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Editorial

Professor Herbert A. Mang

The 2014 Nathan M. Newmark Medal was awarded to Professor Herbert A. Mang (see Fig. 1) at the annual ASCE Structures Conference, which took place in Boston, April 3–5. The award citation reads: "*For his outstanding research contributions in the area of nonlinear continuum and computational mechanics that clarified the cause of collapse of important concrete structures and quantified the influence of the initial postbuckling behavior of metallic structures*". In selecting Herbert Mang for this award, the committee particularly noted his initiating ground-breaking new research in computational structural stability.

Structural stability in a computational setting is one of several areas to which Herbert Mang has made substantial scientific and practical contributions in his professional career of more than 45 years. More recently, motivated by the objective to improve the initial postbuckling behavior of structures by means of minor changes of the original design, Herbert was involved in a detailed study concerning the conversion of imperfection-sensitive into imperfection-insensitive structures with the help of *Koiter's* initial postbuckling analysis in the frame of the Finite Element Method (FEM) [1,2]. An arch bridge (span 40 m, width 6 m, rise 5 m), shown in Fig. 2a, analyzed numerically by his associate Xin Jia [3], is chosen as an example for such a conversion. Fig. 2b illustrates the effect of adding sufficiently stiff tensile members (hangers) on the stability limit and on the postbuckling behavior of the perfect structure.

Herbert was born in Vienna, Austria. He graduated from Vienna University of Technology in 1967, with a *Dipl.-Ing.* degree in Civil Engineering. His first doctoral dissertation was on the application of Muß'chelichvili's method to the analysis of trapezoidal plates. In the 1960s this method was very popular, particularly in Central and Eastern Europe. It involved complex function theory and conformal mapping. In 1970, Herbert was graduated to *Dr.techn.* from Vienna University of Technology. This was the time when the FEM started to become popular in Central Europe. After having read the book by Prof. Zienkiewicz on the FEM, it became clear to Herbert that this new method could only be learned by doing. Encouraged by his wife Barbara to go to the US, Herbert went to Texas Tech on a Fulbright scholarship with the intention to study this method and to apply it to structural problems. This resulted in his second dissertation, the title of which was "Finite Element Analysis of Doubly Corrugated Shells." In 1974, he was graduated to *Ph.D.* Herbert's first paper in an ASCE journal was based on his US dissertation (Fig. 3). Having used Newmark's β-method for dynamic analysis of such shells, he could not foresee that 40 years later he would receive the Nathan M. Newmark Medal of ASCE. He is grateful to his adviser, Prof. C.V.G. Vallabhan, for having instructed him in the FEM.

Still in Texas, Herbert started to correspond with Prof. Richard H. Gallagher after having studied his dissertation. This resulted in the invitation to come to Cornell University as a Research Fellow. Supported by the Max Kade Foundation upon recommendation by the Austrian Academy of Sciences, he spent 15 months at Cornell University, together with his wife and two sons of three and two years of age. He remembers this time as one of the most productive periods in his professional life. Not only could he prepare his habilitation thesis, which included a critical assessment of the simplified hybrid displacement method representing a special form of FE analysis, but he also got involved in Dick Gallagher's consulting activities concerning the analysis of wind-loaded cooling towers. Herbert's professional relationship with Dick has led to a deep friendship. Herbert always viewed Dick, who passed away in 1997, as his American mentor (Fig. 4).

At Cornell University, Herbert met Luigi Cedolin from Politecnico di Milano, one of the European pioneers of computational mechanics of concrete, who later went to Northwestern University to co-operate with Prof. Zdeněk Bažant. The acquaintance with Luigi Cedolin was the initial ignition of Herbert's activities in this important scientific field. Indirectly, it was also the starting point of a deep professional and personal friendship with Prof. Bažant.

