Professor Hans Heinrich Bleich (1909 – 1985)

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The following article is by Mario G. Salvadori

Hans Heinrich Bleich died of a heart attack on February 8, 1985, at the age of seventy-five. He was born in Vienna on March 24, 1909. He studied at Vienna's Technical University, from which he obtained a civil engineering degree in 1931 and a doctor of science degree in engineering in 1934. Following his graduation, he worked in Vienna as a design engineer for A. Poor Engineers until 1939, when he moved to London and became senior design engineer for the prominent engineering firm of Braithwaite and Company. Unfortunately, there are no records in the United States of his work while in Europe.

In 1945 Dr. Bleich moved to the United States. He worked briefly as a research engineer for Chance-Vaught Aircraft in Stratford, Connecticut. He then became an associate engineer at Hardesty and Hanover, a well-known firm of bridge engineers in New York City. During his tenure with the firm he was involved in the design of a number of important bridges and special structures.

From 1957 to the day of his death, Dr. Bleich was permanently affiliated as a consultant with Weidlinger Associates Consulting Engineers of New York City. He participated in the design of some of the most important and innovative buildings in the United States – from high-rise office buildings to exhibition halls and special structures.

In 1967 Dr. Bleich served as a consultant to the Mount Wilson Observatory and was responsible for the support design of the observatory's new two-hundred-inch astronomical mirror at Mount Palomar. In 1967 – 1968, as a consultant to Parsons Brinkerhoff Quade and Douglas, Inc., he participated in the design of the Fremont Bridge in Portland, Oregon. In 1969, as a consultant to the firm of King and Gavaris, he helped design the Raritan Bridge in New Jersey.

In 1947 Dr. Bleich joined the faculty of Columbia University's School of Engineering as a lecturer and was named professor of civil engineering in 1952 and director of the Guggenheim Institute of Air Flight Structures in 1954. He retired from Columbia University in 1975 as James Renwick Professor Emeritus of Civil Engineering.

Dr. Bleich was a member of the American Society of Civil Engineers (ASCE), the American Institute of Astronautics and Aeronautics, and the American Society of Mechanical Engineers. He was also associate editor of the American Rocket Society of the American Institute of Astronautics and Aeronautics and a member of the Hull Structures Committee of the Society of Naval Architects.

Dr. Bleich was honored as a fellow off the American Society of Mechanical Engineers and as an associate fellow of the American Institute of Astronautics and Aeronautics. He also received the ASCE Laurie Prize in 1951, the ASCE J. James R. Croes Medal in 1963, the ASCE Wellington Prize in 1969, and the coveted von Kármán Medal of the ASCE Applied Mechanics Section in 1973.

At the early age of fifteen, he contributed a chapter to the pioneering book on finite difference equations written by his father, Friedrich Bleich and Ernst Melan, two world-renowned structuralists. In 1935 he wrote a book on the analysis of suspension bridges entitled *Die Berechnung verankerter Hangerbrucken*, published by J. Springer in Vienna. In 1952 he edited and completely revised his father's book, *The Buckling Strength of Metal Structures*, which is still the standard reference book on the subject.

In 1952 Bleich coauthored the ASCE manual, "Design of Cylindrical Shell Roofs", and in 1960 the "Guide for the Analysis of Ship Structures" published by the U.S. Department of Commerce, Office of Technological

Services. In 1968 he was a contributor to “Support and Testing of Astronomical Mirrors” published by Kitt Peak National Observatory in Arizona.

Between 1928 and 1975 Dr. Bleich published eighty-six papers and reports of the greatest importance on problems of applied mechanics. A sampling of their titles indicates the breadth of his interests: “Bending, Torsion and Buckling of Bar Composed of Thin Walls”; “The Strain Energy Expressed for Thin Cylindrical Shells”; “Response of Elasto-Plastic Structures to Transient Loads”; “Surface Waves in an Elastic Half-Space”; “Moving Step Load on the Surface on a Half Space of Granular Material”; and “Use of Nonassociated Flow Rule for Problems of Elasto-Plastic Wave Propagation”. His technical reports dealt with the gamut of those applied mechanics problems that are of practical significance in the field of dynamics and, particularly, in the interactions between fluids and elastic and plastic bodies. Of special note is that in 1932 he was the first scientist to use shakedown theory.

It is hard to describe the modesty, simplicity, and courteousness of this outstanding individual. His students, to whom he dedicated unlimited time and attention, today occupy chairs in structural engineering and applied mechanics in most of the outstanding universities of our country. He was always ready to help with suggestions and to advise both his academic colleagues and his coworkers in the many engineering offices where he was a consultant. He was one of the very few outstanding research men who was also interested in and knowledgeable about the practical application of the theories he helped to develop. In short, he was a great engineer. Dr Bleich’s contributions to the work of many agencies of the U.S. government have been of the greatest importance and have been duly recognized.

