Layered Models Representing Breasts in Electrical Impedance Tomography

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Approach:
The observed conductivities in compressed breasts in EIT are smaller than those seen previously in whole chest imaging. Looking at the anatomical breast model we could attribute this to a thin resistive skin layer present in breasts. To test this hypothesis and try to more accurately model breasts, we have developed a layered analytical forward model. Our layered model has three layers, thin top and bottom layers representing skin and a thicker middle layer representing breast tissue.

Mammography Geometry

Forward voltages in the first (skin), second (tissue) and third (skin) layers respectively

\( \gamma_1 \): Admittivity in the first and third layers
\( \gamma_2 \): Admittivity in the second layer

Comparison of the two models

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<tr>
<th>Current Pattern</th>
<th>Homogeneous Model</th>
<th>Layered Model</th>
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Estimation of \( \gamma_{\text{skin}} \) and \( \gamma_{\text{body}} \) for clinical patient data

The calculation and fitting of \( V_{\text{ThreeLayer}} \) to the patient data \( V_{\text{Patient}} \) however needs estimation of \( \gamma_{\text{skin}} \) and \( \gamma_{\text{body}} \). The cost function to be optimized is:

\[
E(i) = \sum (V_{\text{Patient}}(i) - V_{\text{ThreeLayer}}(i))^2
\]

In the plot below we compare the estimated breast tissue and skin admittivity with those published in previous research [4], [5].

Future Work

Mammography
• Studying finite element noise in measured data and hence in error in the estimation of and
• Applying the layered model to the patient data and comparing the reconstructions with those obtained with the homogeneous model.

Hand-held Probe
• Study reconstructions from homogeneous hand-held probe for experimental tank data
• Apply the layered hand-held probe model to experimental data.

Publications Acknowledging NSF Support:

References

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