Herbert's habilitation at TU Vienna in 1977, entitled him to supervise Ph.D. students. One of his first doctoral students was Helmut Floegl, whose dissertation on "Ultimate load analysis of reinforced concrete shells by the Finite Element Method considering a realistic material behavior and geometric nonlinearity" contained the investigation of a wind-loaded cooling tower. It was in May 1981 that Herbert reported, at Prof. Phil Gould's invitation, on the "Analytical prediction of short-term behavior of reinforced concrete panels, slabs and shells" at Washington University, St. Louis. Within a week's time he repeated this lecture at an International Convention and Exposition of the ASCE in New York City, and at Cornell University. Two years later, he published his first paper in Engineering Structures (Fig. 5) [4]. In this paper it was shown that wind-loaded hyperboloid cooling towers made of reinforced concrete fail by progressive damage and loss of material strength rather than buckling, which previously was the school of thought in civil engineering. At that time, he had no way of knowing that 11 years later he would become the Regional Editor of Engineering Structures for Europe.

In 1979, Herbert spent three months as a Visiting Research Associate at Tokyo University, collaborating with the late Prof. K. Washizu. In the same year he was promoted to Associate Professor at TU Vienna. In 1981, he worked for three months as a United Nations Field Expert at the Zhengzhou Research Institute for Mechanical Engineering in China. This activity marked the begin

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Fig. 1. Herbert A. Mang, F. ASCE, Regional Editor of Engineering Structures for Europe.

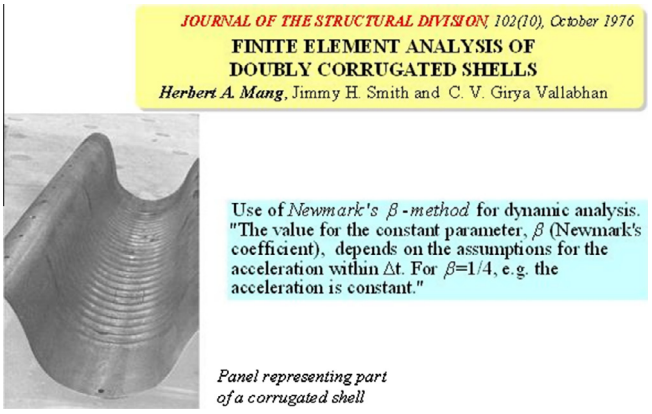

Fig. 3. First research paper of Herbert A. Mang in an ASCE Journal.

of intensive scientific relations with Chinese academic institutions continuing to this day. In 1983 Herbert was appointed to Full Professor at Vienna University of Technology. He has held this position until 2010 when he became Professor Emeritus. For 22 years he has also held the position of Head of the Institute for Strength of Materials at the Department of Civil Engineering of Vienna University of Technology, which was renamed in 2004 to Institute for Mechanics of Materials and Structures. From 1991 to 1994 he served as Dean (Chairman) of the Faculty (Department) of Civil Engineering and from 1994 to 1995 as Prorector (Vice President) of Vienna University of Technology.

Herbert has conducted basic and applied research in the following areas: mechanics of deformable solids, structural mechanics, computational mechanics (static and dynamic stress analysis, stability of structures, ultimate load analysis of reinforced concrete structures, geomechanical investigations, numerical simulations of the mechanical behavior of concrete rock and soil, finite element technology, boundary element methods, and coupling of finite element and boundary element discretizations), computational acoustics, multi-field analysis, multi-scale analysis.

An outstanding example of his early achievements in the area of stability analysis is buckling of multi-lamellae compression flanges of welded I-beams [5]. This elasto-plastic stability problem is characterized by partial loss of contact of the individual lamellae at loss of stability. Its solution revealed that standard design methods are frequently on the unsafe side.

Exploiting complementary advantages of the FEM and the Boundary Element Method (BEM), Herbert together with his assistants elucidated elasto-acoustic coupling by means of a novel hybrid BEM-FEM method [6]. A theoretically important by-product of his advances with the BEM was the development of an efficient method for evaluating hypersingular integrals occurring in stress analysis of structures.

