

# Hierarchical Price-based Production Coordination for Plant-wide Optimization

Master thesis topic proposal

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The complexity of control of large-scale dynamic systems represents a major obstacle in application of advanced process management solutions in the processing industry. The systems in chemical production lines consist usually of several production units which are coupled by streams of material and energy. The decentralized and distributed control approaches are introduced in this context in order to coordinate the optimal distribution of shared resources and to distribute the complexity of production coordination among the local unit controllers and an upper-layer coordinating agent. This distribution may be achieved in different ways depending on the amount of information shared among the units and between the individual unit and coordinator. The more information is shared, the more complex the resulting optimization problem gets.

There are different approaches to solve the arising optimization problems in a decentralized manner. Some of the recent approaches exploit the theories of market mechanisms. A promising option here is represented by the dynamical adjustment of internal prices of the shared resources via auction-like protocols in order to control their consumption such that the near-optimal plant-wide performance is achieved.

The work on the proposed master thesis topic involves the study, analysis and application of price-based coordination mechanisms to steer the whole plant to the economically optimal production regime. The selected case studies from the domain of chemical engineering and production will be treated.

## **Tasks and work plan:**

- Familiarization with the provided case studies
- Study of NMPC and the implementation of (local) economic model predictive controllers for production units
- Determination of plant-wide optimum control policy (centralized approach)
- Study of the price-based coordination approaches and the development of tailored schemes to achieve near-optimal plant-wide performance
- Evaluation of the performance of designed coordination strategies by numerical simulations