



AUTHORS — NOVEMBER 1990

FISSION REACTORS

MODIFICATION OF A MOBILE NUCLEAR REACTOR FOR MEDICAL DIAGNOSIS

Chien Chung (top) (PhD, chemistry, McGill University, Canada, 1980) is a professor in the National Tsing-Hua University (NTHU) Institute of Nuclear Science. He is also director of the Nuclear Science and Technology Center at NTHU, supervising the operation of the radiochemistry, health physics, instruments, and reactors divisions. His research interests are in nuclear radiochemistry, health physics, nuclear medicine, and nuclear engineering. **Chen-Yi Chen** (MSc, nuclear science, NTHU, 1985) is a chemical engineer with the Taiwan Power Company. His professional interests are reactor chemistry, radiochemistry, and waste treatment.

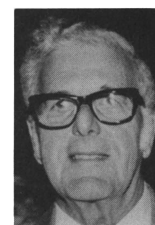
*Chien Chung
Chen-Yi Chen*



STATE FEEDBACK ASSISTED CLASSICAL CONTROL: AN INCREMENTAL APPROACH TO CONTROL MODERNIZATION OF EXISTING AND FUTURE NUCLEAR REACTORS AND POWER PLANTS

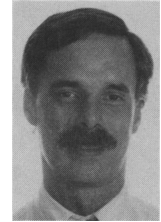
Robert M. Edwards (top) (MS, nuclear engineering, University of Wisconsin, 1972) has been a research assistant while pursuing a PhD in nuclear engineering at The Pennsylvania State University (PSU). In the early 1970s, he worked in controls and transient analysis of large high-temperature gas-cooled reactors at General Atomic. Following a 10-year sojourn as director of software development for a manufacturer of microprocessor-based image analysis systems, he returned to the university environment to study artificial intelligence and expert systems technology. His areas of interest include simulation testing of diagnostic and control guidance expert systems. **Kwang Y. Lee** (center) (PhD, system science, Michigan State University, 1971) joined PSU's electrical engineering faculty in 1986 and also serves as the chair of the Power Systems Program. He has been on the faculties of Michigan State University and the University of Houston. His areas of interest are system theory and its application to large-scale systems and power systems. **M. A. Schultz** (bottom) (BS, electrical engineering, Massachusetts Institute of Technology, 1939) wrote the first textbook on reactor control. He was a professor of nuclear engineering at PSU from 1964 to 1982 when he retired with emeritus status. He has been engaged in nuclear power safety since his retirement and serves as a consultant to PSU on U.S. Department of Energy funded research in the advanced controls area.

*Robert M. Edwards
Kwang Y. Lee
M. A. Schultz*



A RANDOM SAMPLING DISCRETE PROBABILITY ALGORITHM WITH CONDENSATION FOR PROBABILISTIC ANALYSIS

*Robert E. Kurth
David C. Cox*



Robert E. Kurth (right) (PhD, nuclear engineering, The Ohio State University, 1985) is a senior scientist in the Technology and Hazards Evaluation Division of Science Applications International Corporation. His research interests include probabilistic mechanics modeling related to nuclear safety modeling, nuclear power plant structural aging, elastic-plastic fracture mechanics modeling, crack initiation, and welded material behavior. The probabilistic mechanics models developed for nuclear power plant modeling have been extended to gas transmission pipelines, aircraft structures, and the space shuttle main engines. **David C. Cox** (photograph not available) (PhD, mathematics, The University of Rochester, 1981) is a Washington, D.C., based consultant. His research interests include the statistical and mathematical modeling of large data bases and physical systems. He has been involved with the development and application of simulation methods, distribution fitting, Markov processes, and martingales to processes in the nuclear, transportation, and environmental sciences.

