New insight to EIT reconstruction using virtual X-rays

Siiri Rautio

Department of Mathematics, University of Helsinki, Helsinki, Finland

Abstract

The mathematical model of electrical impedance tomography (EIT) is the inverse conductivity problem introduced by Calderón. The aim is to recover the conductivity σ from the knowledge of the Dirichlet-to-Neumann map Λ_σ. It is a nonlinear and ill-posed inverse problem.

We introduce a new reconstruction algorithm for EIT, which provides a connection between EIT and traditional X-ray tomography. We divide the exponentially ill-posed and nonlinear inverse problem of EIT into separate steps. We start by mathematically calculating so-called virtual X-ray projection data from the DN map. Then, we perform explicit algebraic operations and one-dimensional integration, ending up with a blurry Radon sinogram. We use neural networks to deconvolve the sinogram and finally, we can compute a reconstruction of the conductivity using the inverse Radon transform. We demonstrate the method with simulated data examples.

This is a joint work with Samuli Siltanen, Matti Lassas, Rashmi Murthy, Fernando Silva de Moura, Juan Pablo Agnelli, and Melody Alsaker.