

Spaghetti Monster or: how to engineer a tangled structure and get it approved by the Expo

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Abstract

International Expositions historically offer a privileged stage for experimenting with adventurous designs and daring structures. From Gustave Eiffel's 1889 eponymous Tower, to Buckminster Fuller's Geodesic Dome and Frei Otto's West Germany Pavilion at Montréal 1967, the history of architecture and engineering is somehow also linked to the chronology of world fairs. Making no exception to the rule, the 2020 Expo in Dubai already promises to be a thrilling performance of engineering prowess and architectural feats.

For the development of the Czech pavilion, an unusual yet visually striking entrance canopy will serve as primary outdoor shading element as well as main design feature of the pavilion. The odd appearance and geometrical complexity of the piece has predictably earned it the nickname *Spaghetti Monster* (Fig. 1). Owing to thorough expertise in the field of bending-active structures, the engineering team has been pushing for an innovative solution which will involve building the ribbons of the canopy out of GFRP rods elastically bent into shape. Due to the challenging geometry, the complex erection process and the strict local safety regulations, each phase of the project represents a perfect engineering test case that pushes the boundaries of what is feasible in the field of elastic systems. In particular the form-finding and the analysis of the structure have required the use of the most recent numerical tools available to create a consistent workflow spanning from the conceptual design phase to the detailed assessment of the structural behaviour [1]. The current paper will address the salient processes that were involved in the development of the project so far, focusing also on the engineering requirements to obtain approval by the authorities. In this respect, the project will represent an interesting test-case within the field of bending-active structures, and its successful completion will feel almost like having tamed the Monster.

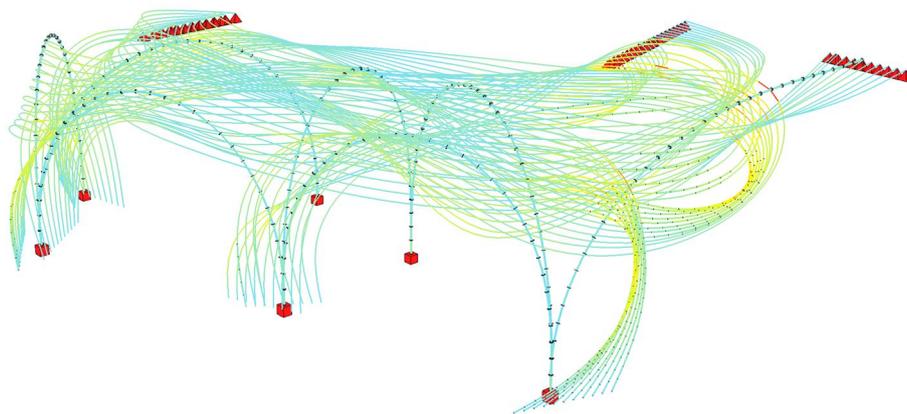


Fig. 1 Analysis model of the entrance canopy

References

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