

ICTP – [The Abdus Salam International Centre for Theoretical Physics](#), Trieste, Italy

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The Abdus Salam International Centre for Theoretical Physics (ICTP, Trieste), in co-operation with the International Atomic Energy Agency (IAEA, Vienna), is organising a Workshop on "The Application and Development of Nuclear Reactor Simulators for Educational Purposes² to be held from 16 - 27 October 2000. The Workshop will be conducted by Professor George Bereznai from Chulalongkorn University, Bangkok, Thailand, Dr. Wilson K. Lam from CTI Simulation International Corporation, USA/Canada and Mr. Robert B. Lyon of the IAEA.

In the second half of the 20th century nuclear power has evolved from the research and development environment to an industry that supplies 16% of the world's electricity. Global environmental change, and the continuing increase in global energy supply required to provide increasing populations with an improving standard of living, make the contribution from nuclear energy even more important for the next century. For nuclear power to achieve its full potential and make its needed contribution, it must be safe, economical, reliable and sustainable. To achieve this, a wide spectrum of scientific and engineering personnel is required, with a broad understanding of the technology, as well as in-depth understanding of their respective specialties.

To contribute to the training of scientific and engineering personnel, the IAEA sponsors the development of educational simulators that operate on personal computers and which simulate responses of a number of water-cooled reactor types to operating and accident conditions. The simulators are designed to provide insight and understanding of the general design and operational characteristics of various power reactor systems. The purpose is to provide university professors and engineers involved in teaching topics in nuclear energy with tools to demonstrate reactor operational response characteristics. The tools are also supplied directly to students, junior engineers, and senior engineers and scientists interested in broadening their understanding of the topic. (Note that the simulators are not intended for plant-specific purposes such as design, safety analysis, licensing or operator training, and they are not designed to link with control system components).

This Workshop will include a combination of lectures and computer exercises on the use of a number of simulation packages: the CANDU Reactor Simulator, the Advanced Reactor Simulators and the Classroom Advanced Reactor Demonstrators. Heavy water reactors, pressurized light water reactors and boiling light water reactors are included in these packages. By using the simulation software, in combination with the training material, participants will investigate and develop an understanding of the operational response characteristics of various reactor types. In addition to the use of the simulators, a model development system that assembles integrated codes from a selection of pre-programmed and tested sub-components will be used to provide participants with illustration and practice in the development of such reactor simulation codes. This will provide insight and understanding in the construction and assumptions of the codes that model the design and operational characteristics of the various power reactor systems.

The programme of the Workshop will include:

Basic plant system descriptions including the reactor coolant systems, the

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reactor protection systems, the emergency core cooling systems, the containment and the control systems, for Pressurised Heavy Water Reactors (HWRs), Pressurised Water Reactors (PWRs) and Boiling Water Reactors (BWRs).

Principles of operation of the reactor systems, including demonstration of the behaviour of the reactors in transient conditions and the consequences of operator actions and margins to safety for transient events.

For each of the simulation systems, instruction and practice in installation and use of the codes, with sample runs for each of the reactors, covering normal operation and load reduction, and various malfunctions such as loss of coolant accidents and steam line breaks. There will be exercises in postulating malfunctions, predicting the consequences and then performing the simulations and analysing the results.

Illustration and practice in the development of a reactor simulation code. Using a modular development system, a simple point kinetic reactor model will be developed, followed by development of a model which will simulate the effect of Xenon/Iodine concentration on changes in reactor power. Lastly, an absorber and adjuster control rod, and a liquid zone controller model will be developed to control reactivity. The built model will be used to demonstrate reactor behaviour in sub-critical, critical and supercritical states.

The Workshop is open to participants from all countries that are members of the United Nations, UNESCO or IAEA. The main purpose of ICTP is to help research workers from developing countries through a programme of training activities within a framework of international cooperation. However, students and post-doctoral scientists from developed countries are also welcome to attend. The participants must have completed several years of study after a first university degree and must have an adequate knowledge of English, the official language of the workshop. Participants should have a basic understanding of nuclear power plants, an interest in modeling and computer simulation and some experience with computer programming in solving sets of differential equations. A science or engineering degree (e.g. in physics, mechanical, chemical or nuclear engineering) or equivalent qualification is necessary. The Workshop will be of particular interest to individuals involved in the training process. Logistics limit the number of participants to 40.

As a rule, travel and subsistence expenses of the participants are borne by the home institutions. However, limited funds are available for participants from developing countries to be selected by the Organizers. Such financial support is available only to those attending the entire Workshop. Every effort should be made by candidates to secure support for their fares (or at least partial fare) from their home country. There is no registration fee for attending the Workshop. The closing date for requesting participation is 30 April 2000. The completed request for participation form, to be found at the back of this Bulletin (also obtainable via e-mail: smr1245@ictp.trieste.it, by typing on the subject line: get bulletin, or via WWW server: <http://www.ictp.trieste.it/>), should be sent to

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Trieste, December 1999

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