Geometric features and parameter sensitivity analysis for the prestressed state of the innovative honeycomb multi-post cable dome structures

Yuan. TU *, a, Shi L. DONG

* Space Structures Research Center, Department of Civil Engineering, Zhejiang University
38 Zheda Road, Hangzhou 310027, China
Room 406, Civil Engineering and Technology Building
Email: tuyuan@zju.edu.cn

a Department of Material Science and Engineering, Massachusetts Institute of Technology, Boston, MA 02129, USA

Abstract
Abandoning Buckminster Fuller’s initial tensegrity concept of continuous tension and discontinuous compression, the circular multi-post cable dome structure was carried out with all ridge cables framing a honeycomb-shaped net, multiple posts connected at each lower and upper node. Regard to all kinds of cable-post layout, cable dome structures related in research and practical projects can be classified into 13 types, including Geiger type, Levy type, Kiewitt type, bird nest type, et al. The newly proposed type has desirable geometric features in its multi-post setting and innovative honeycomb ridge cable unit shape, thus being particularly advantageous over the existing ones above in terms of structural properties, complexity of construction, costly cable consuming and thus economic benefits. There is no cable dome structure without prestress. Based on the former derivation of the general recursive formulas for the internal forces, this paper carries out new initial prestress design table with shifted parameter. Comparative analyses show more detailed prestress distribution regulations and demonstrate the exact significance of depth-to-span ratio. This study provides a new solution for the selection, design and construction of cable domes.

Keywords: honeycomb cable dome structure, multi-post setting, new structure, geometric feature, prestressed state, mechanical properties, parameter sensitivity analysis, design table.

References
