

Title: Hassle-Free Prediction of Excitation-Wave-Quenching Thresholds using Actors

Abstract: Cardiac arrhythmias can be viewed as undesirable excitations in myocardial tissue. From this perspective, the role of a defibrillator is to quench these excitations and return the heart to its normal function. We are specifically interested in the quenching of stable (travelling-wave) excitations, which is a more insidious yet less well-studied problem. Methods for finding protocols and thresholds for such quenching are manually as well as computationally intensive. We use the actor model of concurrent programming to accelerate threshold prediction for excitation wave quenching. Our novel approach employs any number of actors to carry out the simulations of potential thresholds in parallel with a supervisor actor making decisions about the ongoing simulations. In particular, simulations can use the information in real-time to reason about other (even ongoing) simulations. For example, new simulations can be started with updated brackets for the threshold. This information can also be used to stop simulations that are deemed unnecessary and re-allocate resources to new ones. This approach can drastically accelerate the time to solution. However, a further major advantage is the hassle-free nature of the process, which essentially runs from start to finish with no further intervention from the user.