

Contemporary Membrane Structures in Europe (2010-2018)

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Abstract

During the 2nd decade of the XXI century membrane structures are characterized by the diversification of applications together with new developments. The current range of applications encompasses from small to large-scale structures for sports, transport, culture, fairs, retailing, health and entertainment. Other new or intensified uses that deserve special mention are façades, refurbishment, urban conditioning, towers, sculptures, experimental prototypes, worship, environment protection and energy harvesting.

Noticeable advances occur in design, materials and technology. Updates of commercial software include non-linearity, hybrid systems, wind-structure interaction, gas law and parametric form optimization. They contribute to bring the computer models closer to reality and to clarify the misunderstandings of the so-called free-forms. The materials improve constantly extending their longevity and incorporating new features including photovoltaic cells, sensors, leds, acoustic absorption capability, transparency or translucency. And the use of ETFE is being extended and consolidated.

The low level of environmental control has so far been a severe limitation to the use of membranes in cold climates. However, remarkable progress is taking place introducing translucent insulating materials, printing capabilities, low emissivity coatings and multi-layering.

Progress is also being made in the understanding of the appropriateness of membrane structures, led by lightweight large-scale sport stadium roofs. They expand all over the world imposing the tensile bicycle wheel as a much more efficient structure than bending solutions based on trusses and cantilevers. Bending is expensive as it was already clear in the 50s pioneering experiences of Frei Otto and his team. But many designs do not take it into account to the point that membrane structures frequently end up being conventional steel structures. Some recent realizations are not yet rid of this drawback but others have assumed it to the point of improving the behaviour of the structure even more. It is not only the case of the aforementioned spoked-wheels, but also of the Tensairity system, cable-beams, active-bending or flying masts, among others.

Some significant examples will illustrate the future trends that point towards the diversification of applications, the increase of the structural efficiency and the improvement of the environmental behaviour.

References

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