Electromagnetic Simulation and the Design of Smart Chest Belt for Cardiac Health Monitoring

Vijayalakshmi M and Raj C Thiagarajan*
*Corresponding author: ATOA Scientific Technologies Pvt Ltd, 204, Regent Prime Business Park, 48 Whitefield Main Road, Whitefield, Bangalore 560066, India, www.atoa.com. Raj@atoastech.com

Introduction: Conventional cardiac monitoring techniques such as Electro cardiograph (ECG) are prone to operator error due to multiple lead attachment requirements. These multiple electrode based systems are also inconvenient for continuous cardiac health monitoring, though ECG is the best way to measure and diagnose abnormal rhythms of the heart. In this paper a smart chest belt based electrical potential monitoring technique is explored for error proof and smart monitoring of cardiac electrical signals.

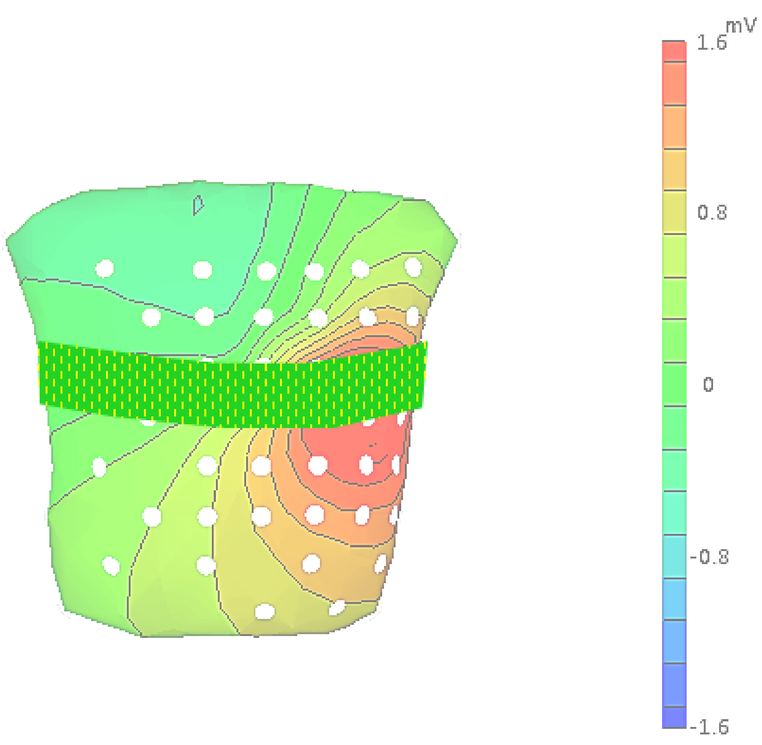

Figure 1. Schematics of smart chest belt.

Computational Methods: The COMSOL electromagnetic physics interface is used to model the electrical field distribution on a realistic 3D geometric model of the heart and torso. COMSOL equation-based modelling is used to simulate the bio electrical signal propagation in cardiac tissue using the FitzHugh-Nagumo equations and the Complex Ginzburg-Landau equations.

Results: Figure 2 shows the simulation results related to the electrical signal propagation in the cardiac tissue. Figure 3 shows the electrical potential distribution in the torso and propagation from cardiac tissue to the outer skin. The coupled simulation results will be used for chest belt sensor design and optimization.

