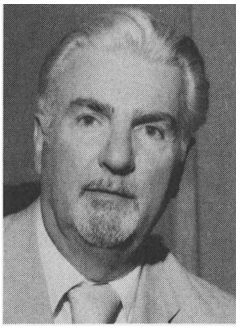
nuclear technology®

AUTHORS — MID-DECEMBER 1980

MECHANICS APPLICATIONS TO FAST BREEDER REACTOR SAFETY

CHARACTERIZATION OF LIQUID-METAL FAST BREEDER REACTOR ENGINEERING MECHANICS EFFORT BY LINES-OF-ASSURANCE

Stanley H. Fistedis



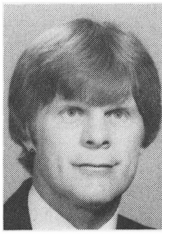
Stanley H. Fistedis (BS, civil engineering, Robert College, 1947; MS, structural mechanics, Montana State University, 1949; PhD, theoretical and applied mechanics, University of Missouri-Columbia, 1953; MBA, Executive Program, University of Chicago, 1965) is senior engineer at Argonne National Laboratory and manager of the Engineering Mechanics Program in the Reactor Analysis and Safety Division.

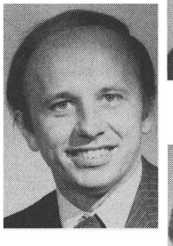
He is internationally recognized for the utilization of theoretical and applied mechanics in nuclear reactor technology and for his work on containment of fast breeder reactors. He has authored or coauthored 85 publications or patents. This year he was the recipient of the 1980 honor award of the University of Missouri for Distinguished Service in Engineering.

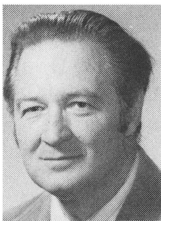
Fistedis is president-elect of the International Association of Structural Mechanics in Reactor Technology, based in Berlin, Germany. He is scheduled to serve as deputy general chairman of the Sixth International Conference of Structural Mechanics in Reactor Technology, SMiRT-6, in August 1981, in Paris. He is also slated to serve as scientific and general chairman of SMiRT-7 scheduled for August 1983 in Chicago, Illinois. He also serves as editor of the International Journal *Nuclear Engineering and Design*, published in Amsterdam, The Netherlands.

A QUASI-EULERIAN FLUID-STRUCTURE CODE FOR SIMULATION OF HIGH-PRESSURE TRANSIENTS IN CORE COMPONENTS

James M. Kennedy
Ted B. Belytschko
Daniel F. Schoeberle







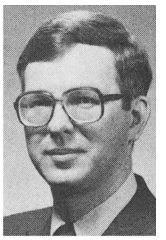
James M. Kennedy (top) (BS, mechanical engineering, Bradley University, 1964; MS, mechanical engineering, University of Illinois, 1965; PhD, theoretical and applied mechanics, University of Illinois, 1969) is presently engaged in the development of finite element methods for doing structural safety analysis at Argonne National Laboratory (ANL). His current interests are in core subassemblies and above-core structures structural safety problems. **Ted B. Belytschko** (center) (BS, engineering sciences, 1965, and PhD, mechanics, 1968, Illinois Institute of Technology) is professor of civil and nuclear engineering at Northwestern University and a consultant to ANL. His main interests are in structural dynamics and finite element methods. **Daniel F. Schoeberle** (bottom) (BS and MS, mechanical engineering, University of Illinois, 1957; PhD, theoretical and

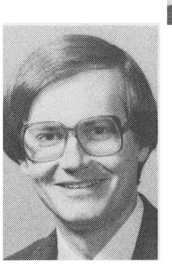
applied mechanics, University of Illinois, 1964) is associate professor of mechanical engineering at the University of Illinois, Chicago Circle Campus. He was formerly employed by ANL (1957-1961) as a research engineer. His research interests are in numerical methods for solving problems in structural dynamics, thermal stresses, and machine dynamics.

EFFECTS OF CRACKS ON THE RESPONSE OF CIRCULAR CYLINDRICAL SHELLS

THE DYNAMIC RESPONSE OF CRACKED FAST REACTOR SUBASSEMBLY DUCTS

Henry J. Petroski
John L. Glazik, Jr.





