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Deformation of the tensegrity units

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Abstract

Tensegrity structures have been applied in some areas and attracted some attention from scholars all over the world. At present, research on the tensegrity structures is mainly focused on shape optimization of structure, stability, topology and so on. Assembling the tensegrity units is a common method to construct complex and large-scale tensegrity structures. The method is based on the tensegrity unit. Therefore, more tensegrity units is helpful to construct more various types of tensegrity structures. Based on the 3-bar tensegrity unit, a new method of deformed the tensegrity units is developed in this paper. Firstly, configuration and structural characteristics of the existing tensegrity units are described. Then, under the condition that the radius of the cylinder enclosing the tensegrity unit remains unchanged, the top end plane of the tensegrity units is declined at a certain angle to deform the unit. Mathematical model of the deformed tensegrity unit is established. Then, the mathematical model is applied to set up several the physical models with different shape dimensions. The stable physical models prove that the deformation method is correct and can be applied to obtain stable tensegrity units. Relationships between the structural parameters of the tensegrity units which are obtained with the deformation method are deduced and changes of the parameters are investigated. Finally, the obtained tensegrity units are assembled into some spacial shapes to prove that various complex spacial shapes can be obtained by application of the new tensegrity units.