Deployable bamboo dome

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Abstract

This article describes the process of design, analysis, and manufacture of a modular, adaptable and lightweight folding dome. The structure is composed of six flat semi-arches, that fold through the scissor-type system reducing the size of the dome to facilitate is transport. Bamboo bars with a circular section are used as a main material for the structural arches. This research has been contextualized in the development and the form-finding process of curved surfaces with articulated bars. Félix Escrig's projects have been taken as the main reference, in particular, his method based on the regular polyhedrons geometry, which allows obtaining the largest number of similar pieces [1]. For this case study, a new approach to the regular polygon method is applied in the design process. The new methodology allows to easily define the main characteristics of the bars: length and position of the joints; as well as achieving equal and modular pieces [2].

The case study incorporates analysis and simulation graphics in two dimensions of the semi-arch type elements comparing the initial positions to the final stage of deployment. This graphical method of analysis allows finding the adequate deformation based on the self-weight of the structure and in this way to define the ideal position for the opening of the semi-arch that matches the initial geometry established to form a stable arc (Fig 1). The fabrication process explains the design strategies employed to select the connection mechanisms between the bamboo bars that will ensure correct structural behavior and functionality of the dome. The resulting prototype aims to demonstrate the potential of bamboo bars within deployable structures to generate innovative and sustainable solutions for temporary buildings.

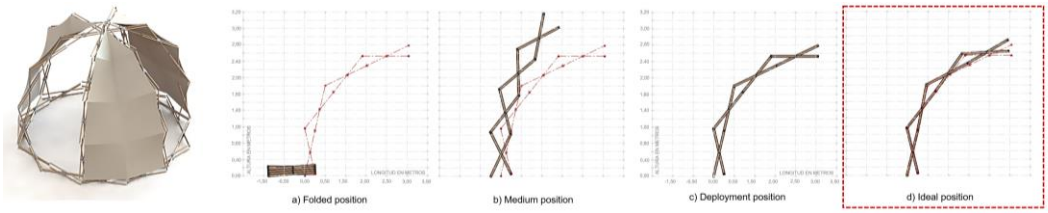

Fig. 1 Deployment stages analysis

References

[1] F. Escrig (eds.), *Modular, ligero y transformable. Un paseo por la arquitectura ligera móvil.*, Seville, Spain, 2012.

[2] N. Torres and D.M. Peña, "Deployable Arches Based on Regular Polygon Geometry,"*Achi Doct*, 14 Febrer, vol. 4, no. 2, pp. 89-105. 2017.