RELAP5/MOD2 ANALYSIS OF N REACTOR COLD-LEG MANIFOLD BREAK TRANSIENT WITHOUT SCRAM

*K. Sathyanarayana
Donald M. Ogden*



K. Sathyanarayana (right) (BS, mechanical engineering, Sri Venkateswara University, India; MS, mechanical engineering, Indian Institute of Science, India; PhD, computational fluid mechanics, University of Cincinnati) is an engineer at Westinghouse Hanford Company (WHC). He has been involved in reactor transient analyses. His present activities include loss-of-coolant accident modeling, severe accident issues, and licensing. His research interests include nuclear reactor system safety analysis, core thermal hydraulics, and neutronics. **Donald M. Ogden** (photograph not available) (BS, physics; MS, mechanical engineering) is manager of water reactor safety analysis at WHC. He has been involved for the last 10 years in reactor safety analysis, working at the Idaho National Engineering Laboratory, Exxon Nuclear, and WHC.

FISSION PRODUCT RELEASE FROM SPENT UO₂ FUEL UNDER URANIUM-SATURATED OXIC CONDITIONS

*Bernd Grambow
R. S. Forsyth
Lars O. Werme
Jordi Bruno*



Bernd Grambow (top) (PhD, chemistry, Freie Universitat, Federal Republic of Germany, 1984) worked for 10 years at the Hahn-Meitner-Institut in the field of nuclear waste materials/water reactions. He is currently working at Kernforschungszentrum Karlsruhe on near-field geochemistry. No photograph or biography is available for **R. S. Forsyth**. **Lars O. Werme** (bottom) (PhD, physics, University of Uppsala, Sweden, 1973) is

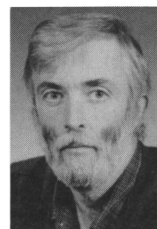
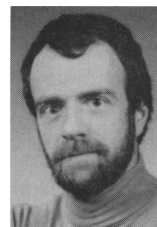
manager of the materials research program at the Swedish Nuclear Fuel and Waste Management Company. No photograph or biography is available for **Jordi Bruno**.

FISSION PRODUCT RELEASE AND FUEL BEHAVIOR OF IRRADIATED LIGHT WATER REACTOR FUEL UNDER SEVERE ACCIDENT CONDITIONS: THE ST-1 EXPERIMENT

Michael D. Allen (top right) (PhD, engineering, University of California, Davis, 1983) is a research scientist in the Severe Accident Phenomenology Division, Department of Reactor Research, at Sandia National Laboratories (SNL). His research interests include aerosols released in nuclear reactor accidents, high-pressure melt ejection and direct containment heating research, and, in general, light water reactor (LWR) safety studies.

Harlan W. Stockman (top left) (PhD, geochemistry, Massachusetts Institute of Technology, 1982) is a member of the technical staff at SNL. His interests include the design of radiochemical techniques for chemical analysis, the development of models for fission product release from LWR fuel, and the use of cellular automata to calculate fluid flow and chemical dispersion in complex geometries. **Kenneth O. Reil** (bottom right) (PhD, nuclear engineering, University of New Mexico, 1977) is the supervisor of the Reactor Safety Experiments Division at SNL. His fields of expertise include in-core severe reactor accident phenomenology, reactor core melt progression, fission product behavior, severe accident energetics, and the development and application of related in-pile experimental methods. **Arthur J. Grimley** (bottom left) (PhD, physical chemistry, Cornell University, 1979) is a member of the technical staff at SNL. His research interests include high-temperature, high-pressure chemically reacting systems and chemistry in radiation and plasma environments.

*Michael D. Allen
Harlan W. Stockman
Kenneth O. Reil
Arthur J. Grimley*

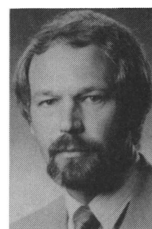
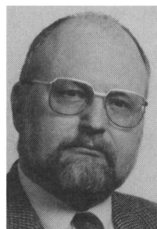


