

How to reduce reproducible measurements to an ideal experiment?

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Abstract

© Kazan Federal University (KFU). Is it possible to suggest a general theory for consideration of reproducible data that are measured in many experiments? One can prove that successive measurements have a memory and this important fact allows separate all data on two large classes: ideal experiments without memory and experiments with a memory. We introduce the concept of an intermediate model (IM) that helps to describe quantitatively a wide class of reproducible data. Experiments with memory require for their description the Prony's decomposition while experiments without memory are needed for their presentation the Fourier decomposition only. In other words, it means that a measured function extracted from reproducible data can have a universal description in the form of the amplitude-frequency response (AFR) that belongs to the generalized Prony's spectrum (GPS). It is shown also how real data distorted by the experimental equipment and how to eliminate these uncontrollable factors in order to reproduce approximately the conditions corresponding to ideal experiment. New and elegant solution of elimination of the apparatus (instrument) function is suggested. In an ideal case the decomposition coefficients belong to the Fourier transform and presentation of reproducible data in this form leads to the IM for this case. The suggested general algorithm allows considering many experiments from the unified point of view. The real example based on available electron paramagnetic resonance (EPR) data confirms this general concept. The unified "bridge" between the treated experimental data and a set of competitive hypothesis that pretend for their description is discussed. The results obtained in this paper help to put forward a new paradigm in data/signal processing.

Keywords

Apparatus function, Data/signal processing, EPR measurements with/without memory, Fourier transform, Intermediate model, Prony's decomposition