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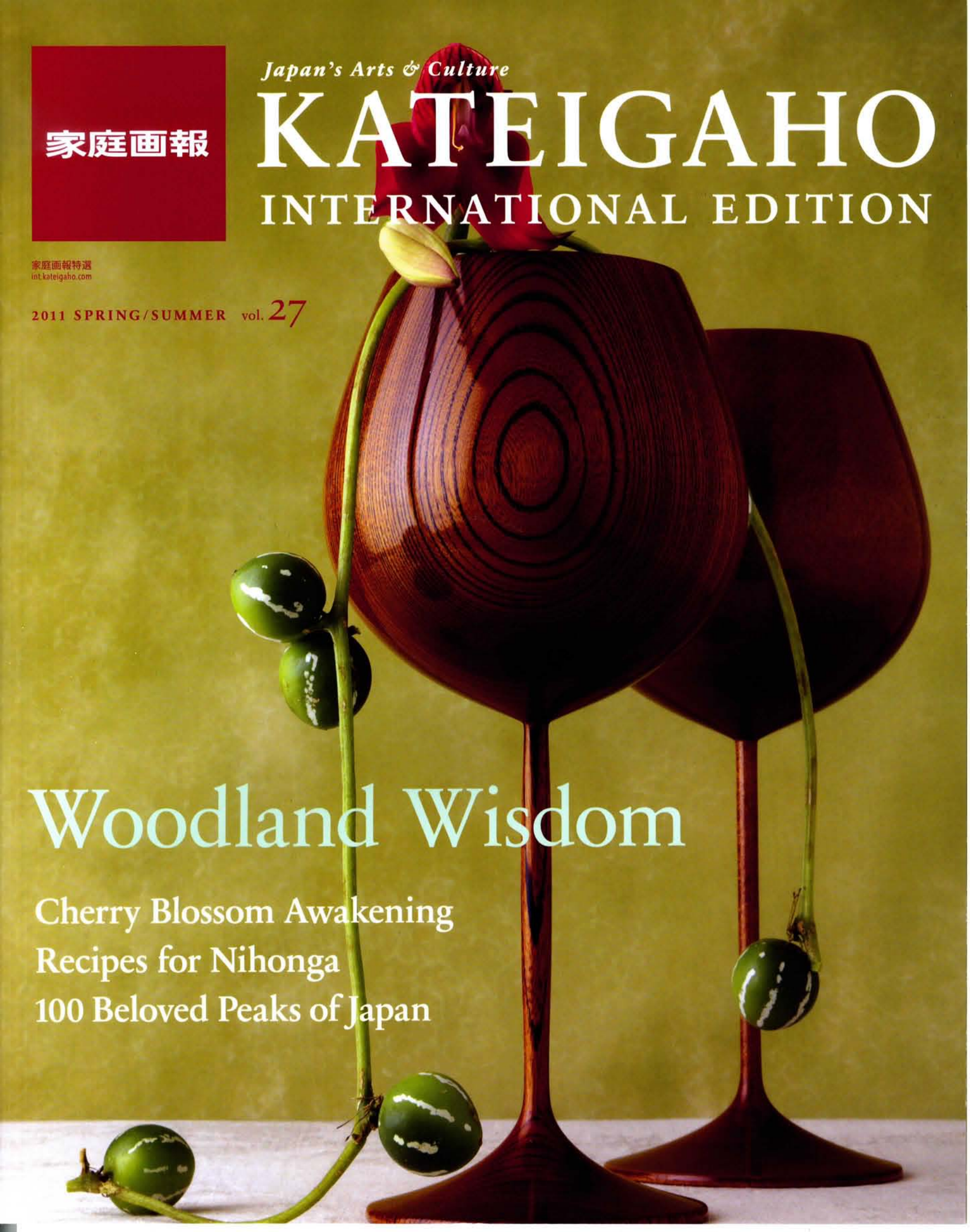


Woodland Wisdom

Cherry Blossom Awakening
Recipes for Nihonga
100 Beloved Peaks of Japan

Rethinking wood, part 1

Skyscrapers of wood?

Engineered wood and the search for the future

Mention wood architecture in Japan and most people think of traditional edifices such as temples and shrines. Coming quickly to mind are the seventh-century Horyuji temple near Nara, with the world's oldest wooden buildings, and Kyoto's Toji, whose five-story pagoda is the country's tallest wood tower. The fact that these have stood for so many hundreds of years evokes awe.