RADIOACTIVE WASTE MANAGEMENT

GUIDELINES FOR QUALITY ASSURANCE AND QUALITY CONTROL OF RADIOACTIVE WASTES

Ernest Warnecke (top) [Dr. rer. nat., radiochemistry, University of Heidelberg, Federal Republic of Germany (FRG), 1975] worked on the development of new processes for the minimization of radioactive wastes from spent-fuel reprocessing at Kernforschungszentrum Karlsruhe. He joined the Physikalisch-Technische Bundesanstalt (PTB), the federal authority for the disposal of radioactive wastes, in 1977 and was responsible for the disposal of all types of radioactive wastes. His duties included classification and characterization of radioactive wastes, determining waste amounts and the required disposal capacity, waste acceptance requirements, and quality assurance/quality control of radioactive wastes as well as the migration of radionuclides in the geosphere. He is now at the Bundesamt für Strahlenschutz, which has taken over the responsibility for the disposal of radioactive wastes from the PTB. **Dietmar Bröcking** (center) (Dr. rer. nat., physics, Aachen Institute of Technology, FRG) is head of a division of the Federal Ministry for the Environment, Nature Conservation, and Nuclear Safety. He is responsible for basic policies concerning the treatment and disposal of nuclear waste and the nuclear fuel cycle. **Peter Podewils** (bottom) (Diplom

*Ernst Warnecke
Dietmar Bröcking
Peter Podewils*



Physiker, neutron physics, University of Kiel, FRG, 1978) was an assistant for nuclear physics at the Nuclear Research Centre, Geesthacht. From 1980 to 1983, he worked on a freelance basis for the German Company for Reprocessing of Used Nuclear Fuel (DWK) in the field of safeguards. He is now a member of the DWK staff, responsible for the documentation project within the waste services department.

MODELING ON EVAPORATION CHARACTERISTICS OF A REPROCESSING PLANT HIGH-LEVEL LIQUID WASTE CONCENTRATOR

Masanori Takahashi (top right) (BS, 1981; MS, 1983; and PhD, 1989, nuclear engineering, University of Tokyo, Japan) is a researcher at Hitachi, Ltd., Energy Research Laboratory (ERL). He has worked in the chemistry of fission products and actinides. His current research interests include radiation chemistry and reactor safety. **Tatsuo Izumida** (top left) (BS, 1976; MS, 1978; and Dr. Eng., 1981, unit process engineering, Hokkaido University, Japan) is a researcher at ERL. His interests and activities are irradiation chemistry, radioactive waste treatment, and fuel reprocessing. **Fumio Kawamura** (bottom right) (BS, chemical engineering, Gunma University, Japan, 1970; MS, 1972, and Dr. Eng., 1976, chemical engineering, Tohoku University, Japan) is a senior researcher at ERL. He specializes in transport phenomena and is currently working in the field of radioactive waste and fuel reprocessing. **Hideo Yusa** (bottom left) (BS, physics, Tohoku University, Japan, 1959; Dr. Eng., Osaka University, Japan, 1969) is a chief researcher at ERL. He is responsible for the research and development of radioactive waste management and fuel reprocessing.

*Masanori Takahashi
Tatsuo Izumida
Fumio Kawamura
Hideo Yusa*



MATERIALS

STUDIES OF THE DECOMPOSITION OF SODIUM CARBONATE IN HIGH-TEMPERATURE SODIUM

S. Rajendran Pillai (top) (PhD, chemistry, University of Madras, India, 1987) has been a scientific officer at the Indira Gandhi Centre for Atomic Research since 1974. He has studied the compatibility of materials with high-temperature sodium. He has also measured the carbon potentials of reactor materials (Types 304 and 316 stainless steel and 2.25 Cr-1 Mo ferritic steel) and mixed carbide fuel by using a newly developed electrochemical carbon meter. He is currently studying the fuel/clad chemical interaction of carbide fuels. **R. Ranganathan** (center) (BS, chemistry, University of Madras, India, 1972) is a scientific officer at the Indira Gandhi Centre for Atomic Research. He works with the chemical characterization of liquid sodium, especially with respect to carbon. **Cherian K. Mathews** (bottom) (PhD, chemistry, McMaster University, Canada, 1964) was with the Bhabha Atomic Research Centre from 1959 to 1978. He is currently with the Indira Gandhi Centre for Atomic Research, where he is head of the radiochemistry program. His research areas include the chemistry of fast reactor materials, especially fuel and liquid sodium.

