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It's About Time –the Impact of Time Delay and Time Dynamics on Soft Sensing in Industrial Data

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The increasing affordability of physical and digital sensors has led to the availability of considerable process data from a range of production processes. This trend, in turn, has enabled researchers and industrial practitioners to employ these large amounts of data to improve process efficiency at most levels, thereby facilitating the operation of the process. A fundamental step in some of these applications is to obtain a frequent and reliable prediction of a quantity that is either impractical, impossible, or time-consuming to measure to use as a surrogate in further modelling or control steps. These surrogate measurements are usually derived by utilising models that link easy-to-measure process variables to the quantities of interest; these models are frequently called “soft sensors”.

In developing soft sensors for continuous processes, it is common to have time delays and dynamics in the data, as both are intrinsic to continuous production processes and how they are operated. It is essential to consider these aspects when developing the soft sensor, as they can be detrimental to the soft sensor's performance.

In this contribution, we illustrate and compare different techniques to account for time delay[1–5] and dynamics[6–9] in the pre-processing and modelling steps of soft sensor development. On the time delay side, these techniques vary from the classical correlation coefficient to information-theoretic measurement and complex optimiser-based methods, while on the time dynamics side, the focus is mainly on dynamic latent variable methods.

The work is based on a real case study from the food industry.

Keywords

Time Delay, Time Dynamics, Soft Sensing, Real Industrial Data

Classification

Mainly application

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