an AP sequence, which is a well-known period-doubling instability that can lead to severe arrythmias. The simple and continuous nature of the equations allows for all qualitative properties to be derived analytically. More specifically, we are able to derive the action AP and the conduction velocity restitution curves, which are crucial for determining the conditions for alternans initiation. In this work we want to show the model characteristics and how they can improve our understanding of the electrophysiology of the heart.

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