His death represents a loss to the academy of one of its most valuable, widely knowledgeable, and generous members.
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Most widely held works by Hans H Bleich:
A contribution to the dynamic elastic-plastic analysis of structures by Melvin L Baron (Book)
1 edition published in 1960 in English and held by 4 libraries worldwide

Surface waves in an elastic half-space by C. C Chao (Book)
1 edition published in 1960 in English and held by 4 libraries worldwide

Final report of project SR-132 to the Ship Structure Committee on notes on the influence of unfair plating on ship failures by brittle fracture by H. H Bleich (Book)
1 edition published in 1956 in English and held by 4 libraries worldwide

THE EFFECT OF A MOVING LOAD ON A VISCOELASTIC HALF-SPACE (Book)
1 edition published in 1962 in English and held by 3 libraries worldwide
Abstract: Cole and Huth have studied the effect of a line load moving with constant velocity V along the surface of an elastic half-space. The present paper treats the equivalent problem for a viscoelastic (standard solid) material when the velocity V is less than the velocity cs of shear waves of high frequencies. No solution could be obtained when the velocity V was equal to the velocity of Rayleigh waves. The present analysis yields a solution for this special velocity. It also permits an evaluation of the effects of viscosity at other values of V. In certain ranges these effects are minor, but in other ranges major differences occur due to focusing phenomena. (Author).

On uncoupling structure-fluid interaction problems : status report on the IDCA (Book)
2 editions published in 1977 in English and held by 2 libraries worldwide
Abstract: A concerted effort has been made to analyze submerged structures under explosive loadings, by utilizing the Doubly Asymptotic Approximation (DAA), to account for the structure-fluid interaction. The current implementation of the DAA employs a modal analysis for the structure and a set of orthogonal functions (surface expansion functions) for the fluid, the latter being used to improve the conditioning of the governing response equations. The DAA yields exact results for high and low frequencies and produces a smooth transition between these limits. Since a more accurate fit at intermediate frequencies may prove to be important in some problems of interest, the DAA may prove to be inadequate in some cases. The Inertial-Damping Collocation Approximation (IDCA), gives exact results for low, high, and selected intermediate frequencies, and as such represents a potential improvement over the DAA.

VISCOELASTIC RINGS WITH FINITE DEFLECTIONS (Book)
1 edition published in 1966 in English and held by 2 libraries worldwide
Abstract: An analysis applicable for finite deflections of viscoelastic rings under diametrically opposed forces is presented under the assumption that the strains are small and that the rings are inextensible. Two cases are considered. In the first one the ring is linearly viscoelastic in flexure, while shear effects are neglected. In the second case the ring is elastic in flexure, but viscoelastic shear effects are included in the analysis. Two alternative formulations are given, one leading to an integro-differential equation, the other to a partial differential equation. Both formulations are non-linear, but are suitable for numerical solution by digital computer. In addition to the above exact formulations a useful and simple approximate one is presented. It is a generalization of the elastic-viscoelastic analogy for the case of small deflections. The methods, presented for rings, are generally applicable to statically determinate or indeterminate structures consisting of straight or curved bars. (Author).

DYNAMIC BUCKLING OF SUBMERGED PLATES AND SHELLS (Book)
1 edition published in 1954 in English and held by 2 libraries worldwide

Non-linear creep deformations of columns of rectangular cross-section /c by H.H. Bleich and O.W. Dillon, Jr by Hans Heinrich Bleich (Book)
1 edition published in 1958 in English and held by 2 libraries worldwide

An approximation in problems of viscoelastic wave propagation by H. H Bleich (Book)
1 edition published in 1960 in English and held by 2 libraries worldwide

Plane waves in an elastic-plastic half-space due to combined surface pressure by Hans Heinrich Bleich (Book)
1 edition published in 1965 in English and held by 2 libraries worldwide

Similarity Solutions for Wave Propagation on Nonlinear Hysteretic Media Cap Model Description (Book)
1 edition published in 1972 in English and held by 1 library worldwide
Abstract: Two dimensional steady state solutions for a half-space subjected to uniform surface loads which move with superseismic speeds have been formulated for a Cap Model, recently developed for soils. The solutions require only quadratures, and were developed to have an independent check on solutions obtained by computer using either two dimensional finite differences, or finite elements. By going to the limit, when the speed V of the applied load approaches infinity, problems of one dimensional wave propagation are also solved

when an additional, uniform load is applied to the surface of a half-space. Graphical and/or numerical results for a numer of situations are given. They can be used directly to check new computer based codes under development. (Author).

