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"Mecanismos para a Integração de Informações: Fusão de Dados Quantitativos e Qualitativos com Aplicação à Estimação de Estado de Sistemas de Potência"

This Dissertation presents methods, tools and ways which use quantitative and qualitative data, gathered from various heterogeneous sources of information, aiming at combining them in a process of informationÆs fusion (data fusion). This process improves the requirements of quality and credibility of the final information obtained, leading to a better understanding of the system behaviour and providing a complete and accurate exploration of the scenarios under analysis.

Different forms of uncertainty representation and mathematical/statistical modelling are presented and discussed. Also, this work proposes a taxonomy for the data fusion processes according to the nature of the information involved. Two new statistical models are formalised: FMIMO (Fuzzy Multiple Input Multiple Output) and FMISO (Fuzzy Multiple Input Single Output), which involve qualitative variables. These models are equivalent to MIMO (Multiple Input Multiple Output) and MISO (Multiple Input Single Output) classical models found in Statistics and related to quantitative variables.

The data fusion process is applied to the power system state estimation problem. Quantitative data (obtained from telemetering equipment) are processed together with qualitative data (fuzzy pseudomeasurements provided by an intelligent system) to compute the system state vector.

Numerical results of simulation studies show the performance of the proposed algorithm in dealing with data of heterogeneous sources of information. Credibility curves are built for the estimated components of the state vector.