MECHANICAL ENGINEERING DEPARTMENT

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Supercritical Fluids: Applications in GenIV Nuclear Systems

by

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Wednesday, February 21, 2007
3:15 pm — Coffee & Cookies — Room 401 Walter DTC
3:30 pm — Graduate Seminar — Room 402 Walter DTC

ABSTRACT — Conceptual designs of advanced nuclear reactors has recently emerged after 2000 using supercritical fluids in their power cycles. A nuclear reactor cooled by supercritical fluid (water or CO_2) would have a high thermal efficiency (~44%) with a once-through direct power cycle or indirect cycle design, and could be based on standardized reactor components. The theoretical efficiency could be improved by more than 33% over that of current water-cooled reactors and could be much-simplified with higher system reliability; e.g., a boiling water reactor without steam separators or dryers. Such improvements would be accompanied by a corresponding decrease in the nuclear plant levelized electricity cost, and thus, could make this nuclear steam supply system quite competitive in future electric power markets as a centralized power source. In addition, this concept could take advantage of a half-century of current nuclear reactor technology, would allow for incremental as well as substantial improvements in reactor technology to maintain and enhance safety and reliability, and would provide flexibility in the fuel cycle to allow for substantial improvements in sustainability. This talk will focus on new experimental work on heat transfer and choked flow in supercritical fluids and implications for power cycle in advanced nuclear systems.

BIO — Prof. Michael L. Corradini earned a B.S. degree (1975) in Mechanical Engineering from Marquette University, Milwaukee WI, an M.S. degree (1976) and a PhD degree (1978), both in Nuclear Engineering from the Massachusetts Institute of Technology. He was a Member of the Technical Staff of Sandia National laboratories from 1978-81. Since 1981, he has been a faculty member at the University of Wisconsin-Madison. Prof. Corradini is Chair of Engineering Physics and Wisconsin Distinguished Professor of Nuclear Engineering and Engineering Physics at the University of Wisconsin-Madison. He served from 1995 to 2001 as Associate Dean for the College of Engineering. He also holds appointments in the Department of Mechanical Engineering and Institute of Environmental Studies. Previously, at Sandia National Laboratories he was principal investigator for the LWR vapor explosion research for the USNRC as well as other severe accident research. He was chosen as a NSF Presidential Young Investigator in Nuclear Reactor Safety in 1984. He has been a consultant for fifteen years to the NRC Advisory Committee on Reactor Safeguards in severe accidents, containment systems, and multiphase flow as well as many DOE National Laboratories, the AECL and CEC. He was Vice-Chairman of the 1985 NRC Steam Explosion Review Group and other NRC safety review panels. He has published widely in areas related to vapor explosion phenomena, jet spray dynamics, and transport phenomena in multiphase systems. He was elected a 1990 Fellow of the American Nuclear Society. In 1998, he was elected to the National Academy of Engineering. He was also served as a presidential appointee in 2002 and 2003 as the chairman of the Nuclear Waste Technical Review Board (a separate government agency). In 2004, he was appointed as a board member of the INPO National Accreditation Board for Nuclear Training and the National Council on Radiation Protection. Most recently, he was appointed to the Scientific advisory board to the French Civilian Atomic Energy Agency. In 2006, he was appointed to the USNRC Advisory Committee on Reactor Safeguards.

Informal Faculty Luncheon: Wednesday, February 21, 2007, 12:00 noon. Meet in 1100 ME and walk to lunch with other faculty. Prof. Michael Corradini will be able to attend.