Integrated Business and Engineering Framework for Synthesis and Design of Enterprise-Wide Processing Networks

The synthesis and design of processing networks is a complex and multidisciplinary problem, which involves many strategic and tactical decisions at business (considering financial criteria, market competition, supply chain network, etc) and engineering levels (considering synthesis, design and optimisation of production technology, R&D, etc), all of which have a deep impact on the profitability of processing industries. In this study, an integrated business and engineering framework for synthesis and design of processing networks is presented. The framework employs a systematic approach to manage the complexity while solving simultaneously both the business and the engineering aspects of problems, allowing at the same time, comparison of a large number of alternatives at their optimal points. The results identify the optimal raw material, the product portfolio and select the process technology for a given market scenario together with the optimal material flows through the network and calculate the corresponding performance and sustainability metrics. The framework includes a software infrastructure for integrating different methods and tools needed for problem definition, formulation and solution of the design problem as a MINLP, reducing thereby the time and cost needed to generate and solve the design/synthesis problems and providing efficient data transfer between the tools. A generic structural process model has been implemented within the framework to describe the multidimensional engineering issues allowing thereby fast and flexible model development for various production processes. A case study from vegetable oil industry is used successfully to demonstrate the applicability of the integrated framework for making optimal business and engineering decisions.

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