Detection of Faults and Drifts in the Energy Performance of a Building Using Bayesian Networks

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Résumé en anglais	Despite improved commissioning practices, malfunctions or degradation of building systems still contribute to increase up to 20% the energy consumption. During operation and maintenance stage, project and building technical managers need appropriate methods for the detection and diagnosis of faults and drifts of energy performances in order to establish effective preventive maintenance strategies. This paper proposes a hybrid and multilevel fault detections and diagnosis (FDD) tool dedicated to the identification and prioritization of corrective maintenance actions helping to ensure the energy performance of buildings. For this purpose, we use dynamic Bayesian networks (DBN) to monitor the energy consumption and detect malfunctions of building equipment and systems by considering both measured occupancy and the weather conditions (number of persons on site, temperature, relative humidity (RH), etc.). The hybrid FDD approach developed makes possible the use of both measured and simulated data. The training of the Bayesian network for functional operating mode relies on on-site measurements. As far as dysfunctional operating modes are concerned, they rely mainly on knowledge extracted from dynamic thermal analysis simulating various operational faults and drifts. The methodology is applied to a real building and demonstrates the way in which the prioritization of most probable causes can be set for a fault affecting energy performance. The results have been obtained for a variety of simulated situations with faults deliberately injected, such as increase in heating preset temperature and deterioration of the transmission coefficient of the building's glazing. The limitations of the methodology are discussed and are translated in terms of the ability to optimize the experiment design, control period, or threshold adjustment on the control charts used.
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