Henry J. Petroski (top) (PhD, theoretical and applied mechanics, University of Illinois, 1968) has been a mechanical engineer at Argonne National Laboratory (ANL) since 1975. His primary research interests at ANL have been fracture mechanics and the structural dynamics of cracked reactor components, especially simple analytical models for their behavior. **John L. Glazik** (PhD, theoretical and applied mechanics, Northwestern University, 1977) joined the Reactor Analysis and Safety Division of ANL following the completion of his graduate work in 1976. He has been involved in the study of fracture in fast reactor components using the finite element method.

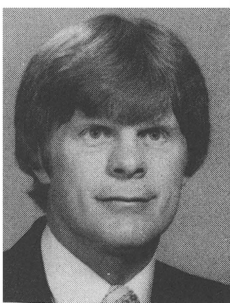
A EULERIAN METHOD FOR ANALYZING ABOVE-CORE HYDRODYNAMICS AND SODIUM SPILLAGE DURING A HYPOTHETICAL CORE DISRUPTIVE ACCIDENT

Chung-Yi Wang

Chung-Yi Wang (PhD, engineering mechanics, University of Michigan, 1972) is a mechanical engineer at Argonne National Laboratory (ANL). He has been with ANL since 1972 and has initiated the development of the Eulerian and coupled Eulerian-Lagrangian computer codes for the safety analysis of reactor containment and components. He is currently engaged in the development of several computer codes for the analysis of hypothetical core disruptive accidents and seismic excitation. His research interests include fluid dynamics, structural mechanics, and multiphase fluid flow.

THREE-DIMENSIONAL NONLINEAR STRUCTURAL MODEL FOR ABOVE-CORE STRUCTURES

James M. Kennedy



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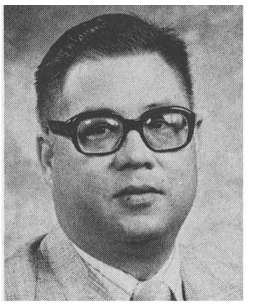
ARBITRARY LAGRANGIAN-EULERIAN METHOD FOR TRANSIENT FLUID-STRUCTURE INTERACTIONS

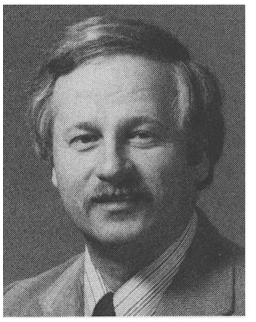
Han Y. Chu



Han Y. Chu (BSME, Chinese Naval College of Technology, Taiwan, 1953; MSME, Cheng-Kung University, Taiwan, 1963; PhD, University of Alabama, 1968) is currently a staff physicist at the Physics Internaional Company, San Leandro, California. He worked in reactor safety studies and developed MICE and ALICE computer codes for fluid-structure interaction analyses at Argonne National Laboratory (ANL) from 1974 to 1980. Prior to his employment at ANL, he was a principal engineer at the Ralph M. Parsons Company, Pasadena, California. His principal interests of study are in the areas of fluid and solid mechanics.

THEORY AND APPLICATION OF THREE-DIMENSIONAL TREATMENT OF POOL-TYPE LIQUID-METAL FAST BREEDER REACTOR COMPONENTS

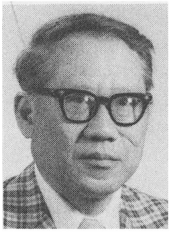
Ronald F. Kulak



Ronald F. Kulak (BS, mechanical engineering, University of Illinois, 1964; MS, 1970, and PhD, 1974, materials engineering, University of Illinois, Chicago Circle Campus) is currently a mechanical engineer in the Reactor Analysis and Safety Division at Argonne National Laboratory and a visiting lecturer at University of Illinois, Chicago Circle Campus. His current interests are computational fluid-structure interaction dynamics, nonlinear constitutive algorithms, and thermal stress analysis as applied to reactor safety analysis.

VALIDATION OF PRIMARY CONTAINMENT COMPUTER CODES

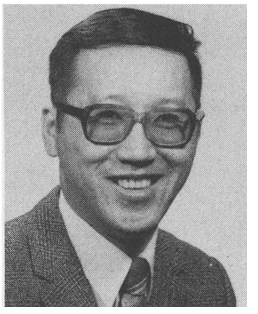
Yao W. Chang
Joseph Gvildys



Yao W. Chang (top) (BS, civil engineering, National Chiao-Tung University, 1947; MS, civil engineering, Oklahoma State University, 1957; PhD, engineering mechanics, University of Michigan, 1964) is a senior civil engineer in the Reactor Analysis and Safety Division at Argonne National Laboratory (ANL). He has been involved in development of computational procedures, methods, and computer codes for analyzing primary containment response to hypothetical core disruptive accidents (HCDAs) in fast reactors. **Joseph Gvildys** (BS, mechanical engineering, University of Toronto, 1956) is a member of the Structural Mechanics Section of the Reactor Analysis and Safety Division at ANL. Since 1968, he has been involved in the development of containment codes, in particular, the REXCO family of codes that evaluate the response of the reactor components and containment under dynamic loads.