STRESS WAVES IN A SOIL-FILLED CYLINDRICAL SHELL (Book)
1 edition published in 1970 in English and held by 1 library worldwide
Abstract: An approximate solution to the problem of transient longitudinal wave propagation in a semi-infinite cylindrical body of elasto-plastic material restrained radially by a stacked-ring shell and subjected to a normal pressure at the end is obtained by a Galerkin technique using the radial coordinate as an expansion parameter. In order to get equations applicable to numerical computations the expansions are truncated to the leading term in each variable. This truncation creates a mathematical problem when elastic and plastic regions occur along the same radial line. A finite-difference scheme is used to solve the differential equations resulting from application and truncation of the Galerkin expansion. A special method for handling the boundary between elastic and plastic regions along the same radial line is developed in conjunction with this numerical solution. Numerical results of the finite-difference scheme are presented for several variations in such parameters as shell stiffness and material constants. For the purpose of evaluating the results of the truncation to the leading term in each expansion, the analogous problem is formulated for a linear inviscid fluid and solved twice, once with a truncation to the first term and once carrying two terms in each expansion. The numerical results are presented for these two solutions so that the change in the solution caused by the truncation can be evaluated. (Author).

EFFECTS NEAR THE SURFACE OF AN ELASTIC HALF-SPACE DUE TO A PRESSURE LOAD DECELERATING THROUGH SONIC SPEED (Book)
1 edition published in 1968 in English and held by 1 library worldwide
Abstract: Some unusual near surface effects due to air blasts on a solid half-space are studied by an analytic treatment of the stress field in an elastic half-space subjected to a two dimensional uniform pressure applied suddenly and permitted to expand with a linearly decreasing velocity from an initial supersonic velocity. A partial solution is obtained in closed form by asymptotic methods. The results indicate the presence of very large gradients of stress in the neighborhood of the surface of the half-space as the velocity of the surface pressure approaches and passes through the velocity of P-waves. (Author).

STEP LOAD MOVING ON THE SURFACE OF A HALFSPACE OF A LOCKING MATERIAL: SUBSEISMIC CASE (Book) 1 edition published in 1965 in English and held by 1 library worldwide
Abstract: Considering a locking material prior to compaction as a special case of a nonlinearly hardening elastic material, conditions at a discontinuity--a locking front-are analyzed on the basis of three dimensional theory. This study leads to the important result that the major compressive principal stress at a locking front must always be normal to the front, even if the front is not plane. Based on this general result, the effect of a uniform step pressure traveling with subseismic velocity on the surface of a half-space is obtained for the case of a locking material which after compaction has elastic-Coulomb behavior. Such a material acts linearly elastic if the state of stress does not overcome internal friction, but slip occurs if the stresses reach a critical state defined by Coulomb friction. As a special case the solution applies also for a material which is linearly elastic after compaction. The stress, velocity and acceleration histories due to the traveling step pressure are discussed and compared to those in the one dimensional case of a suddenly applied uniform surface pressure. (Author).

EXCITATION OF DISTRIBUTED SYSTEMS (Book)
1 edition published in 1959 in English and held by 1 library worldwide

INITIAL VELOCITY IN SHELLS AT A FREE SURFACE DUE TO A PLANE ACOUSTIC SHOCK WAVE
1 edition published in 1956 in English and held by 1 library worldwide, Final Report (Book)

FREE AND FORCED VIBRATIONS OF AN INFINITELY LONG CYLINDRICAL SHELL IN AN INFINITE ACOUSTIC MEDIUM (Book)
1 edition published in 1952 in English and held by 1 library worldwide
Abstract: A method is presented which permits the determination of the frequencies of vibrations of infinitely long thin cylindrical shells in an acoustic medium. Expressions are obtained for the displacements of the shell and for the pressures in the medium in the case of forced vibrations due to sinusoidally distributed radial forces. The results indicate that there is a low-frequency range, where no radiation takes place, and a high-frequency range where the external force provides energy which is radiated. Resonance occurs in the low-frequency range only; in the high-frequency range it is prevented by the damping due to radiation. Free and forced vibrations of steel shells submerged in water are discussed; with limitations, the theory may be applied approximately to stiffened shells. The method requires only a minor modification to account for the effect of static pressure in the surrounding medium. The treatment of transient problems is also considered. If high-frequency terms occur in the force, or shock effects are wanted within a short time after the application of the force, a treatment using solely modes of vibration of the submerged structure would be incomplete, as additional terms occur in the solution. As an alternative approach, the modes of free vibration of the structure may be used as generalized coordinates which fully describe the response of the structure but leave the medium to be treated, by means of the differential equations for the potential or in any other way desired.

Excitation of distributed systems by H. H Bleich (Book)
1 edition published in 1959 in English and held by 1 library worldwide

On the use of a special nonassociated flow rule for problems of elasto-plastic wave propagation by H. H Bleich (Book) 1 edition published in 1971 in English and held by 1 library worldwide