World Academy of Science, Engineering and Technology
International Journal of Energy and Environmental Engineering
Vol:11, No:04, 2017

Hybrid Adaptive Modeling to Enhance Robustness of Real-Time Optimization

Authors : Hussain Syed Asad, Richard Kwok Kit Yuen, Gongsheng Huang

Abstract : Real-time optimization has been considered an effective approach for improving energy efficient operation of heating, ventilation, and air-conditioning (HVAC) systems. In model-based real-time optimization, model mismatches cannot be avoided. When model mismatches are significant, the performance of the real-time optimization will be impaired and hence the expected energy saving will be reduced. In this paper, the model mismatches for chiller plant on real-time optimization are considered. In the real-time optimization of the chiller plant, simplified semi-physical or grey box model of chiller is always used, which should be identified using available operation data. To overcome the model mismatches associated with the chiller model, hybrid Genetic Algorithms (HGAs) method is used for online real-time training of the chiller model. HGAs combines Genetic Algorithms (GAs) method (for global search) and traditional optimization method (i.e. faster and more efficient for local search) to avoid conventional hit and trial process of GAs. The identification of model parameters is synthesized as an optimization problem; and the objective function is the Least Square Error between the output from the model and the actual output from the chiller plant. A case study is used to illustrate the implementation of the proposed method. It has been shown that the proposed approach is able to provide reliability in decision making, enhance the robustness of the real-time optimization strategy and improve on energy performance.

Keywords : energy performance, hybrid adaptive modeling, hybrid genetic algorithms, real-time optimization, heating, ventilation, and air-conditioning
Conference Title : ICSREE 2017 : International Conference on Sustainable and Renewable Energy Engineering
Conference Location : Boston, United States
Conference Dates : April 24-25, 2017