

MULTI-VARIABLE OPTIMIZATION MODELS FOR BUILDING ENVELOPE DESIGN USING ENERGYPLUS SIMULATION AND METAHEURISTIC ALGORITHMS

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Abstract

The paper presents the method of optimal design of the building envelope. The influence of four types of windows, their size, building orientation, insulation of external walls, ceiling to unheated attic and ground floor on the life cycle costs in a single-family building in Polish climate conditions is analyzed. The optimization procedure is developed by means of the coupling between MATLAB and EnergyPlus. The results using three metaheuristic methods: genetic algorithms, particle swarm optimization, and algorithm based on teaching and learning are compared. The analyses have shown the possibility of reducing the life cycle costs through the optimal selection of the building structure. The high initial investment (above the required standard) pays off in the long run when using a building.

Keywords: Genetic algorithm; Particle swarm optimizer; Teaching-learning-based optimization; Energy consumption; Building simulation; Building envelope.