



Werner Sobek

IStructE Gold Medallist **Werner Sobek** shot to fame in the 1980s when he successfully tackled the structural engineering design of the largest inflatable structure in the world, a demountable cover for the Roman amphitheatre in Nîmes. Now his long-established mantra of building for everyone with the minimum of waste is striking a chord with new audiences. Helena Russell finds out more.

LIGHTWEIGHT STRUCTURES

SPECIALIST Werner Sobek cuts a quietly confident figure – and well he might; as a practising engineer and architect for more than 40 years he has achieved worldwide acclaim – not for his physical projects alone, but also as a passionate advocate for sustainable design. He is not afraid to take on difficult challenges, and he is tirelessly vocal about how the climate emergency is impacting society.

This year's Gold Medallist is recognised for his innovative work on adaptive structures and his research into the contribution of structural engineering to carbon-zero. Sobek touched on these themes in his address, highlighting the challenges posed by an increasing population and climate change in the context of confrontational global relations.

Standing on the shoulders of giants

As a young man in Germany, Sobek wanted to be a set designer, and while at school he earned pocket money painting murals in discos. 'But then we had the oil crises and there were no jobs available for stage designers. People told me that I would be on unemployment benefit for the rest of my life,' he recalls. As he was always drawing buildings, he flipped a coin to choose between architecture and engineering, and started a degree course in civil engineering at the University of Stuttgart.

Despite being taught by some of the country's leading engineers, he felt unfulfilled. 'Within a few weeks I realised that the course was only about analysis, not about synthesis. I told the professor that we were analysing things that didn't make any sense structurally, and he said that this is the life of a structural engineer – making architects' designs stand up. It was quite clear to me that I didn't want this for my future.'

Sobek started sneaking into architecture lectures, to see whether that would suit him better. 'I was fascinated, but after a while I realised that they were doing synthesis only. In my opinion, the scientific foundation of what they were learning was poor.' He concluded he needed to study both, so he started

an architecture degree alongside his engineering course.

Two degrees would keep most people fully occupied – Sobek himself admits that it was 'a hell of a workload' – but he was hungry for knowledge. 'I realised that there are certain things that aren't covered even when you are studying engineering and architecture – lightweight building, using materials such as titanium and aluminium and so on. So, I went to the professor of fuselage and aircraft design and asked if I could sit in some of his lectures.

'He said I was the first student from another discipline to take an interest in his lectures. He really took care of me, and gave me a deep insight into aircraft design and these lightweight materials. This was when I fell in love with working with the minimum, because it is the most complicated thing. If you can design something to the absolute minimum, then the rest is trivial.'

The same thirst for knowledge drove him to seek out Professor Frei Otto, head of Stuttgart University's Institute for Lightweight Structures, to learn how to design fabric structures. Otto did not teach, so Sobek had to try a different tack. After some pestering, Otto told him the best way to get the knowledge he sought was to get a student job at the institute. 'I soon found out that although these people knew a lot about designing with these materials, they did not understand how they were produced, their mechanical properties and so on.' Sobek again sought out what he needed – this time from the professor for textile

CAREER MILESTONES

1980	Graduated from University of Stuttgart with degrees in civil engineering and in architecture
1980–86	Postgraduate in wide-span lightweight structures at University of Stuttgart
1983	Fazlur R. Khan Award, New York
1984	Worked for Skidmore, Owings & Merrill as well as at the Illinois Institute of Technology, Chicago
1987–91	Worked for Ingenieurbüro Schlaich Bergemann & Partner, Stuttgart
1992–95	Professor at University of Hanover
1992	Founded his own engineering consultancy
1995	Succeeded Frei Otto as chair of the Institute for Lightweight Structures at University of Stuttgart
2000	Succeeded Jörg Schlaich as chair of the Institute of Concrete Structures at University of Stuttgart
2000	Created the Institute for Lightweight Structures and Conceptual Design (ILEK) at University of Stuttgart
2008–14	Succeeded Ludwig Mies van der Rohe as professor at the Illinois Institute of Technology in Chicago
2021	Gained emeritus status
2022	Awarded the German Federal Cross of Merit
2024	Awarded the IStructE Gold Medal

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technology, whose lectures were aimed at those designing machines for the textile industry.

After 13 semesters, he felt he had a well-rounded education. 'All my colleagues said I would never get a job in the building industry with my profile, but I didn't want to. I was not interested in being streamlined – a "ready-made piece of human being for the industry". I felt I had the right to study what I wanted.'

Sobek acknowledges his mentors – 'five great academic teachers of world-class standard' – structural engineers Frei Otto and Jörg Schlaich, architectural historian Jürgen Joedicke, architect Myron Goldsmith and geodesy professor

Klaus Linkwitz. 'I was lucky to get them to open the door for me, so I have to be very grateful. If you stand on the shoulders of such giants, you can look much further,' he says.

Ballooning reputation

An accidental introduction to Jörg Schlaich led not only to a doctoral dissertation at Schlaich's institute, but subsequently to the project on which Sobek made his name. 'In his engineering office, Schlaich had a project for an inflatable roof to cover the Roman arena in the French city of Nîmes (**Figure 1**). Out of the 40 or 50-strong office of engineers, none had

any idea how to design inflatable textile structures or how to implement such a thing in a protected monument, where you were not allowed to drill a single hole into the structure.

'He said, you are always talking about inflatables, lightweight structures and textiles; would you be keen enough to be the responsible engineer for the project? This was the chance of my life, but I was in at the deep end!' Sobek recalls.

