

Abstract

Title and Subtitle

Aluminum Covering for Freeform Surfaces

Description and structural analysis of a construction method with plank profiles to create double-curved building surfaces for the Ferrari-Maserati Museum in Modena

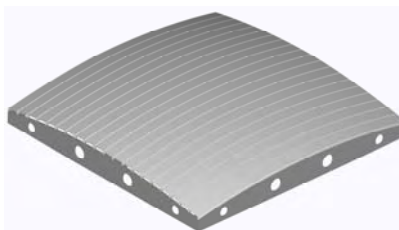
Description

One of the few fields of innovation remaining in the area of building technology and architectural form is the creation of *structures with double-curved surfaces*. Though their virtual generation is greatly facilitated by modern CAD programmes and, accordingly, they are often found in contemporary designs and competitions, their structural calculation and constructional execution remains difficult, even if IT also offers new tools in this respect.

The Italian foundation “Fondazione Casa Natale Enzo Ferrari” had organised an international planning competition for the construction of a museum in Modena, in which the winning concept was the design by the London-based group of architects *Future-Systems*. The main feature of the project, at the time it was written in the final planning stage, is its double-curved, car body shaped roof.

The technological solution for the structure is a system used in shipbuilding, developed by the company “PINICAL Shipbuilding & Architecture”, which is being specifically offered in the contracting process now in course. Using *aluminum extrusions* bent by means of a special stretch bender, freeform elements with any chosen curvature, a waterproof surface and a nearly jointless appearance can be produced. The problem of segmentation, which occurs in most implementations of freeform surfaces, is thus solved. The *Pinical System* is now to be further developed for architectural applications, with the aim of turning it into a largely standardised building component system with a corresponding planning system.

This piece of work uses the example of the *Ferrari-Maserati Museum* in Modena, in the planning stage, as the basis for working out and presenting a strategy for the structural design of the roof and its substructure, and includes a fundamental analysis of its structural properties using modern 3D FEM structural engineering software.



A *consistent calculation strategy* was developed for the Pinical technology, taking into account all characteristics specific to the system as far as possible. As the quantity of data and the quality of modelling go beyond the technical and computational limits of structural engineering programmes, necessary simplifications were carried out and documented.

The results of this piece of work are intended to make a contribution to better managing the complex problems arising in the planning and execution of double-curved facades and roofs, ensuring economic efficiency and a secure technological basis.