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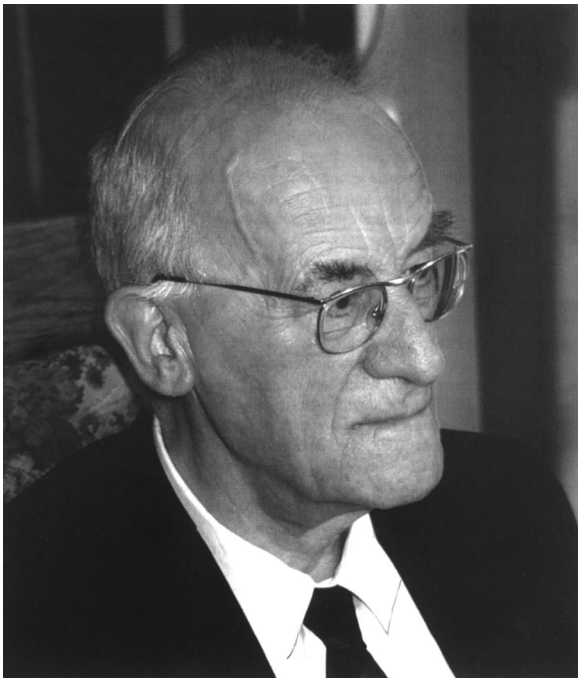
# Preface

## Stability, Strength and Stiffness in Materials and Structures



In Memoriam
Warner Tjardus Koiter

This special issue of the *International Journal of Solids and Structures* is dedicated by friends, colleagues and former students to the memory of the internationally famous scientist and teacher, Warner Tjardus Koiter, Professor Emeritus at Delft University of Technology, who died after a long illness on 2 September 1997 at the age of 83.

The papers were invited and edited by an editorial committee consisting of Johann Arbocz, René de Borst and Erik van der Giessen, all from Delft University of Technology.

The wide range of topics, covered by the various contributions are representative of the breadth of scientific interest of Warner Koiter. The papers are also related, as they cover the various interacting aspects of the stability, strength and stiffness that one encounters when dealing with the theory describing the behavior of materials and structures.

Warner Tjardus Koiter was born in Amsterdam on 16 June 1914. He was raised in Zutphen and attended school there. After graduating from grammer school he enrolled at Delft Institute of Technology (as

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Delft University of Technology was called then) in 1931 and in 1936 he obtained his Mechanical Engineer's degree Cum Laude.

Initially, he worked at the National Research Institute (Rijks-Studiedienst voor Luchtvaart, the forerunner of NLR, the current National Aerospace Laboratory), where under Ari van der Neut he initiated his studies on the buckling behavior of thin-walled structures. This work later culminated in his famous Ph.D. thesis entitled "On the Stability of Elastic Equilibrium", published in Dutch in 1945, the year Koiter obtained his Ph.D. Cum Laude under C.B. Biezeno at the Delft Institute of Technology.

The story goes that the thesis was finished already in 1942, but Koiter refused to publish it in German, the only foreign language that was allowed under the occupation regime. Thus, it was only a decade and a half later, in the early 1960s, that the international scientific community became aware of Koiter's seminal contribution. A humorous incidence occurred at one of Koiter's initial presentation of his work at the Harvard University. His lecture was enthusiastically received and among the many questions asked there was one inquiry whether the work could be published. Whereupon Koiter became somewhat indignant and answered that the work had already been published in 1945. The first English translation of Koiter's thesis appeared only in 1967.

There are few publications in engineering mechanics that have had such a profound impact on the work of a large part of the scientific community as Koiter's Ph.D, thesis. The thesis provided the stability investigation of elastic bodies with a solid mathematical foundation. Koiter's Imperfection Sensitivity Theory started a completely new branch of engineering analysis. His theory came at the time when the stability behavior of thin walled structures used for the launch vehicles of the military and space programs of the 1960s was a very hot topic. Koiter participated actively in the ongoing research activities and he continued as one of the most influential and leading scientists working on the stability of thin-walled shells for many years.

