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SCALE Newsletter

Nuclear Analysis Methods and Applications Group
Nuclear Science and Technology Division
Oak Ridge National Laboratory
SCALE Web Site: http://www.ornl.gov/scale
SCALE Electronic Notebook: http://www.ornl.gov/scale/scale_notebook.html

Special points of interest:

- Slide Rule workshop to be held in late February 2002
- SCALE Source Terms & Shielding and KENO-VI courses to be held in March 2002
- ORIGEN-ARP 2.0 to be released in March 2002

Inside this Issue:

ORIGEN-S Upgrade Has Improved Neutron Source Methods

A major upgrade has been performed on the SCALE ORIGEN-S point depletion and decay code. The upgraded version is planned to be released in SCALE 5 (RSICC package CCC-545) and ORIGEN-ARP 2.0 (RSICC package CCC-702).

The methods and nuclear data used to calculate the neutron source intensities and energy spectra in ORIGEN-S have been extensively upgraded using the computational algorithms and data from the SOURCES-4B code (RSICC package CCC-661). The new methods allow the user to calculate multigroup neutron spectra for spontaneous fission, (alpha,n) and delayed neutron sources in irradiated or unirradiated materials. The algorithms adopted from SOURCES assume a homogeneous mixture of alpha emitting sources and target material. The (alpha,n) source can now be calculated for any problem-specific matrix of alpha source and target materials. This greatly expands the neutron source capability in ORIGEN, which was previously restricted to calculating (alpha,n) neutron source spectra for either a UO_2 or a fixed borosilicate glass matrix composition.

The spontaneous fission neutron spectra are calculated using a database containing spectral data for 43 actinides. The generalized (alpha,n) source capability uses measured and/or evaluated (alpha,n) cross sections for 19 target nuclides. ORIGEN-S will also calculate delayed (beta,n) neutron sources and spectra using an evaluated library of 105 precursor nuclides. The neutron energy spectra can be calculated in any group structure selected by the user.

The integration of ORIGEN-S and the SOURCES algorithms allows neutron source spectra to be rapidly evaluated for the time-dependent inventories associated with decay of either radioactive source material or spent nuclear fuel. Options are available to allow the (alpha,n) component to be calculated for the fuel compositions defined in the ORIGEN-S input, or using an alternate matrix material defined by the user. Results of benchmark studies using the new neutron source methods will be presented at the ANS RPSD 2002 Topical Meeting in Santa Fe, NM.

The OrigenArp Windows GUI has also been extensively updated to handle the new source options and facilitate the automated display and plotting of spectral results. The new version of OrigenArp will be released in the ORIGEN-ARP 2.0 package and will be available to download from the SCALE website in March.

New Website Addresses for SCALE and ORIGEN-ARP

We have moved our SCALE and ORIGEN-ARP websites. The new URLs for each site are respectively

http://www.ornl.gov/scale
http://www.ornl.gov/origen-arp

For future reference, please update your bookmarks with these new addresses.

SCALE Training Courses at ORNL

March 11–15, 2002

March 18–22, 2002

Catch Our Early Bird Special

The SCALE staff at ORNL are offering two training courses this spring. The courses emphasize hands-on experience solving practical problems on PCs. There will be workgroups of two persons each. No prior experience in the use of SCALE is required to attend. The registration fee is $1800 for one course or $3000 for both courses ($300 discount if you register at least one month in advance). A copy of the SCALE software and manual on CD may be obtained for an additional fee of $700, and the KENO3D 3-D visualization tool on CD is available for $800 (single license). Registrations are accepted on a first-come basis. Registration forms submitted directly from the Web are preferred. Registration via FAX or e-mail is also acceptable. The registration fee may be paid by check, travelers checks, bank transfer, or credit card (VISA or MasterCard only). The course agendas are included in this issue.

We're on the Web!

For information or to register online, go to:

http://www.ornl.gov/scale/trcourse.html

Nuclear Criticality Slide Rule Workshop

February 26–27, 2002

Come Join Us !

Oak Ridge National Laboratory (ORNL) has developed rapid "in-hand" and electronic methods for estimating pertinent information needed to guide response team actions and help characterize some types of nuclear criticality accidents. The concept uses a series of sliding graphs that function similarly to a slide rule. This tool was developed with the promise that visual demonstration of trends (e.g., dose versus time or distance) are helpful to response personnel.

The hand-held version provides rapid assessments for direct radiation approximations. The PC version is useful for solving for parameters that are dependent upon independent specific parameters such as variable shielding, distances, and anticipated time related radiation doses to personnel.

The Nuclear Criticality Slide Rule Workshop is intended for criticality safety and radiation shielding engineers, health physicists, and emergency response personnel. The Slide Rule is available in working hand-held hard copy or as a Windows PC program. The workshop includes hands-on-training with both versions. **Attendees must bring a laptop PC (Windows 95/NT or later) with CD-ROM drive.**

We're on the Web!

