The lab that's betting on low-tech

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From the Saint Loup Chapel in Pompaples to the soon-to-be-completed Vidy Theatre Pavilion in Lausanne, the lab run by Yves Weinand is developing new innovations based on an age-old material: wood. A newly published book highlights the lab's most important discoveries, for scientists and wood-industry professionals alike.

Taking inspiration from origami, basket-weaving, and the history of carpentry, researchers at EPFL's Laboratory for Timber Constructions (IBOIS) have used "low-tech" wood to develop innovative structures and architectural concepts that are not only modern and stylish, but also durable and uniquely original. Laboratory head Yves Weinand has just published a book showcasing the lab's main innovations over his ten years-plus at EPFL. His book aims to build awareness about the many advancements in wood-based technology in his lab and demonstrate wood's potential as the construction material of the future.

What was your main priority when you joined EPFL in 2005?

Our aim was to develop contemporary architectural designs based on timber, so as to encourage its use as a building material. We wanted people to look beyond the traditional chalet style that is typically associated with wood. But we knew that would require winning architects over with elegant designs. The thesis projects carried out at the lab until 2010 focused on developing computer-assisted design software as well as new construction methods employing wood. Our software expanded the range of applications for the engineered wood

products introduced on the market some 20 years ago. It also helped create a new field of R&D in timber construction.

What are the special features of wood as a building material?

The materials we work with are mainly cross-laminated timber (CLT) panels and laminated veneer lumber (LVL) made from coniferous trees and, more recently, deciduous trees. These panels inspire engineers, since they have impressive mechanical properties and retain their shape well. In conventional timber structures, the load-bearing elements are straight, like beams. But with these panels, we can create structures where the load-bearing elements are incorporated into the façade – which is an innovation. We were able to develop such technology by bringing in PhD students from a range of fields – including architecture, civil engineering, computer science, and mathematics – from the very start to work on cross-disciplinary projects. A number of architects have expressed an interest in our work; the first thesis projects at our lab culminated in the construction of the Saint Loup Chapel in Pompaples, in Vaud Canton, in 2008.

What has more recent PhD research focused on?

Over the past five years, we have been working more on developing computer-assisted design software incorporating load specifications. These mathematical models enable us to resolve problems related to cutting, manufacturing, and assembling wooden panels and to evaluate interactions between absolute and local geometries, especially for testing building resistance. The shapes of our buildings aren't chosen at random. They are calculated by our models to withstand a given set of loads. It's a whole new way of thinking about architecture. Assembly methods have also changed over the past five years. While the panels in the Saint Loup

Chapel and the Vaud parliament building were assembled using metal joints, those in the Vidy Theatre Pavilion will be assembled using exclusively wood joints. That will make the Pavilion even more sustainable, since it will be easier to dismantle and recycle. And it will eliminate the cost of sorting metal screws from wood during the recycling process.

How important is the inauguration of the Vidy Theatre Pavilion, in 2017, for your laboratory?

It's one of our flagship projects. It is a concrete example of the new construction principles we advocate. It is also the cornerstone project of a new teaching method I used this year in a course for architectural students here at EPFL.

What's next for the IBIOS lab in terms of research?

Our next challenge will be to increase the clear span of our arches from 20 meters – like those at the Vidy Pavilion – to 50 meters. That will entail developing more complicated mechanical designs and enhancing our software. Ditto for wood panel assembly methods. The next building we design will have 23 double-curvature vaults with clear spans of 52 meters. We are also developing structures that can be assembled with robots instead of manually. We plan to build an industrial hall with this aim in mind.

Apart from robotized assembly, what do you think will be your main innovation in the coming years?

We hope to eventually bypass the panel-cutting step and cut the shapes we want directly from trees. That means we'll need to develop a robot that can pick the best trees for a given structure, and then carve out the

elements we need. That would make our process even more coherent and sustainable by reducing the number of trees that would have to be cut down. This will be the topic of future thesis projects.

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