

Anatomically accurate torso mesh for EIT

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Abstract: We describe an anatomically accurate torso mesh and set of tools to allow arbitrary electrode placement. The work is made available through EIDORS and on Zenodo.

1 Introduction

Anatomically-accurate finite element meshes (FEM) are needed for EIT forward and inverse simulations. While many such meshes are publicly available, EIT also requires the ability to specify and refine body surface electrodes. To investigate novel EIT configurations (e.g. for 3D EIT) tools are needed to support arbitrarily electrode positions.

2 Methods and Results

The base geometry was taken from BodyParts3D[6]. Separate surface triangulations were merged and modified to avoid overlaps and increase quality. Closed organ surfaces were created, meshed with Gmsh [3] and merged in EIDORS [1]. A torso shape without arms was derived from the whole-body skin surface in BodyParts3D, on which electrodes can be placed in EIDORS [4]

The mesh contains the heart, lungs, and major vessels. The heart is segmented into the heart wall and left and right blood pools, without valves. Simplified vessels (aorta, left

and right pulmonary artery, inferior/superior vena cava, pulmonary veins) are modelled with ~ 2 mm thick walls, truncated, and capped, enclosing the blood pool in their lumen. The lumen of the trachea and major bronchi is modelled as void space. Equipped with electrodes, the model torso consist of ~ 7 million elements.

Example image of the FEM mesh are shown in Fig.1. All software to generate the component sub-images is part of the latest EIDORS release [2] (function `mk_thorax_model_bp3d`).

3 Discussion

We hope this contribution helps the EIT and bioimpedance community to more easily model detailed anatomical features of the thoracic anatomy. To facilitate access to this model, it has been made available as part of EIDORS[2], and also uploaded to Zenodo[5].

References

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- [3] Gauzaine C, Remacle J-F, *Int J Numer Methods Eng* 79(11), 2009.
- [4] Grychtol B, Adler A, *IEEE EMBS 2013* 6429–32, 2013.
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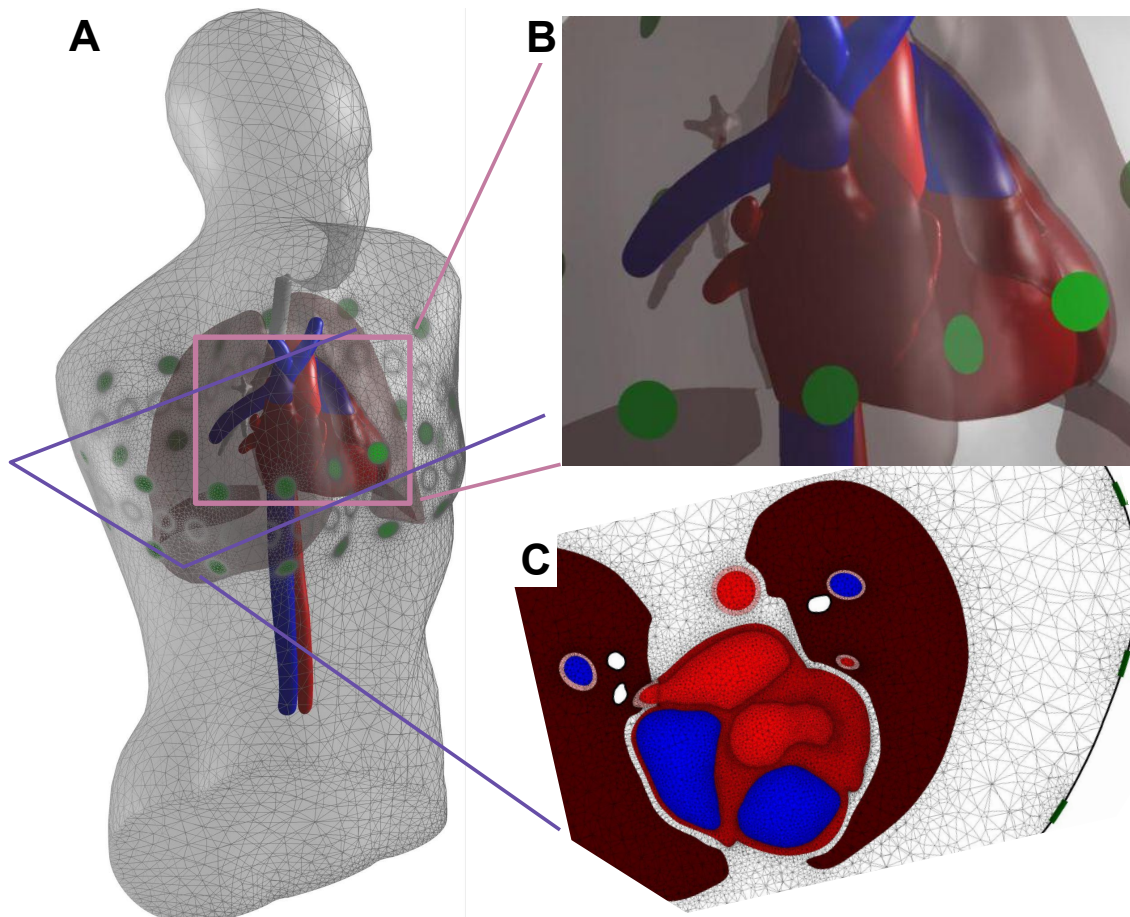


Figure 1: Illustrations of the generated FEM with multiple electrode planes. A) Full model with coloured organ regions, B) zoomed image into the full model in the heard region, C) FEM mesh in a slice through the ventricles.