'I was a young, German doctor of engineering, the calculations were all in English but they were based on the French codes written in French. There was no internet-based translation in 1987, you just had to learn it!' he continues. It was the largest inflated building in the world – a cover that was designed to be erected at the start of each winter season and removed before the summer tourists arrived, allowing events to be hosted in the arena throughout the winter.

It was an elliptical, lentic-shaped 'cushion' with a clear span of 60m by 90m and 12m at midspan – 8m above the horizontal and 4m below. Formed of 1mm thick polyester fabric, it had a structural deadweight of about 2.5kg/m². 'It was so light that under certain wind conditions it was at risk of flying away; to prevent this I incorporated hidden flaps in the facade that opened by suction under certain conditions.'

On top of the technical challenges, Sobek had to deal with the close attention of city mayor Jean Bousquet, head of the couturier Cacharel. 'I met with him twice a week, mostly in the evening when he came from his office to stop by the arena and ask for an update.

'This building made me famous because it was in the public eye; it was quite obvious that it was me who designed and engineered it and took the responsibility, with a lot of innovations,' Sobek says. The steel frame and cushion were dismantled and rebuilt over the arena every year for 14 years.

Breaking down disciplines

As an achievement for a newly qualified engineer, the Nîmes project was undoubtedly impressive, but Sobek also had aspirations to progress in academia. While he accepted a post as a professor at the University of Hanover, it was Frei Otto's chair at the Institute for Lightweight Structures that interested him, and three years later he got the opportunity to move back to Stuttgart when Otto retired.

In 2000, when Jörg Schlaich prepared to retire from his own position as chair



FIGURE 1: Sobek made his name with inflatable, demountable roof for Roman arena in Nîmes, which applied his knowledge of lightweight structures and textiles





↑ FIGURE 2:
Modular R128 house in Stuttgart embodied Sobek's sustainability ethos with high recyclability and energy self-sufficiency

ZOOEY BRAUN

of the concrete structures institute at Stuttgart University, they struggled to find a successor. 'One Sunday morning at 8am Schlaich called me up and said there was only one person he would accept for the position. The following day I got a call from the university offering me the post – so now I had two chairs!' Sobek proposed that the two be unified to create the Institute for Lightweight Structures and Conceptual Design (ILEK) – a move that caused some controversy. 'But I argued that it should be about the philosophy of how we research and how we teach; from that time on, disciplines would be of secondary importance.'

Lectures were open to both architecture and engineering students. 'My courses were not obligatory, so people came out of interest and they asked good questions. We also held studio sessions that required a design task, with both engineering and architectural aspects,' he says. Having to build these projects taught students about taking responsibility for their designs.

Aspiring to the minimum

In 1992, Sobek decided to establish his own engineering practice – a company that now employs 450 staff working on projects worldwide.

'I was lucky to meet one or two architects who gave me interesting work, enabling me to pay the employees that I needed; as a result the office rapidly grew to 10 people,' Sobek recalls. The

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architects he met included Helmut Jahn, whose Chicago-based firm subsequently employed Sobek to do all the structural facade engineering for its projects, and whose work was influenced by Sobek's ideas and philosophies. The two became lifelong friends.

Other collaborators include Christoph Ingenhoven, Norman Foster, Hans Hollein, Jean Nouvel and Dominique Perrault. 'These people called me because they realised that I have a way of working that takes them further – a way that doesn't necessarily influence the architectural style or expression, it is about minimisation of energy, waste, emissions, simplicity of construction on site, logic and so on.' Sobek's opinion was sought at concept stage on many projects. 'My criticism was not only accepted, it was demanded,' he says.

His practice is acknowledged as a leader in sustainable design, but Sobek



tse@istructe.org



@IStructE
#TheStructuralEngineer



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admits this was not a strategic decision, it was a natural consequence of his design philosophy. 'We build with a minimum of material – for me this came to mean building with a minimum of production waste. It does not make sense to optimise the design of a wooden beam, say, making it spatially curved with no angles if, when we take into account the material that is left over, it can no longer be regarded as a lightweight structure. From 1995, our objective has been not just to be energy efficient, but to reduce the emissions from the production as well as the operation phase.'

His ideas for a more sustainable built environment include designing and building a series of houses that each had an experimental characteristic. 'I wanted to know if we could build a house without a chimney, which was more than 90% recyclable and self-sufficient in terms of energy,' he says. The result was the R128 family house in Stuttgart (Figure 2), a completely glazed building powered by solar panels and built from modular panels and joints that allow it to be easily dismantled. Subsequent projects included buildings that could communicate and manage the way they shared excess energy with electric cars and even neighbouring properties.

What's more, Sobek is committed to sharing his knowledge and encouraging others to do the same. One of a number of not-for-profit organisations he co-founded is the DGNB – the German Sustainable Building Council – which brought together several hundred architects and engineers working *pro bono* to establish a centre of excellence for sustainable architecture and a certification scheme. 'Within two years it was the leading source of knowledge on how to create a built environment in a sustainable way,' he says.

His lifelong altruism was acknowledged by his home country in 2022 when Sobek was awarded the German Federal Cross of Merit: 'It's the highest award you can get if you are not a diplomat or a royal!' he smiles.

Watch the Gold Medal address

If you missed the livestream of Werner Sobek's Gold Medal address, 'Building in a new world', on 23 September, a recording is available on the IStructE website at www.istructe.org/resources/career-profiles/werner-sobek/.