But wood for such landmarks was hand-hewn, and the structures hand-built, with human judgment compensating for irregularities inherent in materials from nature. Lack of uniformity is a drawback that has hindered wider use of timber in contemporary architecture. Today, though, advances in the development of "engineered wood" are opening new horizons of structural performance. Engineered wood is fast drawing attention as a material that can be used like steel and concrete.

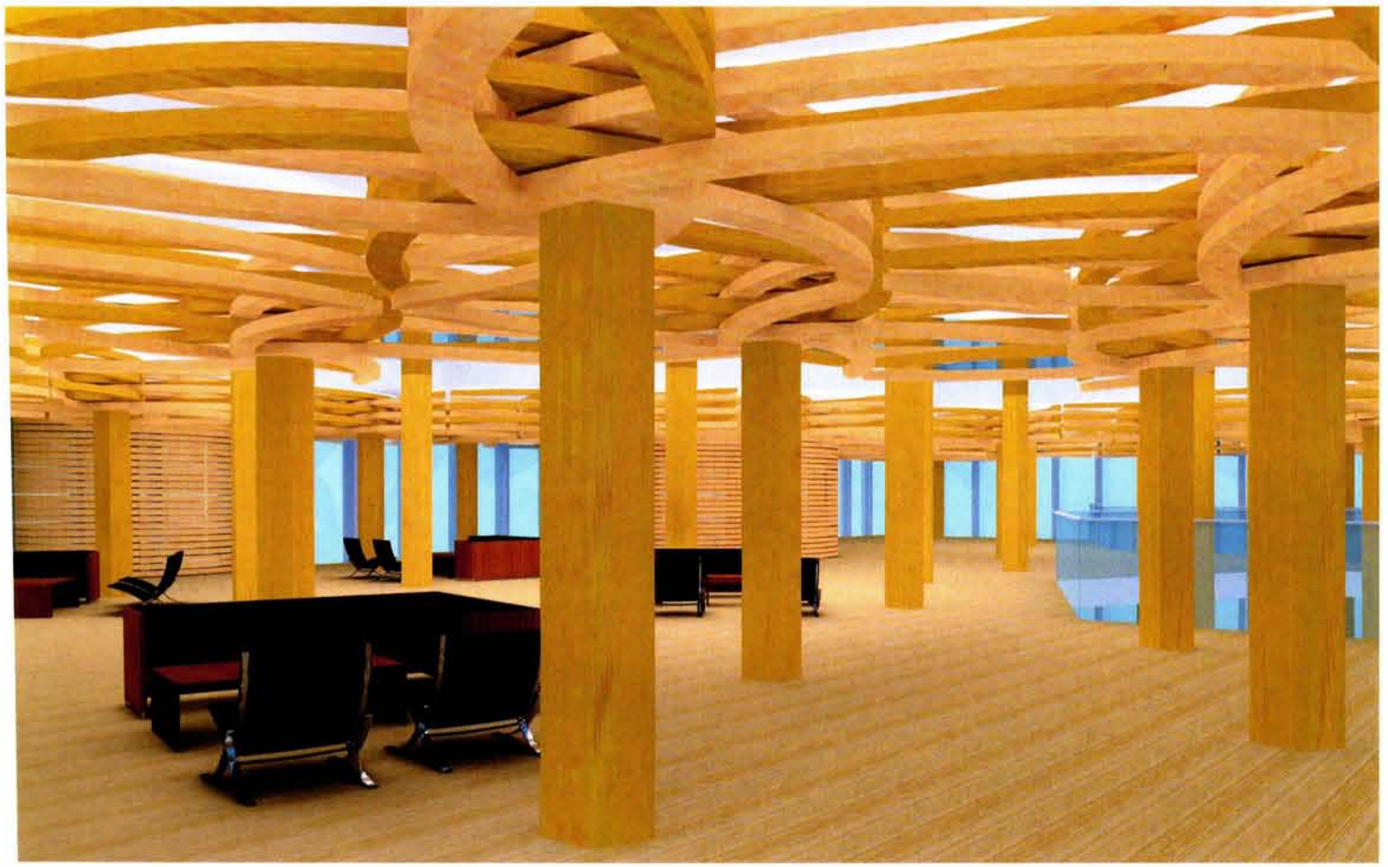
An event in May 2010 at Spiral Hall, in Tokyo's trendy Aoyama district, was titled "The Search for New Possibilities in Wood Construction–Team Timberize." In virtual form it showcased how high-rise wooden buildings have already become a realistic option for urban areas. Team Timberize is a group of architects and technologists who are exploring new possibilities for constructing with

wood. Their virtual building projects, depicted on these pages, demonstrate how a neighborhood's appearance and atmosphere can change radically when an urban streetscape lined with reinforced concrete buildings is interrupted here and there by a few 30-meter-tall wooden structures.