ANALYSIS OF HIGH-ENERGY EXCURSIONS USING THE IMPLICIT CONTINUOUS-FLUID EULERIAN CONTAINMENT CODE (ICECO)

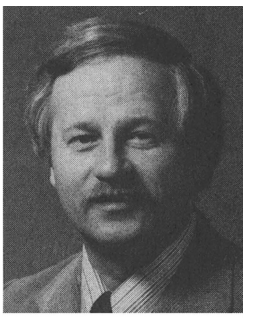
Chung-Yi Wang



Chung-Yi Wang (PhD, engineering mechanics, University of Michigan, 1972) is a mechanical engineer at Argonne National Laboratory (ANL). He has been with ANL since 1972 and has initiated the development of Eulerian computer codes for the safety analysis of reactor containment and components. He is currently engaged in the development of several computer codes for the analysis of hypothetical core disruptive accidents and seismic excitation. His research interests include fluid dynamics, structural mechanics, and multiphase fluid flow.

THREE-DIMENSIONAL ANALYSIS OF REACTOR DECKS AND THEIR SUPPORTS

Ronald F. Kulak



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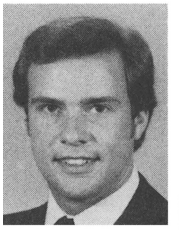
ANALYSIS OF SODIUM SPILLAGE FROM PRIMARY CONTAINMENT FOLLOWING SLUG IMPACT

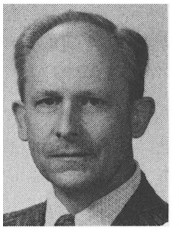
Wayne R. Zeuch
Chung-Yi Wang

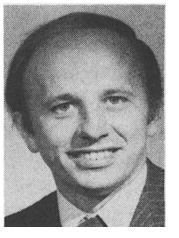


Wayne R. Zeuch (top) (BS, physics, Illinois Institute of Technology, 1975; MS, nuclear science, University of Michigan, 1976) joined the Engineering Mechanics Program in the Reactor Analysis and Safety Division at Argonne National Laboratory (ANL) in 1977. Since that time he has been involved in the development and utilization of analytical models for simulating the dynamic response of liquid-metal fast breeder reactor (LMFBR) primary containment. He has conducted various investigations of work energy releases into large scale LMFBRs and has performed safety analyses for several LMFBR experimental loops. He is currently involved in the modeling of sodium spillage from primary containment and the resultant influences on secondary containment. **Chung-Yi Wang** (PhD, engineering mechanics, University of Michigan, 1972) is a mechanical engineer at ANL. He has been with ANL since 1972 and has initiated the development of the Eulerian and coupled Eulerian-Lagrangian computer codes for the safety analysis of reactor containment and components. He is currently engaged in the development of several computer codes for the analysis of hypothetical core disruptive accidents and seismic excitation. His reasearch interests include fluid dynamics, structural mechanics, and multiphase fluid flow.

TRANSIENT ANALYSIS OF A PRESTRESSED CONCRETE REACTOR VESSEL FOR LIQUID-METAL FAST BREEDER REACTOR PRIMARY CONTAINMENT

Algirdas H. Marchertas
Ted B. Belytschko

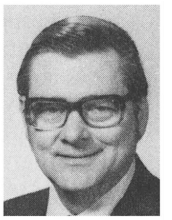


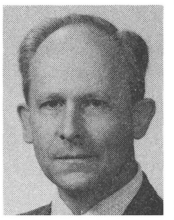


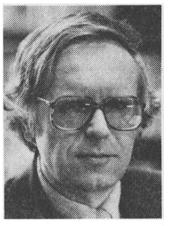
Algirdas H. Marchertas (top) (BS, mechanical engineering, University of Illinois, 1956; MS, theoretical and applied mechanics, University of Illinois, 1957; PhD, applied mechanics, University of Nebraska, 1963) has been involved in design, stress analysis, and mathematical modeling of structural problems at Argonne National Laboratory (ANL) since 1957. Recently he has been developing the DYNAPCON code, which is intended for analytical modeling of prestressed and reinforced concrete structures under transient loading. **Ted B. Belytschko** (BS, engineering sciences, 1965, and PhD, mechanics, 1968, Illinois Institute of Technology) is professor of civil and nuclear engineering at Northwestern University and a consultant to ANL. His main interests are in structural dynamics and finite element methods.

