CYBERNETICA
Model based control systems for the process industry

CENIT

Optimize the operation of your critical process units using Model Predictive Control (MPC) with first principles / mechanistic process models. With Cybernetica CENIT you are able to control your continuous or batch processing units in the economically most optimal way using frontier algorithms for dynamic optimization and estimation of unmeasured process variables.

Nonlinear
Model Predictive Control

Cybernetica CENIT is used for model predictive control (MPC) and real-time dynamic optimization of nonlinear continuous and batch processes. The system includes modules for estimation of process states and parameters (soft sensing) based on Kalman Filtering (KF) and Moving Horizon Estimation (MHE) techniques. The constrained dynamic optimization is executed using a SQP-type optimization algorithm.

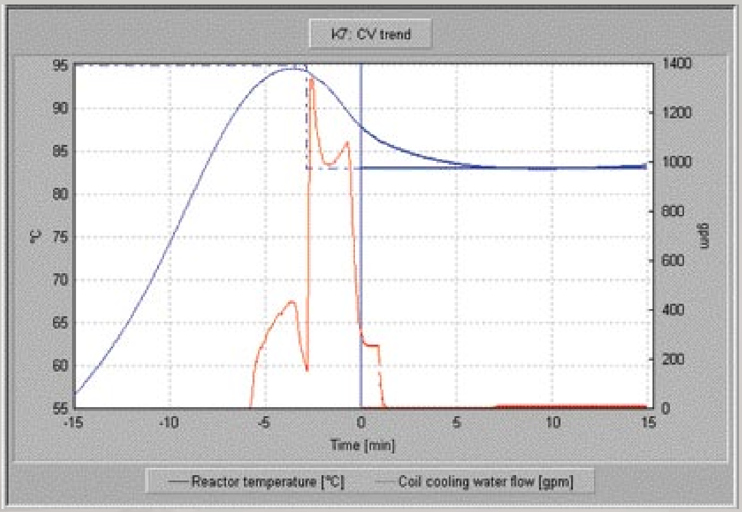
First principles process models

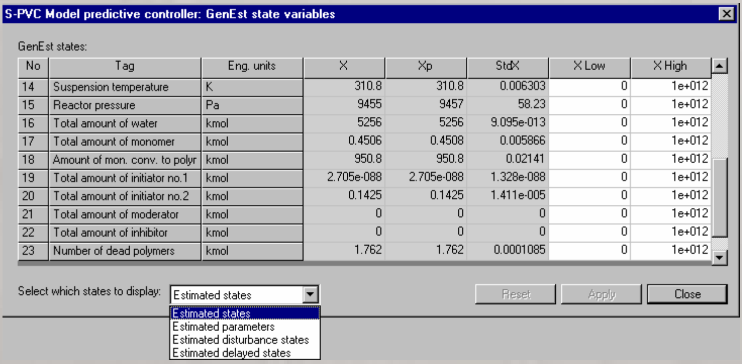
Process models are usually developed from mass, energy and component balances and from knowledge of fluid dynamics, reaction kinetics, thermodynamics, etc. The models are implemented as a set of nonlinear differential equations which are solved using a DE or a DAE solver. Process model components are developed for each type of process unit. Process models developed using third party modelling or simulation systems might be used. During application development the process models are fitted to the particular process using the software Cybernetica ModelFit.

Why use first principles models?

First principles models, which are generally nonlinear, are advantageous for several demanding processes where data driven (“black-box”) type of models will not lead to satisfactory performance, such as:

- For control of nonlinear processes (e.g., chemical reactors) with frequent changes in operating points (e.g., polymerization reactors with grade changes);
- For optimal operation of batch processes;
- For control of process variables which can not be easily measured.





GenEst states:

No	Tag	Eng. units	X	Xp	StdX	X Low	X High
14	Suspension temperature	K	310.8	310.8	0.006303	0	1e+012
15	Reactor pressure	Pa	9455	9457	58.23	0	1e+012
16	Total amount of water	kmol	5256	5256	9.095e-013	0	1e+012
17	Total amount of monomer	kmol	0.4506	0.4508	0.005866	0	1e+012
18	Amount of mon. conv. to polyr	kmol	950.8	950.8	0.02141	0	1e+012
19	Total amount of initiator no.1	kmol	2.705e-088	2.705e-088	1.328e-088	0	1e+012
20	Total amount of initiator no.2	kmol	0.1425	0.1425	1.411e-005	0	1e+012
21	Total amount of moderator	kmol	0	0	0	0	1e+012
22	Total amount of inhibitor	kmol	0	0	0	0	1e+012
23	Number of dead polymers	kmol	1.762	1.762	0.0001085	0	1e+012

Select which states to display: Estimated states

The CENIT system

The standard version of the CENIT kernel runs on a Windows workstation or server. Embedded systems can also be delivered. The model and application specific information is contained in model components, which are linked to the CENIT kernel at run-time. The CENIT engineering interface (MMI) is used for configuration and application maintenance. It includes access to all variables and parameters in a CENIT application, as well as a trend system for presentation of history and model predictions into the future. A number of MMI applications can be connected to a CENIT kernel, using TCP/IP communication over an intranet or the internet. CENIT comes with an OPC interface for communication with most modern process control systems. Other interfaces can also be delivered. The CENIT system includes an internal data base for application maintenance.

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