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Keywords

- process automation and monitoring
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- learning systems
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- system condition monitoring
- optimization algorithms
- control theory
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Selected Papers

DOI:10.3390/pr10071355

Predictive Control in Water Distribution Systems for Leak Reduction and Pressure Management via a Pressure Reducing Valve

Authors: Jose-Roberto Bermúdez, Francisco-Ronay López-Estrada, Gildas Besançon, Guillermo Valencia-Palomo and Ildeberto Santos-Ruiz

Abstract: This work proposes a model predictive control (MPC) strategy for pressure management and leakage reduction in a water distribution system (WDS). Unlike most of the reported models that mainly consider EPANET-based models, the proposed method considers its dynamic representation given by ordinary differential equations. The proposed MPC uses a pressure-reducing valve (PRV) as a control element to regulate the pressure in the WDS to track the demand. The control scheme proposes a strategy to manage the high nonlinearity of the PRV and takes into account the demand profile throughout the day as well as the leaks that occur in the pipeline. The estimates of magnitude and location of the leak are provided by an Extended Kalman Filter from previous work and with the aid of a rule-based set point manager reduces the fluid loss in the event of a leak. Different scenarios are studied to illustrate the effectiveness of the proposed control system, achieving an approximate reduction of up to 5% of water losses, demonstrating robustness in the case of uncertainty in the leak location estimate.

DOI:10.3390/pr10112311

Where Reinforcement Learning Meets Process Control: Review and Guidelines

Authors: Ruan de Rezende Faria , Bruno Didier Olivier Capron , Argimiro Resende Secchi and Maurício B. de Souza, Jr.

Abstract: This paper presents a literature review of reinforcement learning (RL) and its applications to process control and optimization. These applications were evaluated from a new perspective on simulation-based offline training and process demonstrations, policy deployment with transfer learning (TL) and the challenges of integrating it by proposing a feasible approach to online process control. The study elucidates how learning from demonstrations can be accomplished through imitation learning (IL) and reinforcement learning, and presents a hyperparameter-optimization framework to obtain a feasible algorithm and deep neural network (DNN). The study details a batch process control experiment using the deep-deterministic-policy-gradient (DDPG) algorithm modified with adversarial imitation learning.

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