

Application of On-line Simulation for Building Energy System Fault Detection

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Typical buildings consume 20% more energy than required due to inefficient operation procedures, non-optimal control schedules, and system faults. To improve building energy performance, the system faults have to be detected. The mechanical and electrical problems have to be diagnosed. The optimal control schedules and operating sequences have to be developed and implemented. Today, these tasks have to be conducted by well-trained engineers through field measurement, specialized engineering calculation and analysis, and testing. Due to a lack of skilled engineers and the lengthy process, performance optimization has been limited to a small fraction of the building stock. Consequently, excessive amounts of energy are wasted daily in existing buildings.

Simulation programs, such as DOE-2 and BLAST, have been used for building system design and optimization during the design phase. In the last several years, a number of software programs, such as AirModel, have been developed to identify system faults, diagnose the problems, and optimize the system operation for existing buildings.

Based on current building requirements for energy management, simulation programs have been developed for fault detection, problem diagnosis, and operation schedule optimization for large commercial buildings with built-up HVAC systems.