In 1949, Koiter was appointed Professor of Applied Mechanics at the Department of Mechanical Engineering, with a joint appointment at the Department of Aeronautics of Delft Institute of Technology. He served as Chairman of the Department of Mechanical Engineering 1959–1961. When in the early 1970s the student revolt movement reached Delft, and the established academic order was questioned Koiter left Delft and went abroad. He spent the 1973/74 academic year at the California Institute of Technology in Pasadena, California as a Sherman Fairchild Distinguished Scholar. Meanwhile his friends in the Netherlands, knowing that Koiter would not return to Delft under the newly established order, succeeded in convincing the Undersecretary of Education and Science to create for Koiter a special Chair of Stress Analysis and Stability of Structures totally outside of the administrative hierarchy of the university. Koiter retired officially in June 1979 when he reached the mandatory retirement age of 65. As Emeritus Professor he continued his research work for many years at the office which he kept at the building of the Department of Mechanical Engineering.

Apart from his already mentioned pioneering work on the theory of elastic stability, Koiter also made important fundamental contributions to the theory of thin shells, fracture mechanics and plasticity theory. His excellent theoretical work and his imposing and absolutely honest personality were recognized nationally and internationally. He was elected member of the Royal Dutch Academy of Sciences (KNAW) in 1959. Koiter participated actively in the work of the International Union of Theoretical and Applied Mechanics (IUTAM), where he was elected successively Bureau Member (1956–1960), Treasurer (1960–1968), President (1968–1972) and Vice-President (1972–1976).

Many foreign academic and scientific associations honored Koiter for his life time work and achievements with a membership. Koiter received several Honorary Doctoral degrees, from the University of Glasgow (1978), Ruhr Universität Bochum (1978), Rijksuniversiteit Gent (1979) and Université de Liège (1986). Further, Koiter was elected honorary member of the Polish Society of Theoretical and Applied Mechanics (1969), foreign honorary member of the American Academy of Arts and Sciences (1974), Mitglied der Deutschen Akademie der Naturforscher zu Halle (1976), foreign associate of the National

Academy of Engineering, Washington (1977), honorary member of the American Society of Mechanical Engineers (1980), associé étranger de l'Academie des Sciences de l'Institut de France, Section des Sciences Mecanique (1981), foreign member of the Royal Society (1982), and socio straniero Accademia Nationale dei Lincei, Roma (1988).

Koiter was an excellent lecturer. He had the gift to present very complicated relationships and dependencies in a concise formulation. His many lectures as visiting scientist or professor at well-known universities such as Brown, Caltech, Harvard, Stanford, etc. will be remembered fondly by those who had the privilege to be present. In recognition of his many seminal scientific contributions, Koiter has been honored already during his lifetime by receiving several of the most prestigious prizes and medals such as the von Kármán medal of the American Society of Civil Engineers (1965) and the Timoshenko medal of the American Society of Mechanical Engineers (1968). Very recently, in July 1996, the American Society of Mechanical Engineers decided to introduce a new prize, the W.T. Koiter medal, to be awarded to a distinguished member of the Engineering Mechanics community. As a sign of great esteem, the society awarded Warner T. Koiter the first medal, which was personally presented to him on 22 January 1997 by Prof. J.W. Hutchinson of Harvard University in a styleful, small, closed ceremony among his family, friends and colleagues. At the end of the ceremony, the ones present could see the "old" Koiter vigorously taking the floor thanking for the unexpected honor in a short speech.

In remembrance of Koiter's work, the Governing Board of Delft University of Technology has created the Koiter Institute Delft, in which the solid mechanics groups of the Faculty of Aerospace Engineering, the Faculty of Civil Engineering and Geosciences and the Faculty of Mechanical Engineering cooperate.

Those of us who were fortunate enough to know Warner T. Koiter in his active days will always remember his skill to model complex physical phenomena by relatively simple mathematical equations, which in the end led to surprisingly simple answers. His passing away is undoubtedly a heavy loss for the worldwide Engineering Mechanics Community.

Johann Arbocz
René de Borst
Erik van der Giessen