Identification of cavities in a nonlinear model arising from cardiac electrophysiology

Elena Beretta
NYU Abu Dhabi
eb147@nyu.edu

Detecting ischemic regions is crucial for preventing lethal ventricular ischemic tachycardia. This is typically done by recording the heart's electrical activity using either noninvasive or minimally invasive methods, such as body surface or intracardiac measurements. Mathematical and numerical models of cardiac electrophysiology can provide insight into how electrical measurements can be used to detect ischemias. The goal is to combine boundary measurements of potentials with a mathematical model of the heart's electrical activity to identify the position, shape, and size of ischemias and/or infarctions. Ischemic regions can be modeled as electrical insulators using the monodomain model, which is a semilinear reaction-diffusion system that describes cardiac electrical activity comprehensively.
In this talk, I will focus on the case of an insulated heart without coupling to the torso. I will first review some results related to reconstructing cavities for the stationary model, and then present some results obtained recently in the case of the time-dependent monodomain model.

References

[1] [1] E. Beretta, M. C. Cerutti, D.Pierotti, "On a nonlinear model in domains with cavities arising from cardiac electrophysiology", Inverse Problems 38 (2022), no. 10, Paper No. 105005, 16 pp.

[2] [2] E. Beretta, M. C. Cerutti, D.Pierotti, L. Ratti, "On the reconstruction of cavities in a nonlinear model arising from cardiac electrophysiology" (2023) to appear on ESAIM COCV

[3] [3] A. Aspri, E. Beretta, E.Francini, S. Vessella, D. Pierotti, "On "On the reconstruction of cavities in the monodomain model from boundary measurements " in preparation (2023)