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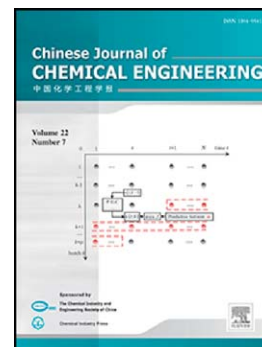
Modeling and identification for soft sensor systems based on the separation of multi-dynamic and static characteristics

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## Special Issue of CPCC

**Modeling and identification for soft sensor systems based on the separation of multi-dynamic and static characteristics**Pengfei Cao<sup>a,\*</sup>, Xionglin Luo<sup>b</sup>, Xiaohong Song<sup>c</sup><sup>a</sup> College of Electrical Engineering and Automation, Shandong University of Science and Technology<sup>b</sup> Research Institute of Automation, China University of Petroleum, Beijing<sup>c</sup> State Grid Shandong Electric Power Company Zibo Power Supply Company, Zibo, China**Abstract**

Data-driven soft sensor is an effective solution to provide rapid and reliable estimations for key quality variables online. The secondary variables affect the primary variable in considerably different speed, and soft sensor systems exhibit multi-dynamic characteristics. Thus, the first contribution is improving the model in the previous study with multi-time-constant. The characteristics-separation-based model will be identified in substep way, and the stochastic Newton recursive(SNR) algorithm is adopted. Considering the dual-rate characteristics of soft sensor systems, the proposed model cannot be identified directly. Thus, two auxiliary models are first proposed to offer the intersample estimations at each update period, based on which the improved algorithm (DAM-SNR) is derived. These two auxiliary models function in switching mechanism which has been illustrated in detail. This algorithm serves for the identification of the proposed model together with the SNR algorithm, and the identification procedure is then presented. Finally, the laboratorial case confirms the effectiveness of the proposed soft sensor model and the algorithms.

*Keywords:* Soft sensor; Modeling; Characteristics separation; System identification; Double auxiliary models

**1. Introduction**

Over the last two decades, soft sensor technique has been extensively studied and increasingly implemented in industrial processes. It solves the real-time measurement problem for important quality variables, and these variables indicate the production quality directly and play an indispensable role in process control [1-3]. The soft sensor model, which is built based on massive amounts of measurements of quality and easily measured variables (primary and secondary variables), is the core of this technique [4,5]. In our last contribution, a new type of soft sensor model consisting of a dynamic submodel in cascade with a static one has been proposed [6,7]. And it could be named as the separation of dynamic and static characteristics based model (or characteristics-separation-based model in brief). Dynamic and static submodels build the dynamic and static relationships between primary and secondary variables respectively. The dynamic and static characteristics are described sufficiently based on these two models, and the parameters

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