As the thesis adviser of his former assistant and present successor, Prof. Christian Hellmich, Herbert was involved in the development of a thermo-chemo-mechanical hybrid method, with

Fig. 4. US mentor, Prof. Richard H. Gallagher†, F.ASCE, with his wife Terry, talking with Prof. G. Maier, Politechnico di Milano, and H.A. Mang.

experimental feedback during construction, for strength analysis of shotcrete shells required to stabilize tunnel excavations by the New Austrian Tunneling Method [7]. A characteristic feature of this traditional method are measurement cross-sections at distances of 6–8 m. Each of them contains several measurement cells for monitoring the displacements. The new idea was to generate a boundary-value field for FE analysis of the shotcrete shell by means of spatial and temporal interpolation.

In 2005 Herbert started to co-operate with the Department of Geotechnical Engineering of Tongji University in Shanghai, which ranked first in the field of civil engineering, in China. In 2012, he was appointed to the National RPGE Chair Professor of this university. (The acronym RPGE stands for Recruitment Program of Global Experts.) The Institute for Mechanics of Materials and Structures of Vienna University of Technology and the Department of Geotech-

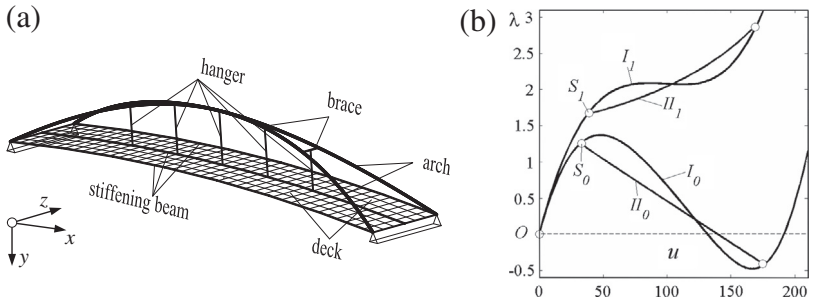

Fig. 2. Arch bridge (a) configuration, (b) load–displacement paths of the central node of the deck for the structure without hangers (subscript 0) and with hangers (subscript 1).

nical Engineering of Tongji University are planning a joint research project concerning the Hongkong-Zhuhai-Macao-Bridge, which is presently under construction. Fig. 6 shows the course of this bridge. Fig. 7 refers to the tunnel between the West Artificial Island and the East Artificial Island (see Fig. 6).

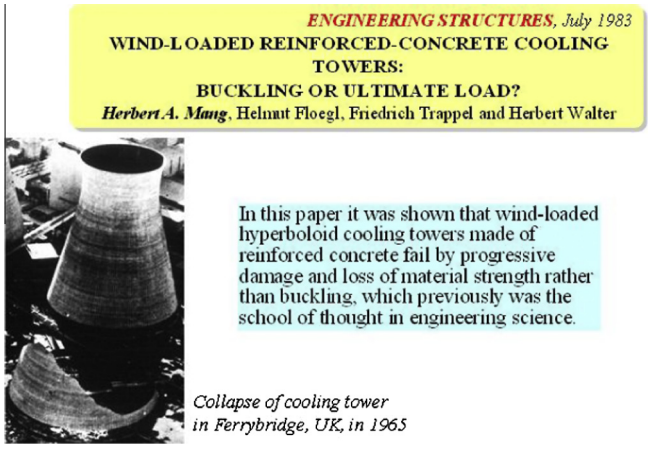

Fig. 5. First research paper of Herbert A. Mang in Engineering Structures.

In addition to his scientific activities, Herbert has always aimed to serve the international and the national scientific community. He was the first President of the Central European Association for Computational Mechanics (1992–1995), and he served as a Vice President of the International Association for Computational Mechanics (1998–2010) and as the President of the European Community on Computational Methods in Applied Sciences (2005–2009). From 1995 to 2003 he was the Secretary General and from 2003 to 2006 the President of the Austrian Academy of Sciences. Since 2010 he has the position of Vice President of the Austrian Science Council.