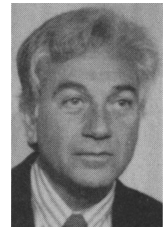
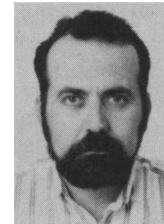
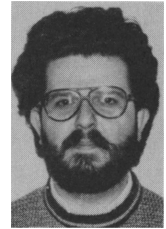
*S. Rajendran Pillai
R. Ranganathan
Cherian K. Mathews*



HEAT TRANSFER MODELING IN LOW FLOWS AND APPLICATION TO REFLOOD HEAT TRANSFER

John C. Statharas (top) (Dipl., mechanical and electrical engineering, University of Patras, Greece, 1982) is currently a research scientist at the "Demokritos" National Research Center for Physical Sciences. He has worked at the University of Patras and the National Technical University of Athens as a research engineer. His interests include fluid mechanics, heat transfer, materials strength, and neutron physics. **John G. Bartzis** (center) [Dipl., mechanical and electrical engineering, National Technical University of Athens, Greece, 1970; MS, 1975, and PhD, 1977, nuclear engineering, Massachusetts Institute of Technology (MIT)] is currently with the "Democritos" National Research Center for Physical Sciences. He has worked at MIT as a research assistant, at Argonne National Laboratory as a research engineer, and at the Public Power Corporation as a research scientist. He has also taught at Purdue University and the Midwest College of Engineering. His interests include fluid mechanics, heat transfer and numerical analysis, and applications to the safety of nuclear and other energy systems. **Demosthenes D. Papailiou** (bottom) (Degree, physics, University of Athens, Greece; Diploma, experimental aerodynamics, v. Karman Institute for Fluid Dynamics, Belgium; MS and PhD, aeronautics, Purdue University) has taught at Purdue University. He has also worked at Martin Marietta, Aerospace and at the Jet Propulsion Laboratory, Caltech. He is currently a professor with the Department of Mechanical Engineering, University of Patras, Greece, and is also the director of the Laboratory of Applied Thermodynamics and the Energy Section. His research activities cover the fields of fluid mechanics, magneto-fluid mechanics, heat transfer and propulsion, with an emphasis on the study of the structure of turbulence and turbulent transport phenomena.

*John C. Statharas
John G. Bartzis
Demosthenes D. Papailiou*

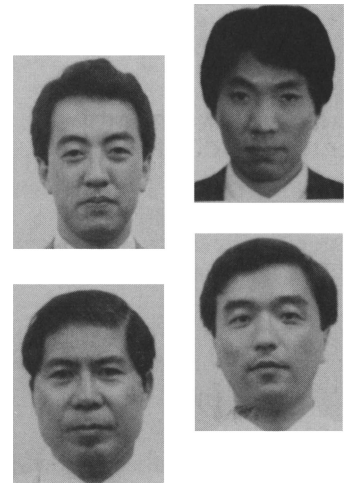
**STUDY OF A NATURAL-CIRCULATION BOILING WATER REACTOR WITH PASSIVE SAFETY**

Hideo Nagasaka (top right) (PhD, mechanical engineering, University of Keio, Japan, 1974) has worked for 16 years at the Nuclear Engineering Laboratory, Nuclear Safety Engineering Section, of Toshiba Corporation. He is engineering manager of the Nuclear Safety Section. His current interests include experiment and analysis of thermal-hydraulic behavior during an accident in an advanced reactor. **Takashi Sato** (top left) (BS, nuclear engineering, University of Tokyo, Japan, 1975) has worked in the Nuclear Safety Engineering Section of Toshiba Corporation for 14 years. He developed the advanced boiling water reactor (BWR) emergency core cooling system (ECCS) configuration utilizing probabilistic safety assessment (PSA) methodology and decided its capacity. His current interests include severe accident management and PSA utilization for high-risk technology. **Hirohide Oikawa** (bottom right) (MS, nuclear engineering, University of Tohoku, Japan, 1982) has worked in the Nuclear Safety Engineering Section of Toshiba Corporation for 8 years. His current interests include thermal-hydraulic analysis of a loss-of-coolant accident (LOCA) and containment response in an advanced reactor. **Ryoichi Hamazaki** (bottom left) (BS, electrical engineering, Nagoya Institute of Technology, Japan, 1979) has worked in the reactor design engineering department of Toshiba Corporation for 11 years. His current interests include

