

# The Evolution in the Design Tools for Membrane Structures

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## ABSTRACT

The design of tensioned membrane structures went through a rapid evolution in the last century: physical models, hand drawings and analytical structural calculations have been gradually replaced by digital 3D modelling tools, CAD software and FEM engineering software.

This presentation provides a summary of the key developments in the architectural and engineering design of tensioned membrane structures with an overview of the analytical structural methods and hand calculations of the early pioneering project [1]. The presentation also includes a description of the physical models and experimental methods to determine the form of structures [2] and the gradual development of reliable computational methods to improve the accuracy and effectiveness of the design process.

The potential of the new design tools is illustrated with practical examples and built projects developed with the support of the new engineering and modelling computer software.

## References:

- [1] MOLLAERT, Marijke, et al. The design of tensile surface structures: from a hand calculation in 1958 to a contemporary numerical simulation. *Steel Construction*, 2015, 8.4: 251-258.
- [2] GAB, Siegfried; OTTO, Frei. *IL 25: Experimente/Experiments – Form Kraft Masse 5/Form Force Mass 5*. 1990.