Mikio Koshihara is an associate professor at the University of Tokyo's Institute of Industrial Science, and the leader of Team Timberize. He is studying practical applications of cutting-edge materials and technologies for use in high-rise wood architecture. He says, "When modern construction methods were introduced from the West starting in the Meiji period (1868–1912), nontraditional wooden buildings began to be erected. These were typically four- or five-story warehouses or factories, called 'modern wood structures' and designed by structural experts instead of craftsmen. During World War II, with iron and other materials difficult to obtain, large buildings such as hangars were also erected of wood. But because it is vulnerable to fire, the postwar Building Standards Law of 1950 prohibited the use of wood for buildings more than 13 meters high or with a total floor area exceeding 3,000 square meters. Over the years, the Building Standards Law was revised. In

Opposite page: "Helix" has a double-helix form achieved with advanced wood-bending technology. Thin structural members, fabricated from layers of peeled timber, overlap to create a helical skeleton.

This page, top left: "Solid" gets its imposing presence from large blocks of laminated veneer lumber, stacked and planed to shape.
Top right: "Lattice" has a central structure of what appear to be randomly assembled latticework elements, creating the airy appearance of trees.
Left: "30" is a rigid-frame building erected from materials with a lumber-wrapped fireproof core. It has been designed as the standard for conceptual wood structures in the 30-meter height range.



1987 the height restriction on large-surface wooden structures was relaxed, and in 2000 restrictions on the permissible number of stories was eliminated as long as the fire-resistance performance requirements were met."

Despite detours along the way, the 2000 revisions to the Building Standards Law began to make urban high-rise wood construction more feasible. Supporting this trend was the development of engineered wood, which, like reinforced concrete and steel-frame construction, makes structural analysis possible.

Koshihara explains, "Composite wood, laminated veneer lumber (LVL), and other types of engineered wood are reconstituted materials; thus, lumber with large surfaces and predictable properties can be produced. The trees these materials originally come from may not be decades or centuries old, but the wood can be engineered in all sizes and even curved into desired shapes. It can be handled just like reinforced concrete or steel girders. Another advantage of engineered wood is that performance is more uniform, and its functional properties are better defined."

Further enhancing the potential for high-rise wood structures are advances in fire- and earthquake-resistance technologies. Koshihara cites research underway at E-Defense, the world's largest full-scale 3-D earthquake testing facility. Located in Japan, it is part of a Japan-U.S. collaborative research program. Here, the professor says, "experiments have already proved the structural performance of wood high-rises. Fire-resistance technologies such as the use of a fireproof core clad in wood, steel framing inside lumber, and wood covered with drywall or other fire-retardant plasterboard have been developed."

The virtual building projects exhibited at Spiral Hall are fascinating. Wood-bending technology is used for the oval-shaped "Helix," which has a double-helix structure. "Solid" is created out of wooden blocks measuring 2 meters square, which are stacked and then planed. The random, three-dimensional configurations of openwork that make up "Lattice" look like trees. In "30," structural wood is used for interior finishes to highlight the appeal of building with wood. These distinctive projects are eye-catching, and structurally speaking, they could all be built now.

With a view to enriching the city streetscape of the future, Koshihara notes that his goal for the time being is to offer high-rise wood structures as one alternative, just like reinforced concrete or steel-frame construction, at the planning stage.

For many reasons, including aspects of environmental quality and preservation, high-rises of wood are eminently suitable for the 21st century.

Opposite page, top: One virtual building has see-through walls made from lumber stacked so that the ends of the members overlap. Photograph by Satoshi Asakawa. Bottom: "Petal" has a pentagonal grid of layered curving beams. They look as though they wrap around the posts, evoking the suppleness of flower petals.

Below: "Digital Woods" is a building composed of wooden units, small enough to carry by hand, which serve as everything from structural posts to shelves, room dividers, and decoration, thus creating a harmonious whole. Design by Yasushi Ikeda, Keio University.
Right: To reduce environmental impact, the structure of "Waving Tree" is made from *hinoki* cypress and uses trusses of solid natural wood obtained from forest thinning. Design by Shuhei Endo, Kobe University.
Photographs by Satoshi Asakawa