*Hideo Nagasaka
Takashi Sato
Hirohide Oikawa
Ryoichi Hamazaki
Kenji Arai
Takao Kageyama
Hiroyuki Yoshida
Hiroshi Machiba*



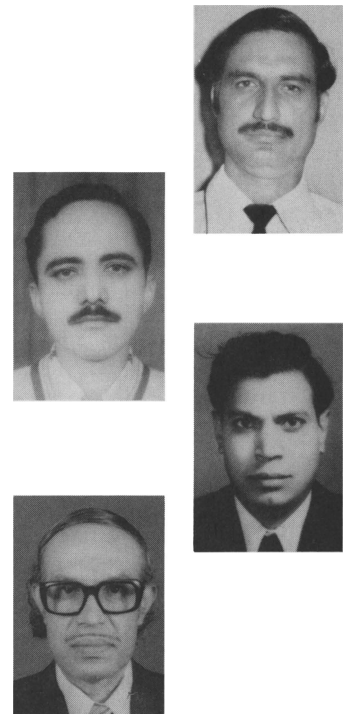
thermal-hydraulic analysis of a LOCA in an advanced reactor. **Kenji Arai** (top right) (MS, nuclear engineering, University of Osaka, Japan, 1980) has worked at the Nuclear Engineering Laboratory of Toshiba Corporation for 10 years. His current interests include performance analysis of a passive ECCS and passive containment cooling system during a LOCA. **Takao Kageyama** (top left) (BS, physics, University of Tsukuba, Japan, 1981) has worked with the nuclear engineering group of Toshiba Corporation for 8 years. His current interests include analysis of BWR transients and stability. **Hiroyuki Yoshida** (bottom right) (BS, nuclear engineering, University of Tokyo, Japan, 1975) has worked with the nuclear engineering group of Toshiba Corporation for 14 years. His current interests include BWR nuclear and thermal-hydraulic design. **Hiroshi Machiba** (bottom left) (BS, mechanical engineering, University of Osaka, Japan, 1966) has worked with the nuclear engineering group of Toshiba Corporation for 20 years. He is senior manager of the nuclear plant design and engineering department.



THERMAL HYDRAULICS DURING BOILING IN THERMO-SYPHON EVAPORATORS

D. P. Pande (top right) [BE, chemical engineering, University of Roorkee, India, 1969; PhD, mechanical engineering, Indian Institute of Technology (IIT), India, 1990] is a senior engineer at the Bhabha Atomic Research Centre (BARC). He has designed several effluent treatment plants, including new evaporation and solidification facilities for radioactive waste. He is responsible for process engineering development, design, and controls. His interests include quantitative and operations research techniques. **P. L. Dhar** (top left) (BE, mechanical engineering, Delhi University, India, 1970; PhD, mechanical engineering, IIT, 1974) is a professor of mechanical engineering at IIT. His research interests include heat transfer, refrigeration, holistic technology, and rural energy systems. **R. S. Agarwal** (bottom right) (BE, mechanical engineering, Jabalpur University, India; M. Tech., 1970, and PhD, 1975, mechanical engineering, IIT) is a professor of mechanical engineering at IIT. His areas of specialization and research include heat transfer, refrigeration, and air conditioning. **R. V. Amalraj** (bottom left) (BE, chemical engineering, Annamalai University, India, 1956; MS, environmental engineering, University of North Carolina, 1970) is head of the centralized waste management facility of the BARC reprocessing group. He is responsible for setting up large-scale treatment plants for nuclear and toxic waste and for guiding research work in related areas.

*D. P. Pande
P. L. Dhar
R. S. Agarwal
R. V. Amalraj*



ANALYSES

AN EMPIRICAL CALCULATIONAL PROCEDURE FOR BETA-PARTICLE ESCAPE EFFICIENCY IN DELAYED SELF-POWERED NEUTRON DETECTORS

M. N. Agu (Dr. Engineer, nuclear instrumentation and measurement, Université Scientifique et Medicale, Grenoble, France, 1986) is a lecturer in applied nuclear science at the Federal University of Technology, Owerri, Nigeria. His fields of interest include reactor instrumentation and control, irradiation damage on reactor first-wall material, and nuclear astrophysics.

M. N. Agu