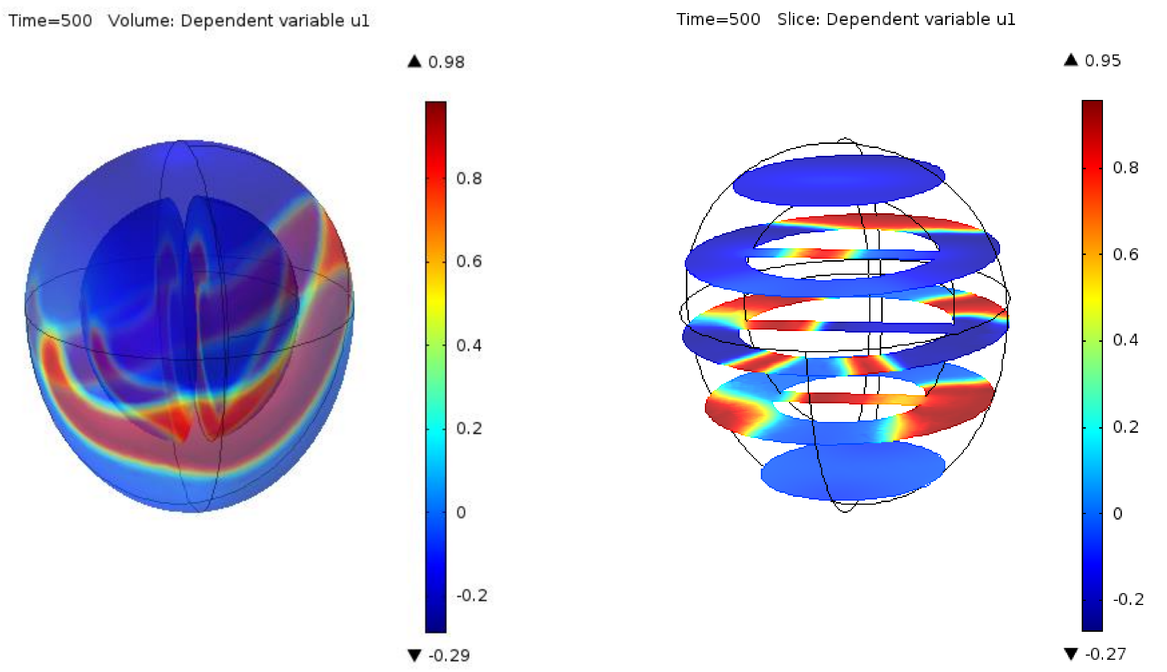

Figure 2. Electrical activity within cardiac tissue.

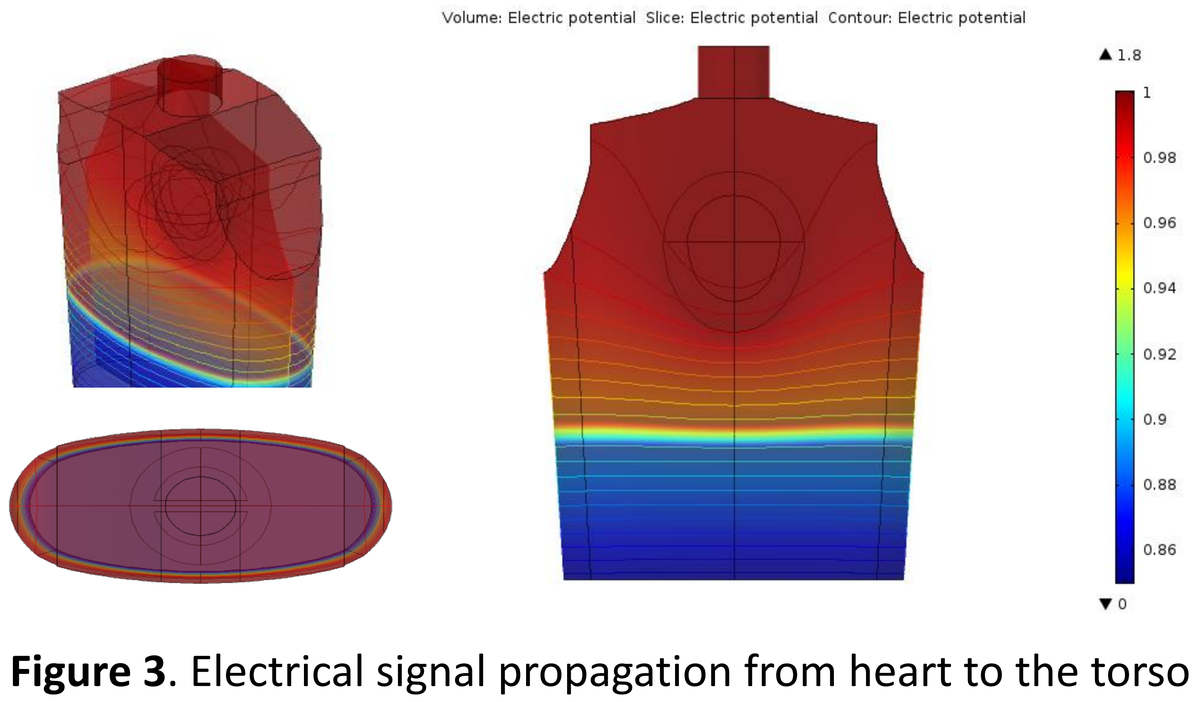

Figure 3. Electrical signal propagation from heart to the torso

Conclusions: A conceptual smart sensor based chest belt was explored for viable product. The COMSOL simulation results shows feasibility of the concept for improved electrical potential mapping of the cardiac electrical signal.