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Abstract

COMPUTER-AIDED ANALYSIS FOR COMBINED BUILDING SERVICES DRAWINGS USING REAL-CODED GENETIC ALGORITHM

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In tradition, the processes for combining building services drawings and checking their physical interference are done manually. Experienced engineers normally spend more than three months to check a floor. However, errors are not all eliminated. The errors will not be discovered until the workers meet them in the construction field. The result takes time and money for reinstallation.

Currently, a lot of software can check physical interference between two building service objects by the 3D constructive solid geometry method, which checks the objects by Boolean pattern UNION. Practically, the spatial clearance between two objects (e.g., a pipe and a duct) should be also checked for installation and maintenance, but so far, none of the software can do that.

This research is the first attempt to use Real-coded Genetic Algorithm (RGA) approach for physical interference checking with clearance consideration. In computational intelligence, Genetic Algorithm (GA) is an evolutionary algorithm to identify global maximum and minimum points of multivariable functions or optimal points in system equations without solving complex mathematical equations or following a number of

decision algorithms. In this research, the nearest distance "R" between two objects is calculated by RGA. If R is less than spatial clearance, then the two objects interfere with each other. Otherwise, there is no interference. With iterative process, RGA can check all the pipework and component objects in the building floor plan using simple mathematical models.

This thesis introduces a set of mathematical models for the components of building services. In order to record the data of the components efficiently, a set of computer-aided design (CAD) tools has been developed. An interference-checking program using modified RGA has also been written in C++ for testing. The program actually shortens the traditional checking process to hours, and the CAD environment can be simplified from the 3D to the 2D as well.