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Fitting and Analysis of the Distribution Function of Relaxation Times for the Polarization

Estimation Inverse Problem for Solid Oxide Fuel Cells.

The mathematical goal of our analysis of the problem was to produce a set of curves which when superimposed fit a set of calculated results and calculate the curves local maxima, or ‘centers’, and area under the curves. To do so we had to determine a family of potential curves, bounds for the number of curves, and methods to fit the superposition of the curves. Based upon inspection of approximate data and some theoretical concerns we examined probability distributions, deciding on a weighted log-normal probability distribution function. After some visual examination, we determined that the number of curves was two, three, or four, most likely three, with more real data being required to confirm the exact number. We then needed to use a non-linear least squares fitting method, with several algorithms and slight variations of the main algorithms considered. The calculations then of the integral of the log-normal PDF’s and the center were possible, but specifics of the methods used to preprocess the data for the nonlinear least squares fitting, including potential normalization, and the set-up and numerical aspects of the fitting itself complicate the usefulness of those final calculations. (Received September 25, 2012)