Certainty and uncertainty in Acousto-Electric Tomography

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Abstract

The objective in Acousto-Electric Tomography (AET) is to reconstruct an image of the unknown electric conductivity inside an object (e.g., the human body) from boundary measurements of electrostatic currents and voltages collected while the object is penetrated by propagating acoustic waves. The problem is a so-called coupled-physics inverse problem utilizing the interaction between electromagnetic and acoustic phenomena.

Accurate knowledge of the propagating acoustic wave is usually required, but since the objects sound speed is only known approximately, systematic errors occur. It is then reasonable to investigate and quantify the uncertainty in the reconstructed images due to the lack of precise knowledge.

In this work, we model the uncertainty in the sound speed of the acoustic wave and formulate a suitable reconstruction method. Our method combines computational statistics and PDE analysis, and the results show that with reasonable uncertainty in the sound speed reliable reconstruction is still possible.

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