

Manufacturing Setup for Complex Forms : Pin-Bed Based Approach

Junaid Nabi*, Rahim Abdul A

* Vellore Institute of Technology
GDN-G05, Vellore Institute of Technology, Vellore, India
pzjayenn@gmail.com ; junaid.nabi@vit.ac.in

Abstract

Efficient structures obtained through Topology Optimization are quite complex and hence difficult to manufacture, especially when the scale of the structures is large, as is the case with Architectural and Civil Engineering Structures, and when the material is brittle, such as concrete. Fabric Formwork is one of the methods to fabricate such shapes, but there are limitations to the maneuverability of the fabric which reflects in constraints to the range of shapes that can be manufactured. This Problem, however can be solved by the external manipulation of the fabric, which can be achieved by Pin-Beds.

The main objective of this article is to propose a setup which is Flexible enough to obtain wide range of forms, that would be impractical to fabricate using conventional formwork. The Proposed setup is an iteration of Fabric Forming Table with the inclusion of Pin-bed approach, originally proposed by Renzo Piano. The Setup has Four moving parts, excluding the pins, providing the flexibility needed to fabricate complex concrete forms. 3D models are presented to explain the working of the setup. A complete description of maneuvers, for moving parts of the setup, to obtain various forms is also presented. The Setup is designed in such a way that all maneuvers can be controlled by a computer. The proposed setup improves on the Fabric Forming Table and also provides an effective alternative to Contour Crafting. It lays the foundation for Adaptive formwork which is the future for manufacturing efficient structures.

It important to note that, no physical models were fabricated. However, 3D models and simulations evince promising results.

References

- [1] Piano, R., *Experimental project of Shell Structures*, Progettazione sperimentale per structure a guscio , 1969.
- [2] L. Mingzhe et. al, *Multipoint shape-adjusting device*, Patent CN102135224, 2011.
- [3] Orr JJ (2012) *Flexible formwork of concrete structures*, PhD Thesis, University of Bath.
- [4] Bailiss J (2006) *Fabric formed concrete beams: design and analysis*, Master's Thesis, University of Bath.
- [5] Veenendaal D. et. al *Design and optimization of fabric formed beams and trusses: evolutionary algorithms and form finding*, Structural Concrete - Journal of the fib,12(4): 241-254,2011.