Eminent Structural Engineer: Julius Natterer

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Brief CV

5.12.39:	Born in Haggn, Lower Bavaria (D)
1965:	Diploma in Civil Engineering, Technical University Munich
1978:	Appointed Professor at ETH Lausanne (CH)
1980–1993:	Founded several structural engineering offices
1981:	Suspended shell, Wien (A)
1989:	Truss bridge over the Simme in Wimmis (CH)
1990:	Holzbau Atlas Zwei
1991:	Polydôme, Ecublens (CH)
2000:	Roof structure for the Expo World Exhibition in Hanover (D)
2006	Professeur honoraire at ETH Lausanne
2007	Zénith at Limoges (F)
2007	Seven story residential building at Berlin (D)

(A: Austria; CH: Switzerland; D: Germany; F: France)

Keywords: Julius Natterer; Timber Engineering; Timber Structures.

Introduction

Hardly anyone over the past few years has had such a formative influence on the development of timber engineering as Julius Natterer (*Fig. 1*). He strongly promoted the use of wood in architecture and applied it in widely differing structural systems (*Fig. 2*). Even today, after he relinquished his teaching activities in Lausanne; work on development, experimentation and design continues.

It would seem that his origins determined his future profession. As the son of a forester's family he was born on 5 December 1938 in Haggn, Lower Bavaria, Germany. After his *Abitur* he studied civil engineering at the Technical University in Munich, and when he had obtained his *Diplom* in 1965 he

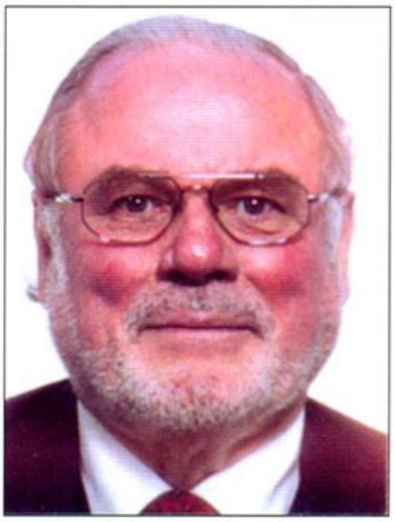

Fig. 1: Julius Natterer

took up the position of assistant in the department of structural design and wood design where he stayed for nine years, and where Professors Rucker, Gattnar, Kupfer and Heimeshoff exercised a formative influence on him. At this time he already opened his first structural engineering office.

In 1978, he was appointed professor at the ETH, Lausanne and entrusted with the management of IBOIS, the Institute for Wood Structures. The President of the ETH Lausanne, Maurice Cossandey, expected this institute to play a driving force in the use of wood in construction and to give impetus to the Swiss timber industry. Under the management of Natterer, who taught and performed research here until he acquired emeritus status, its influence and sphere of attraction were extended across regional boundaries.

Transfer of Knowledge

His preference for structural design and construction determined the contents of his teaching and research. He attached special value to promoting the conceptual and design skills of students in civil engineering and advised them "*gut konstruiert ist halb gerechnet* - a good design means half the calculations"; or for students of architecture "*gut konstruiert ist halb gestaltet* - a good design means half the work of creation". Thus he imparted structural engineering to his students and attempted to guide the two professions towards working together.

This didactic concept also formed the basis of the postgraduate course, "Building with wood" which has been run regularly since 1988. The course brought engineers and architects from the most diverse nations to IBOIS, which in the early nineties developed into a port of call for design engineers, scientists and industrialists. On countless tours Natterer presented his knowledge to the general public; his lively lectures filled halls, had an enthusiastic reception but were also thought provoking and awakened interest in wood as a building material. He was a permanent speaker at international conferences. In 1998, he himself together with his staff staged the World Conference in Timber Engineering in Montreux.

In his most important publication, the Holzbau Atlas,[1,2,3] which is translated into many languages, Natterer makes his idea of structural engineering very clear to the reader. He was himself the structural engineer of a good third of the examples quoted there. The joint authorship with colleagues from architecture, such as Thomas Herzog and Michael Volz, later also with Wolfgang Winter and Roland Schweitzer, is significant. In the course of this work the Atlas underwent continuous development; today it is considered to be standard reading for study and practice.

