



HIGH PERFORMANCE CENTER

DYNAFLEX®

FLEXIBLE SOLUTIONS FOR THE ENERGY
TRANSITION AND RAW MATERIALS SHIFT

DYNAMIC SIMULATIONS OF CHEMICAL PROCESSES

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Processes of the chemical industry are exposed to new challenges regarding energy and raw material availability as well as increasing customer requirements and higher need for product differentiation.

One solution to meet this challenge is to increase the flexibility of the processes. In addition to process control and operation management strategies, a central component is the development of suitable equipment concepts that enable safe and efficient operation in a wide range of parameters.

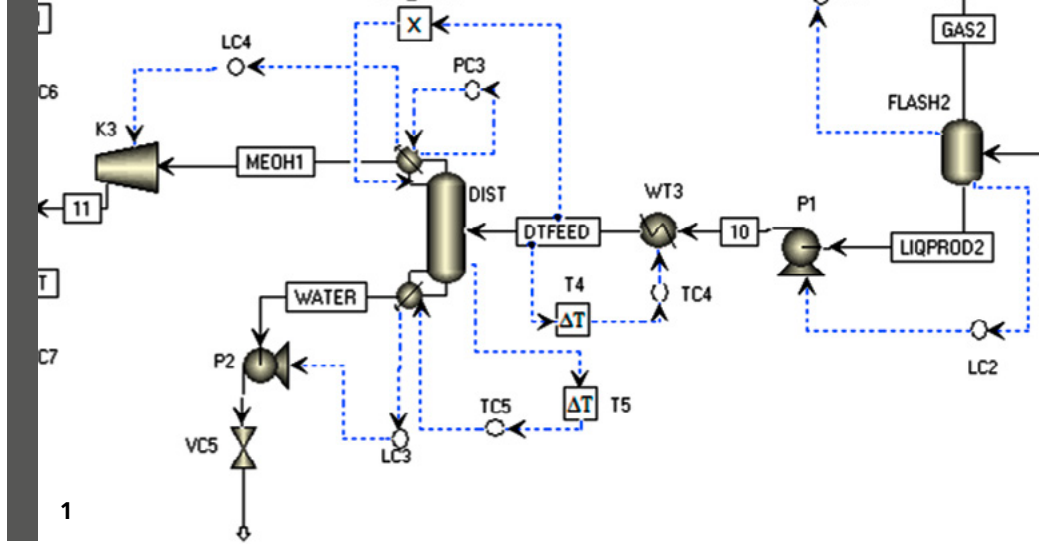
The development, experimental investigation and mathematical modelling of these concepts is the focus of this research area and is always considered under the aspect of a dynamic operation.

Keywords

- Sector coupling
- Rigorous modelling
- Dynamic simulations
- Process synthesis
- Flexibility assessment

Industrial Sectors

- Base chemicals
- Fine and specialty chemicals
- Pharmaceutical industry
- Biological synthesis



1 Zoom in the flow sheet of a dynamic simulation.

Modular Process Engineering

With regard to the new requirements for chemical processes, conventional monoproduct plants have proven to be unsuitable. Although they are highly efficient in terms of energy and raw material consumption, they are inflexible in terms of production volumes.

The fact that modular systems are able to overcome the hurdles of conventional systems has been confirmed in various research projects.

For a successful implementation at production level, however, adequate equipment is still lacking to be able to implement each unit operation with flexible modules. Particularly in the area of downstream processes, there is still a need for research and development, which is carried out in various projects.

Process Simulation

A rigorous simulation of processes and equipment is indispensable for investigating flexibility options, whether in the integrated energy system or for decentralized, modular plants.

Rigorous process simulations provide mass and energy balances from which energy and resource consumption can be calculated, for example. At the same time, conceptual studies and process comparisons are possible from which details for plant planning can be derived.

In addition, process simulation provides the basis for the design of control loops and the parameterization of the control units required for a dynamic analysis.

The work is carried out with the aspenONE® software package

Sector Coupling

A sector coupling between energy systems and process engineering involves many challenges. The expected strong variation e.g. of feed quantities as a function of time is central.

This is particularly challenging for complex chemical processes that are characterized by numerous recycle streams. The required conversion steps are carried out in different apparatuses with characteristic operating limits and time constants.

A deep understanding of the occurring dynamic processes in combination with reliable and extrapolable models is therefore necessary to perform a preliminary calculation of the process behaviour in the overall system context.