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## **Multivariable Control of a Simulated Industrial Gas-Phase Polyethylene Reactor**

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### **Abstract:**

A multivariable control problem of an industrial gas-phase polyethylene reactor is investigated in this paper. This multivariable control problem affects directly the polymer properties and consequently the plant economics. The control task is particularly challenging because of the two-time-scale behavior of the process and because of the multirate sampling of the process controlled variables. Two control schemes and two control algorithms are tested and compared. One control scheme considers the overall control problem using one multivariable control algorithm such as a model predictive controller (MPC). Another control scheme separates the overall control problem into two levels. One level takes care of the controlled variables with fast dynamics via a multiloop proportional-integral algorithm, and the other level takes care of the slow controlled variables via a multivariable control algorithm such as MPC. The simulated comparison revealed the superiority of the second scheme only in providing a faster response. Other than the speed of response, the performances of the two schemes are almost comparable. Further, the first scheme may outperform the second one in the presence of input limitation. On the other hand, linear MPC and nonlinear MPC algorithms were compared for the two control schemes. Simulation results indicated that the nonlinear MPC outweighs the linear MPC in terms of performance, tuning requirements, and robustness.