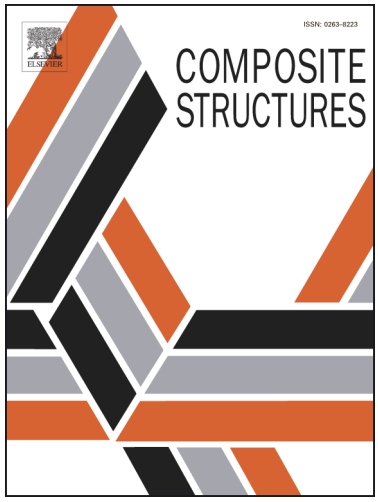

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Dieu T.T. Do, Seunghye Lee, Jaehong Lee

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A modified differential evolution algorithm for tensegrity structures

Dieu T. T. Do[1], Seunghye Lee[2], Jaehong Lee*

Department of Architectural Engineering, Sejong University
209 Neungdong-ro, Gwangjin-gu, Seoul 05006, Republic of Korea

Abstract

In this paper, a novel modified differential evolution (mDE) algorithm for advanced form-finding of tensegrity structures is proposed to define an appropriate candidate for strut members. The form-finding process only requires topology and member type of a tensegrity based on the force density method. The proposed algorithm improved from original differential evolution (DE) is performed to reduce significant computational cost. In the mDE, scale factor F and crossover rate c are adjusted as well as the mutation and selection phases of the original DE are also replaced by the best individual-based mutation and elitist selection techniques. The objective function of the product of α and β related to eigenvalues and force densities is minimized. Since force density values are considered as continuous design variables, optimal solutions obtained by mDE are more accurate than those solved from discrete design variables of GA. Several benchmark numerical examples of two- and three-dimensional tensegrity structures are investigated to verify the effectiveness and robustness of the proposed algorithm by comparing obtained results with those of other methods in the literature.

Keywords: Form-finding; Tensegrity structure; Force density method; Differential evolution (DE); modified Differential evolution (mDE); Genetic algorithm (GA).

1. Introduction

Tensegrity is a structure that consists of a set of continuous cables in tension and a set of discontinuous struts in compression with the word *tensegrity* being an abstract

*Corresponding author. E-mail: *jhlee@sejong.ac.kr*
[1]E-mail: *thanhdieu0801@gmail.com*
[2]E-mail: *lsh2002437@gmail.com*