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A Cooperative Framework for Raw Material Acceptance: Integrating Supplier and Customer Perspectives via SMB-PLS

The increasing digitalization of manufacturing processes is transforming the relationship between raw material suppliers and customers. Rather than defining rigid specifications that often lead to unnecessary rejection of raw material lots, Industry 4.0 opens the door to more collaborative and knowledge-driven strategies. In this context, multivariate raw material specifications should not be understood as static acceptance limits, but as dynamic regions that can be jointly improved by both actors to guarantee final product quality while facilitating raw material acceptance.

This work proposes an integrated framework in which supplier and customer cooperate to improve the feasibility of raw material acceptance through Sequential Multi-Block Partial Least Squares (SMB-PLS). On the supplier side, the methodology provides a systematic diagnosis of assignable causes affecting the capability of the supplied raw material, identifying which properties and variability sources should be modified to better satisfy the customer requirements [1]. Simultaneously, from the customer perspective, the approach identifies process variables that can be manipulated to enlarge the feasible raw materials specifications without compromising the quality attributes of the final product [2].

The novelty of the proposal lies in combining both perspectives into a unified cooperative strategy where supplier and customer iteratively adapt to each other instead of operating under a restrictive pass/fail paradigm. The sequential structure of SMB-PLS is especially suitable for this purpose as it explicitly accounts for the ordered relationships between raw material properties, process conditions and final product quality. The proposed methodology is illustrated through a real industrial case study concerning cheese production from milk.

Special/ Invited session

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Classification

Both methodology and application

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