

عنوان مقاله:

MPC-based energy management system for hybrid renewable energies

محل انتشار:

هفتمین کنفرانس بین المللی توسعه فناوری در مهندسی مکانیک و هوافضا (سال: 1402)

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خلاصه مقاله:

Environmental pollution and the gradual depletion of conventional energy have induced significant research in energy supply systems equipped with renewable and conventional sources. Although wind and solar energy sources emerge as the most promising renewable energies, a supply system comprising two or more sources is recommended to fulfill local loads, as the power generated by renewable sources depends on weather conditions. The main idea of any energy supply system is to fulfill the energy demand with the minimum cost, considering the operational constraints related to the components. As a result, some issues, such as security of supply, improvement in the combination of energy sources, efficiency, energy saving, improvement in access to isolated systems, and the development of renewable energy, should all be taken into account. Up to now, cost reduction and energy saving have been understood almost exclusively as the technological improvement of renewable sources: wind turbines, solar panels, solar collectors, etc. The misconception of "the best system is made with the best components" is still used for the design of energy supply systems. Technological advances in renewable sources should be coupled with a sophisticated energy management system. This paper proposes an energy management system based on control ideas. Therefore, the design of a hybrid controller based on predictions of energy, estimated from physical models and previous measurements, is considered in order to satisfy the energy supply. Model Predictive Control (MPC) has been chosen as the main control strategy since it is able to handle variations in the supply of renewable energy; while, in the energy demand, MPC includes a cost function to be minimized and adds the constraints on the manipulated and controlled variables. The cost function takes into account the value of the energy generated, the cost of storing energy locally, and the aging of the components. It is selected to be simple because the future control actions computed by the optimizer take into account the integration of the model along the prediction horizon. Hybrid process models are then considered in the proposed MPC. Although this gives formulation problems, Mixed Logical Dynamic (MLD) involves continuous variables (involved in linear dynamic equations), discrete variables (specified through propositional logic statements), and the mutual interaction between the two. In this case, the resulting mixed integer quadratic programming (MIQP) could present problems for real time implementation, because the solution is ... computationally complex and d

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