

Common Multiple

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Abstract

How to develop a visually appealing but low-tech, earthquake resistant, lightweight structure with an adaptable design that can be built on different construction sites with different uses and conditions?

The double-layered structure of this lightweight pavilion consists of three parts: flat strips, a membrane and joints. The strips are active-bent, three-dimensional structural elements, which create the structure's flexible frame - a triangular pattern of domed shapes. The membrane ensures the bending and stabilises. The length and the material of the preformed strips can vary, depending on several factors including the demands of transport, construction, and the span widths. It is imperative to note that it performs according to elastic deformation, i.e., after the force is removed, it returns to its original shape. Membrane materials can vary depending on tensile requirements and the intended usage of the structure. Digitally fabricated joints connect the strips to the membrane. A second set of sliding joints help to define and stabilise the shape. By moving the joints, the spans are reduced, and the elements are pulled closer together. This movement causes the structure to rise and take its final shape.

The design process is simple and customer friendly. By defining a few parameters in an algorithmic model, the user can easily adapt the structure. These parameters are the number and position of the footings and the required clearance height. The result is a list of the necessary building parts as well as the position of the joints on the tension membrane. The algorithm also determines the shape, cut and size of the membrane. Due to the fact that the (low-tech) elements required for this structure are available all over the world, long transportation routes can be avoided and CO₂ emissions reduced. The self-explanatory lightweight system facilitates ease of construction, so the pavilion can be built by anyone. Its erection does not require a crane. The design, which is fast and straightforward, acknowledges the challenges of modern construction sites, combines the use of simple building materials with new planning technologies to achieve a simple, fast and ingenious lightweight load-bearing structure.

References

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