

Hybrid structure for the ArtLab EPFL pavilion

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Abstract

The ArtLab pavilion groups three distinct buildings under one same roof. This project, developed by the Japanese architect Kengo Kuma, winner of the 2012 competition, was built on the EPFL campus, next to the Rolex Learning Center, from 2014 until 2016.

The pavilions, with their unifying roof, create a contrast between traditional slate roofing and contemporary design with their dramatic length and various inclined planes as proposed by the architect. But, this contrast also characterizes the structure: while it is made of simple frames, each of them have a specific geometry which calls for modern construction methods and innovation.

The variable geometries of the frames were generated using a 3D model of the pavilions to guaranty the continuity of the different roof planes. To obtain constant cross-sectional frames, a hybrid structure composed of a wooden frame coupled by two frames made of perforated steel plates was developed. Using non-linear material laws, a numerical model was validated with experimental results of bending tests and then used to design of these hybrid frames.

Finally, the northern roof cantilever was created with a three-dimensional pleated structure made of solid wood. The behaviour of this structure was modelled with shell finite elements and verified on site by monitoring the displacements of the roof during construction.

These pavilions demonstrate that innovation can improve the quality of construction.

Keywords: glued laminated timber, perforated steel plates, hybrid structure, innovation, 3D modelling, experimental study, bending tests, , wooden pavilion

1 Introduction

The ArtLab pavilion unites the three following buildings: the Welkom pavilion with the Montreux Jazz Café; the Data Square which shows the outstanding projects of EPFL (Ecole Polytechnique Fédérale de Lausanne) such as the Human Brain Project; the Art and Science pavilion with temporary expositions of the Gandur art foundation.

The project developed by the Japanese architect Kengo Kuma, winner of the 2012 competition, was carried out by the contractor Marti Construction SA. Structural engineering was performed by INGPHI Ltd.

The unifying roof covers the different pavilions as well as the access road to the underground parking of the Rolex Learning Center and a pedestrian pathway that connects Allée de Savoie with Route des Noyerettes. The pavilions reach an