Way of Thinking

Natterer's constructive handwriting can be followed down the years; the structures are functional, and at the same time simplified. Whilst an assistant in Munich, he had already worked on wooden plane load-bearing structures. He got involved in static systems such

as trussed beams, grid and space frame structures, hypar shells and the resulting details, such as pin-jointed connections. It seems to me that there is no kind of load bearing system which he never realized some time, somewhere.

If at all possible he refrained from using expensive wood materials and technologies or heavy connectors. His first choice was round timber - for, says Natterer "timber grows round in the forest" - followed by squared timber, including together with mechanical fasteners and finally glued laminated timber and composite wood products. Frequently the purpose was met by simple boards which were fitted together with mechanical fasteners to become stacked ceilings and domes.[4]

Projects

Natterer's constructions range from the most diverse kinds of structures for building projects such as the pavilion in Dortmund for the 1969 Garden Show, the trade fair halls in Nuremberg in 1974, and the Ministry of Agriculture in Châlons-sur-Marne in 1989, to a recycling hall in Vienna in 1981 (*Fig. 3*), or bridges such as the wide span truss bridge across the Simme in Switzerland in 1989 (*Fig. 4*).

In the course of Switzerland's 700th anniversary celebrations in 1991, Natterer was awarded the contract to build the Polydôme[5] on the ETH Lausanne campus. After a short period of design and construction there appeared a spherical stacked plank dome made of simple planks, the 25 x 25 m plan being laid out with a network of intersecting board lamellae.

Fig. 2: Timber Tower in Sauvabelin

One peak of his practical career is to be found in the construction of the roof for the Expo World Exhibition in 2000 in Hanover (*Fig. 5*) [6]. The elegance of the pre-constructed shells must have been the deciding factor when the roof defeated other proposals. Due to its novelty and size this structure represented a challenge to structural engineering and everyone involved in the construction. The columns of the ten canopies consisted of round timber; in each case four silver firs from the Black Forest which had been planted over 200 years before and were originally intended to serve as masts on Dutch sailing ships. To prevent drying checks the trunks were split down in the middle. The heart of the whole project was formed by the 20 x 20 m, curved, stacked plank shells which were suspended between the cantilevered trusses. The structural analysis was performed by Natterer's son, Johannes.

For his work Julius Natterer received numerous national and international prizes and decorations, such as the Mies van der Rohe Prize in 1981, the Médaille de l'Académie de l'Architecture in 1986, the Ernst Pelz Prize and the Merit Award in the USA in 1995 or the World Award for Timber Structures in Malaysia in 2002, as well as the German Structural Steel Prize in 1976. Since 1992 he has been a member of the Royal Swedish Academy of Engineering Sciences. In 2005, he was awarded the main prize of the Schweighofer Foundation.

Research

His research represents a vital link between teaching and practice. Julius Natterer worked for over twenty years on new technologies, the development of building materials, connections, and construction methods utilizing wood and composite structures.

For many years work at IBOIS was concerned with grading of sawn timber by ultrasonics. These investigations led to a portable instrument which can be used to grade heavily stressed load-bearing elements as well as in renovation work, and which also serves to improve quality in production plants.

Connection techniques are central to timber technology. Right at the beginning of his career Natterer developed a pinned joint which ensures

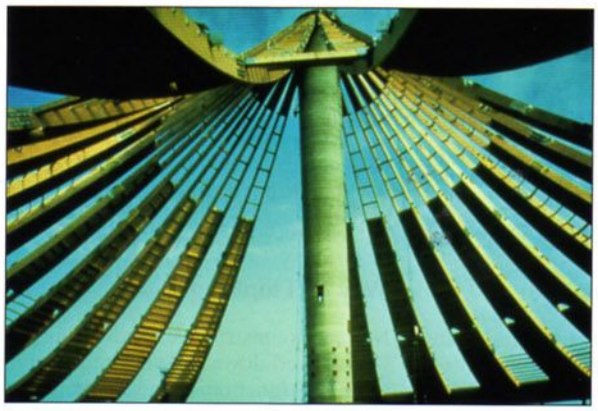

Fig. 3: Suspended construction of a recycling hall in Vienna built in 1981, shortly after Natterer was appointed as Professor at ETH Lausanne in Switzerland

