Thorax Model for the Studies of Hemodynamic Monitoring by Implanted Devices

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Impedance incorporated implanted device provides a unique approach to monitor hemodynamics. The challenge of the use of this method is the optimization of electrode configurations. To alleviate this issue, a 3D thorax model is presented in this study. The model was developed from CT images of a patient, covering from the neck to the lower abdomen. A MATLAB-based program was developed and used to delineate different tissues/organs. The model contains 467 layers and 37 different types of tissues. Each layer had 262,144 pixels with a resolution of 1.0×1.0 mm^2, approximately 122×10^6 pixels (voxels) in total. This high-resolution model can be used as a virtual phantom to optimize electrode configuration for the monitoring of hemodynamics by an implanted device.

Online Artifact Subtraction for Concurrent Neural Recording During Ongoing Electrical Stimulation

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Feedback-control has been proved to be advantageous in various technical fields and is likely to increase the performance of electrical neural interface devices. The control algorithms in such a device will rely on metrics of neural activity, thereby necessitating their differentiation from artifacts caused by electrical stimulation. We demonstrate an efficient algorithm for determining the relationship between the electrical stimulus current waveform and the recorded artifact potential, or transfer function. This facilitates online stimulus artifact subtraction and concurrent neural recordings during electrical stimulation. Furthermore, we demonstrate significant changes in this transfer function, in vivo, that occur on time scales of hours and are indicative of changes in the electrical properties of neural tissue. Tracking these variations is paramount for the successful implementation of a feedback-enabled neural control system.

