

Smart Chest Belt for Cardiac Health Monitoring

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Abstract

Conventional cardiac electrical signal monitoring and measurement techniques such as Electrocardiograph (ECG) are prone to operator error due to multiple lead attachment requirements. These multiple electrode based systems are also not convenient 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. A smart chest belt based chest belt is conceptualized for self-sensing and electrical potential mapping of the cardiac electrical signal.

A smart chest belt embedded with network of sensor is used for mapping the electrical potential. The location, displacement and electrical potential are dynamically monitored and mapped. The active and passive measurement system electrical potential will be used for smart functionality. The electromagnetic field distribution inside the tissue region depends on the time varying magnetic flux.

The AC/DC Module of COMSOL Multiphysics® software will be used to model the electrical field distribution on a realistic geometric model of the heart and torso. COMSOL® equation-based modeling will be used to simulate the bio electrical signal of the heart.

The smart chest belt system will be integrated into the biological system for combined performance simulation. The performance of the system will be compared with an equivalent electrical potential of heart beat and the cellular level biological electrical impulse.

Typical smart chest belt system and electrical potential distribution are shown in Figure 1.

Numerical Design of experiments will be performed to evaluate the performance of the smart system. The signal sensitivity data will be used for benchmarking.

COMSOL Multiphysics® simulation output will be used to design a continuous cardiac health monitoring system.

Reference

R. Sameni and G. D. Clifford, A Review of Fetal ECG Signal Processing; Issues and Promising Directions, The Open Pacing, Electrophysiology & Therapy Journal. Jan 1, 2010; 3: 4–20.

Figures used in the abstract

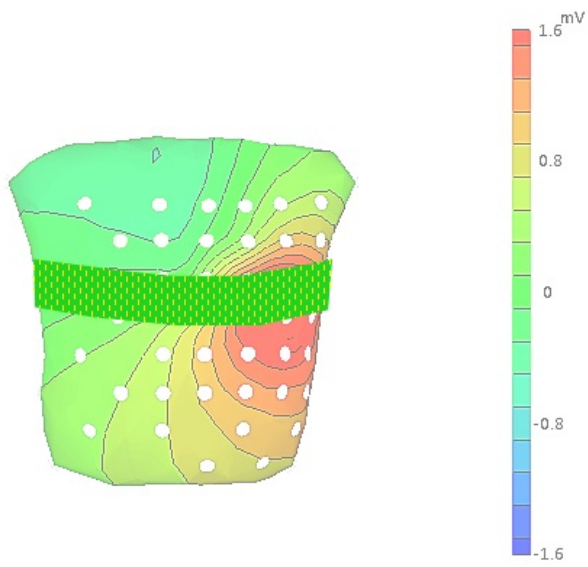


Figure 1: Typical smart chest belt system and cardio electrical potential distribution contour plots.