Title: Singularly Perturbation Method Applied To Multivariable PID Controller Design

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Abstract: Proportional integral derivative (PID) controllers are commonly used in process industries due to their simple structure and high reliability. Efficient tuning is one of the relevant issues of PID controller type. The tuning process always becomes a challenging matter especially for multivariable system and to obtain the best control tuning for different time scales system. This motivates the use of singularly perturbation method into the multivariable PID (MPID) controller designs. In this work, wastewater treatment plant and Newell and Lee evaporator were considered as system case studies. Four MPID control strategies, Davison, Penttinen-Koivo, Maciejowski, and Combined methods, were applied into the systems. The singularly perturbation method based on Naidu and Jian Niu algorithms was applied into MPID control design. It was found that the singularly perturbed system obtained by Naidu method was able to maintain the system characteristic and hence was applied into the design of MPID controllers. The closed loop performance and process interactions were analyzed. It is observed that less computation time is required for singularly perturbed MPID controller compared to the conventional MPID controller. The closed loop performance shows good transient responses, low steady state error, and less process interaction when using singularly perturbed MPID controller.