# Shape, Size and topology optimization of double layer grid structures using HGSAPSO algorithm.

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## Abstract

In this study, a hybrid Gravitational search algorithm (GSA) and particle swarm optimization (PSO) algorithm (HGSAPSO) is proposed to simultaneously optimize size, topology and shape of double layer grid structures. In HGSAPSO, in each iteration, there are good and bad agents in each group. The best agents are selected as a group leader and other agents are randomly located in these groups. In each group every agent has position and velocity that the group leader determines agent's new position using the Newtonian gravity and the laws of motion. In proposed hybrid algorithm it is attempted to eliminate the defects of the PSO and GSA and improve their performance in optimization. HGSAPSO has been compared with some well-known heuristic search methods such as GSA through three examples. The obtained results confirm the high performance of the proposed algorithm in solving various problems.

**Key words**: Optimization, Gravitational search algorithm, Meta-heuristic algorithm, Particle swarm optimization, Double layer grid structures, Harmony search algorithm.

## 1. Introduction

In recent years, the usage of space structures due to their advantages has been increased. Large-scale space structures are used in exhibitions, supermarkets, sports stadiums, and etc. [1]. Designing space structure takes a lot of time due to large number of members. Therefore, many optimization methods have been proposed for space structures.