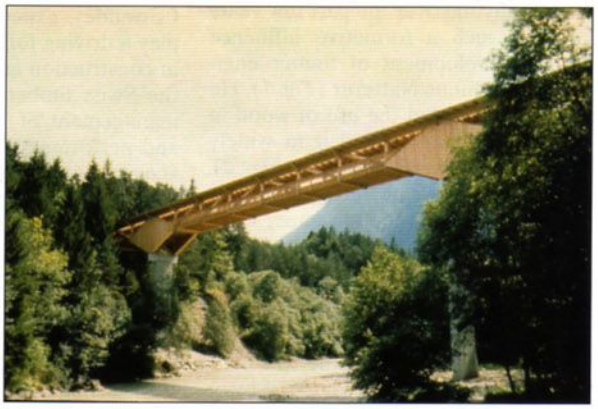

Fig. 4: The bridge over the Simme in Wimmis, Switzerland built in 1989 consists of a truss structure

Fig. 5: Roof structure for Expo World Exhibition in 2000 in Hanover constructed with stacked planks

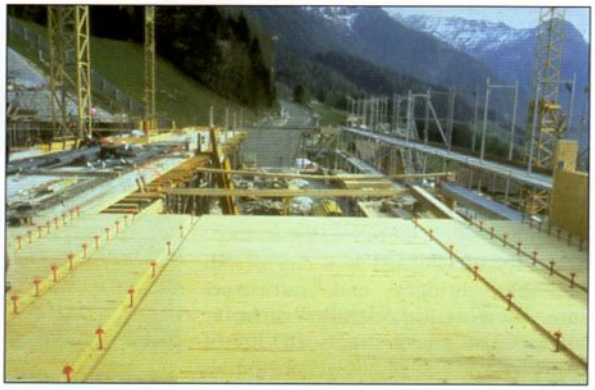

Fig. 6: Timber-concrete composite slabs for a building in Triesenberg

that loads are transferred as intended into the member and at the same time distributes the shearing forces in the cross section of the timber via a steel sheet which has been nailed on. Extensive trials were also carried out on nail connections with smaller nail spacings than foreseen by standards.

In the middle of the eighties IBOIS focussed on wood-concrete composite members. The topic led to a dissertation with theoretical and experimental findings on the compliant composite which was followed by many more investigations. The research at IBOIS led to several practical applications (*Fig. 6*) and further, complementary investigations in this field all over the world, which continue to this day.

Over the past few years the chair has worked on the increasing importance of glass as a load-bearing building material and its combination with wood. This was first used in joists of wood-glass composite construction for a hotel on Lake Neuenburg[7] (*Fig. 7*). The

Fig. 7: Wood-glass composite construction for a hotel on Lake Neuenburg

theoretical and experimental bases also found expression in one of the numerous dissertations which Natterer oversaw.

Further Improvements

The processing of raw timber incurs a large number of by-products such as side boards, wood chips, as well as sawdust and wood shavings which realize only a low price and thus present a financial burden on the sawn timber. Natterer therefore thought about how to utilize any side boards and worked on using them in stacked plank structures and for load bearing in housing construction. Nails connect the boards to level elements which are employed universally in walls, ceilings and roofs. In combination with concrete they guarantee the span and the requisite period of fire resistance. Today the stacked plank method of construction has developed into an alternative to wood frame structures.

It is not easy to judge which qualities have enabled Julius Natterer to achieve such success in his work. I believe they are his eye for the essential and a good mixture of creativity, readiness to commit himself, communicative talents and courage to put into practice. He has now been retired for some years, but this is not to be taken too literally. He is still in charge of his Bois Consult office at home in a time-honoured house on the outskirts of Etoy. Surrounded by vines it has changed the Bavarian beer drinker into a wine enthusiast. On all sides of the house there are the remains of numerous experiments in solid timber, testifying to technological problems in past years and which are still of value today, awaiting their last destination in the dining-room stove. Perhaps this is how his dedication to solid timber originated.

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