Herbert's scientific accomplishments, documented in 23 books (7 co-authored, 16 co-edited), 4 chapters of handbooks, 197 journal papers, and 264 proceedings papers, have not gone unnoticed. He has received 12 (major) foreign/international awards including 2 foreign decorations, and 11 (major) national awards including 4 decorations. He was elected to Foreign Associate of the US National Academy of Engineering and to member of 2 European Academies of Sciences and Arts and of 15 European National Academies of Sciences and/or Engineering. He has received 6 Honorary doctorates and an Honorary Professorship. He is also an Honorary Member/Fellow of 4 professional societies.

Herbert's contributions to structural mechanics, particularly to computational structural stability and to computational mechanics of concrete structures, have culminated in his selection as the recipient of the 2014 Nathan M. Newmark Medal of ASCE. Engineering

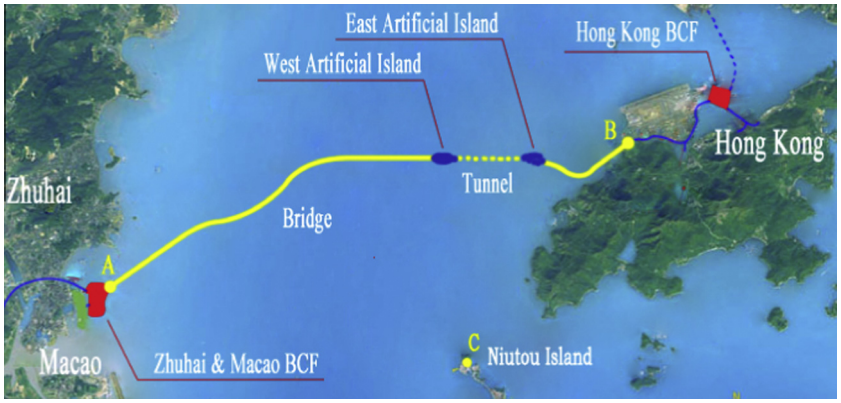

Fig. 6. Course of the Hongkong-Zhuhai-Macao-Bridge.

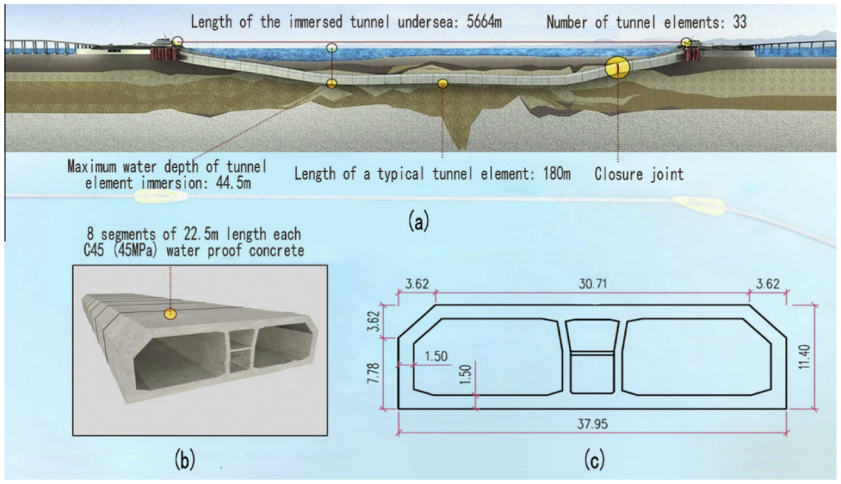

Fig. 7. Tunnel between the West Artificial Island and the East Artificial Island (see Fig. 6). Tunnel: (a) longitudinal section, (b) typical tunnel element, (c) cross-section of a tunnel element.

Structures is honored to present this focus section to highlight the scientific contributions of the journal's European Editor and the impact of his work.

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