For information or to register online, go to:

http://www.ornl.gov/sliderule

Onsite SCALE Training Courses

Do you have several staff members who need SCALE related training?

The SCALE project team is available to conduct onsite courses at your facility. In the past year, we have conducted five onsite courses. For more information contact Steve Bowman (bowmansm@ornl.gov).

SCALE Source Terms & Shielding Course Agenda (March 11-15, 2002)

Monday
Overview of SCALE System
Introduction to SCALE Shielding Sequences
ORIGEN-ARP
Plotting ORIGEN Results with OPUS/PlotOPUS
OrigenArp / PlotOPUS Demonstration
ORIGEN-ARP Problem Session
How to Create ORIGEN-ARP Libraries

Tuesday
Material Information Processor
SAS2 Depletion/Decay/Source Terms Analysis Sequence
SAS2 Problem Session

Wednesday
SAS1 1-D Shielding Sequence
SAS1X 1-D Combined Criticality/Shielding Sequence
SAS1 Problem Session

Thursday
SAS4 3-D Monte Carlo Shielding Analysis Sequence
SAS4 Variance Reduction Techniques
SAS4 MARS Geometry Option
SAS4 Validation/Limitations
ESPN Demo
SAS4 Problem Session

Friday
QADS 3-D Point Kernel Shielding Analysis Sequence
QADS Problem Session
Shielding Course Wrap-up

The course will conclude with lunch on Friday. Attendees may stay for an optional afternoon problem session to work on problems that they bring.

SCALE KENO-VI Course Agenda (March 18-22, 2002)

Monday
Overview of SCALE System
Introduction to CSAS6
Standard Composition Library
Material Information Processor
Resonance Self-Shielding
Unit Cell/More Data
CSPAN Demo
Problem Session 1

Tuesday
Geometry Data
Plot Data
Introduction to KENO-VI Output
Problem Session 2

Wednesday
Parameter Data
Array Data
Content Data - Media/Hole/Array
KENO3D Tutorial
Problem Session 3

Thursday
KENO-VI Output - How to Read It
Mixing Table Data
Start Data
Bias Data
Boundary Data
Problem Session 4

Friday
Monte Carlo Uncertainties
Code and Data Validation Issues
Conclusion / Questions and Answers

The course will conclude with lunch on Friday.

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In Memory: Bill Hermann

O. W. "Bill" Hermann, the author of ORIGEN-S and SAS2H, died on January 15, 2002. Bill was part of the SCALE project from the late 1970's until his retirement last year. He made many significant contributions in the areas of spent fuel characterization and isotopic depletion/decay analytical methods.

He was an avid University of Tennessee football fan as well as an active hiker and camper in the Great Smoky Mountains. He was our friend as well as our colleague. His engineering wisdom, practical experience, and his smile and sense of humor will be sorely missed.

Memorial donations may be made to ALS, Wake Forest University, c/o Peter Donofrio, M.D., Dept. of Neurology, Medical Center Blvd., Winston-Salem, NC 27157.

Words to the Wise

Dancoff Input for Missing Mixture Leads to Wrong Results

As noted in a recent entry in the SCALE Notebook, if a user includes resonance and Dancoff data in MORE DATA for a missing mixture number, the Dancoff factor of mixture 1 (which is usually fuel) is set to zero. The user obtains a calculated result that appears to be valid (but is not), because there is no error or warning message. Users should be careful to remove all resonance input data in MORE DATA associated with a mixture number when removing that mixture from the Standard Composition input. This error will be corrected prior to the release of SCALE 5.

New SMORES Criticality Optimization Sequence

A new SCALE control module named SMORES (**S**CALE **M**aterial **O**ptimization and **RE**placement **S**equence) has been developed as part of the Applicable Ranges of Bounding Curves and Data (AROBCAD) Task undertaken by the DOE Nuclear Criticality Safety Program. The purpose of SMORES is to perform automated 1-D optimization for criticality safety analysis.

The SMORES sequence consists of three major steps: (1) preparation of the problem-dependent cross sections, (2) execution of the 1-D XSDRNPM discrete ordinates code to calculate the angular forward and adjoint fluxes, and (3) calculation of effectiveness functions and optimization of the system using the SWIF module developed by the University of California, Berkeley. SMORES/SWIF optimizes a specified parameter (k_{eff} or minimum mass) by calculating effectiveness functions determined from first-order linear perturbation theory by using the fluxes calculated by XSDRNPM and the problem-dependent cross sections. Since the optimization process is iterative, the above steps are repeated until convergence is achieved.

Results using the SMORES sequence will be presented at the ANS Meeting in Hollywood, Florida, in June. SMORES is planned for release in SCALE 5.