**Data Driven Reconstruction Methods Using Sensitivity Volume Method for Electrical Impedance Tomography**

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ABSTRACT

The sensitivity volume method was recently proposed by the authors as an efficient electrical impedance tomography (EIT) algorithm that maximizes data importance thorough targeted contact allocation, model space parameterization, and measurement protocol selection [1]. The method’s advantage in signal-to-noise can be leveraged for faster inverse solves, higher resolution, or more specific focus on features of interest. For industrial monitoring and damage detection, there exist highly constrained cases wherein the desired information requires a limited number of degrees of freedom such as the cartesian coordinates, depth, and size of predicted damage or inclusion. For such cases, we propose two data driven methods, a stochastic data training approach and a programmatic data training approach, to image the system directly from a reduced number of EIT measurements.

Data driven EIT methods skip the step of conductivity imaging, and instead directly determine the state of interest through comparison of resistance datasets against training set. This talk introduces the step-by-step formulation of training cases through either stochastic or programmatic approaches and demonstrates data driven inversion with 3D experiments employing a Sciospec EIT 128 electrical impedance tomography system measuring a saltwater phantom tank with a non-conducting inclusion. The sensitivity volume method allows severe restriction of the data space to only the limited number of measurements necessary to sensitively probe features of interest. In the stochastic data training approach, a self-propelled insulating inclusion demonstrates a stochastic sampling of positions within the homogeneous saltwater medium. Significantly different datasets are used as training cases of discrete positions for reconstruction. In the programmatic data training approach, an insulating inclusion is deliberately placed to sample equally spaced inclusion positions. All datasets serve as training cases that are interpolated to form a continuous map for reconstruction. Together, these two training methods introduce a new paradigm for expedited and precise data-driven EIT reconstructions.

**Keywords:** electrical impedance tomography, inverse problems, sensitivity volume method, data driven imaging

REFERENCES

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