A STABILITY RESULT FOR ELECTRIC IMPEDANCE TOMOGRAPHY BY ELASTIC PERTURBATION

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Abstract. Perturbing elastic impedance tomography (EIT) measurements by focused ultrasound waves has recently been proposed as a method to obtain additional information for the reconstruction of the conductivity [1]. Assuming that the local variation of the conductivity is proportional to the amplitude of the elastic perturbation, one asymptotically recovers the pointwise values of the energy density at the center of the perturbation. The determination of the conductivity γ can thus be reduced to the resolution of a non-linear equation of the form

$$\operatorname{div}\left(\frac{E(g,x)\nabla u(x)}{|\nabla u(x)|^2}\right) \quad = \quad 0,$$

where $E(g,x) = \gamma(x)|\nabla u(x)|^2$, the energy density corresponding to the input current g of the EIT experiment, is a known function. A uniqueness result has been established in [3] for the recovery of γ from two diffeomorphic measurements, i.e., two input currents for which the associated potentials satisfy $\det(\nabla u_1, \nabla u_2) > 0$ in the region where $E(g,x)$ is known. We present a stability estimate for the reconstructed conductivity, which is linear with respect to $E(g,x)$. This estimate could explain the quality of the numerical results obtained from such internal data. This is joint work with Faouzi Triki [2].

References

[1] H. Ammari, E. Bonnetier, Y. Capdeboscq, M. Tanter, and M. Fink, Electrical impedance tomography by elastic deformation, SIAM J. APPL. MATH. Vol. 68, No. 6, pp. 1557-1573 (2008)

[2] E. Bonnetier and F. Triki, Uniqueness and stability for the inverse conductivity problem with internal energy density data. In preparation.

[3] Y. Capdeboscq, J. Fehrenbach, F. de Gournay, and O. Kavian, An optimal control approach to imaging by modification, SIAM Journal on Imaging Sciences, 2, pp. 1003-1030 (2009).

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