OPTIMAL ANALYSIS AND DESIGN OF STRUCTURES

A Kaveh

Iran University of Science and Technology, Iran

In this paper, a review of optimal analysis of structures is presented. Analysis is called optimal if the corresponding structural matrix (stiffness or flexibility) is sparse, well-structured and well-conditioned. Associating graph models to structural models transform the formation of structural matrices to those of the graph matrices. This not only provides a powerful means for the formation of matrices with the aforementioned properties but also makes the swift analysis of structures feasible. Many space structures and finite element models are either symmetric or regular. A structure is called symmetric or regular if it can be modelled as the product of graphs. Four well established graph products consisting of Cartesian, strong Cartesian, direct and lexicographic products are defined by mathematician and utilized for configuration processing of space structures. Many theorems are also proven for matrices. However, to include more general models, the existing graph products have been swift eigen solution of graph matrices like adjacency and Laplacian generalized by the author and colleagues. These generalized products have to be utilized in linear algebra to increase the utility of the graph products in science and engineering. In this paper, the recently developed methods for swift analysis of symmetric and regular structures for optimal design by metaheuristic algorithms are presented. These methods facilitate optimal design of the structures, where analysis should be performed hundred and even thousands of time. This results in substantial reduction of computer storage and time for large scale structural models.

alikaveh@iust.ac.ir