Control of pH Neutralization Process using Simulation Based Dynamic Programming

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It is generally difficult to control the nonlinear system with a linear model-based control method, so nonlinear controls have to be considered. Among the numerous approaches suggested, the most rigorous approach is to use dynamic optimization. However, as the size of the problem grows, the dynamic programming approach is suffered from the curse of dimensionality. In order to avoid this problem, the Neuro-Dynamic Programming (NDP) approach is proposed by Bertsekas and Tsitsiklis (1996). The NDP approach is to make use of all the data collected to generate an approximation of optimal cost-to-go function and then the approximated cost-to-go function is used to find the optimal input movement in real time control. In this study, the SAE (simulation-approximation-evolution) algorithm using NDP approach is applied to a pH neutralization process to investigate the feasibility of the algorithm and to deepen the understanding of the basic characteristics of the algorithm both in simulation and experiment. In addition to that, the performance of SAE using k-nearest neighbor method is compared to that using neural network as an approximator.