INCREASING PRIMARY CONTAINMENT CAPABILITIES OF LIQUID-METAL FAST BREEDER REACTOR PLANTS BY THE USE OF PRESTRESSED CONCRETE

Ralph W. Seidensticker
Algirdas H. Marchertas
Zdeněk P. Bažant





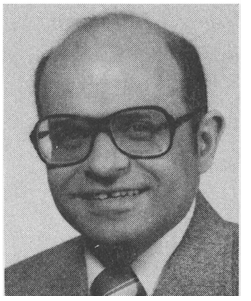


Ralph W. Seidensticker (top) (BS, civil engineering, Illinois Institute of Technology, 1955; MBA, University of Chicago, 1973) is a research engineer in the Reactor Analysis and Safety Division at Argonne National Laboratory (ANL). His current interest involves the use of prestressed concrete structures for both primary and secondary containment for liquid-metal fast breeder reactor plants. He is active in the American Society of Civil Engineers (ASCE) committees on nuclear structures and has worked on the original ACI committee that developed code requirements for nuclear concrete containment structures. **Algirdas H. Marchertas** (center) (BS, mechanical engineering, University of Illinois, 1956; MS, theoretical and applied mechanics, University of Illinois, 1957; PhD, applied mechanics, University of Nebraska, 1963) has been involved in design, stress analysis, and mathematical modeling of structural problems at ANL since 1957. Recently, he has been developing the DYNAPCON code, which is intended for analytical modeling of prestressed and reinforced concrete structures under transient loading. **Z. P. Bažant** (bottom) (civil engineer degree, Technical University, Prague, 1960; PhD, Czechoslovak Academy of Sciences, 1963) has been on the faculty of Northwestern University since 1969 and became a professor in 1973. He has also served as coordinator for the Structural Engineering Program. He served as chairman of the ASCE Engineering Mechanics Division Committee on Properties of Materials and is a member of several editorial boards. For his research on inelastic behavior of concrete as well as stability and fracture, he received from ASCE the Huber Research Prize (1976) and the T. Y. Lin Award (1977). During 1978 and 1979, he held a Guggenheim Fellowship and he was recipient of the 1975 Medal from RILEM, Paris.

RECENT APPLICATIONS AND IMPROVEMENTS OF THE HYDRODYNAMIC-STRUCTURAL PIPING CODE ICEPEL

THREE-DIMENSIONAL FINITE ELEMENT FORMULATION FOR ELASTIC-PLASTIC NONLINEAR ANALYSIS OF PIPING SYSTEMS

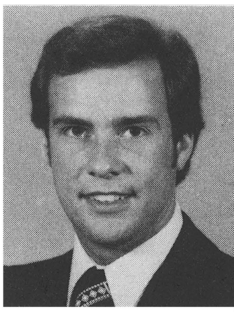
M. T. A-Moneim



M. T. A-Moneim (BS, mechanical engineering, Cairo University, Egypt, 1964; MS, mechanical engineering, Assiut University, Egypt, 1968; MS, applied mechanics, Kansas State University, 1970; PhD, applied mechanics, Kansas State University, 1973) has been a staff member of the Reactor Analysis and Safety Division of Argonne National Laboratory since 1974. He has taught mechanical engineering and applied mechanics and has worked on developing computer codes for the coupled hydrodynamic-structural analysis of piping system under transient loading conditions for the last six years.

EVENTS CONTRIBUTING TO INTERNAL LOADING OF SECONDARY CONTAINMENT: AN INTEGRATED APPROACH

Wayne R. Zeuch



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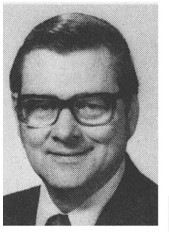
POTENTIAL ADVANTAGES OF PRESTRESSED CONCRETE FOR LIQUID-METAL FAST BREEDER REACTOR SECONDARY CONTAINMENT

Ralph W. Seidensticker
Howard L. Schreyer



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