MATHEMATICAL FRAMEWORK FOR EIT-BASED FABRIC PRESSURE SENSING

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ABSTRACT

Lately, fabric pressure sensing method using EIT ([1],[2]) has been proposed and performed experimentally. It is based on the electromechanical properties of the conducting fabric that varies with changes of mechanical deformation of the fabric surface. Using (portable and low-cost) EIT method, the mechanical load over the fabric surface can be probed. This new sensing method may have potential applications in the areas including smart textiles, pressure sensors, robotics, wearable sensors and so on. However, its mathematical modeling for reconstructing pressure distribution using EIT has not rigorously studied yet. In this paper, we have made a rigorous mathematical model by investigating how the vertical pressure influence the current-voltage data (or Neumann-to-Dirichlet data) that is measured on the clamped boundary of the sensing fabric. The sensing fabric can be viewed as a two-dimensional surface, and the surface due to a pressure can be deformed according to *Hamilton's principle*. This deformation of the fabric surface results in a change of the electrical impedance distribution. We use EIT method to provide the image of the magnitude of the gradient of the displacement due to the pressure, and use *Eikonal* equation and the mean curvature equation to identify the pressure distribution.

REFERENCES

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