



## **RSIC CODE PACKAGE PSR-345**

### **1. NAME AND TITLE**

SAND-II-SNL: Neutron Flux Spectra Determination by Multiple Foil Activation - Iterative Method.

#### **Data Libraries**

SNLRML: Recommended dosimetry cross section compendium.

### **2. CONTRIBUTOR**

Sandia National Laboratories, Albuquerque, New Mexico.

### **3. CODING LANGUAGE AND COMPUTER**

Fortran 77; SUN Sparcstation (P00345/SUN04/00).

### **4. NATURE OF PROBLEM SOLVED**

Neutron energy spectra are determined by an analysis of experimental activation detector data. As with the original CCC-112/SAND-II program, which was developed at Air Force Weapons Laboratory, this code system consists of four modules, CSTAPE, SLACTS, SLATPE, and SANDII. The first three modules pre-process the dosimetry cross sections and the trial function spectrum library. The last module, SANDII, actually performs the iterative spectrum characterization.

## **5. METHOD OF SOLUTION**

The basic physics and operation of the code remain unchanged from CCC-112/SAND-II. The advantages of the SNL version are it provides a better input format, a much enhanced output report, a UNIX-based plot interface built around the publicly available ACE/gr package, treatment of silicon devices as displacement sensors for dosimetry applications, and an interface to the SNL Radiation Metrology Laboratory compendium of dosimetry cross sections which are included here and in the DLC-178/SNLRML package.

An iterative perturbation method is used to obtain a "best fit" neutron flux spectrum for a given input set of infinitely dilute foil activities. The calculational procedure consists of the selection of a trial flux spectrum to serve as the initial approximation to the solution, and subsequent iteration to a form acceptable as an appropriate solution. The solution is specified either as time-integrated flux (fluence) for a pulsed environment or as a flux for a steady-state neutron environment.

## **6. RESTRICTIONS OR LIMITATIONS**

Implementation of the two utility programs, sys\_interface\_1 and sys\_interface\_2, on other UNIX platforms requires running the SETUP utility. Modification and recompilation of the FORTRAN source files for sys\_interface\_1 and sys\_interface\_2 may be necessary because of the varying ways in which operating system calls are made between variations of UNIX. In any event, reference to sys\_interface\_1 and sys\_interface\_2 may be omitted from any of the included script files without serious loss of functionality.

The SAND-II-SNL program includes system calls to set environmental variables (getenv and len\_trim) which will require modification if ported to other computers.

## **7. TYPICAL RUNNING TIME**

SUN Sparcstation SLC

make\_library CSH script - (comprises CSTAPE, SLACTS, and SLTAPE modules) 12 minutes 9 seconds

testall CSH script - (comprises execution of the SANDII module on 10 separate included sample input files and comparison of generated output with sample output) 9 minutes 38 seconds

SUN Sparcstation 2

make\_library CSH script - 9 minutes 33 seconds

testall CSH script - 7 minutes 21 seconds

## **8. COMPUTER HARDWARE REQUIREMENTS**

A UNIX workstation with access to a DC 6150 tape cartridge drive and 15 MB, initially, of disk space are required to install and run SAND-II-SNL. At least 30.3 MB of disk space is needed for full implementation of the code. The code was developed on Sparcstation 10.

## **9. COMPUTER SOFTWARE REQUIREMENTS**

The code was tested at RSIC on both a Sun Sparcstation SLC running SUN OS 4.1.1, Open Windows 2, using SUN FORTRAN 1.4 and on a SUN Sparcstation 2 running Solaris 2.3 using SUN FORTRAN 2.0.

A UNIX FORTRAN compiler is required for creation of the module executables. SUN OS 4.1 or higher is required for execution of the included binaries for `sys_interface_1` and `sys_interface_2`. The code is portable to other UNIX environments. Open Windows 2 or higher can be used for displaying plots using the ACE/gr plotting package. ACE/gr also runs with Motif among other systems. Refer to the XVGR.PS document in the ACE/gr subdirectory.

## **10. REFERENCES**

### **Included in documentation:**

P. J. Griffin, J. G. Kelly, J.W. VanDenburg, "User's Manual for SNL-SAND-II Code," SAND93-3957 (April 1994).

P. J. Griffin, J. G. Kelly, T. F. Luera, J. VanDenburg, "SNL RML Recommended Dosimetry Cross Section Compendium," SAND92-0094 (November 1993).

RSIC, "CCC-112/SAND II Computer Code Abstract" (January 1994).

F. B. Kam, "Notes to Users of the SAND II Program" (January 13, 1969).

B. Cross, "SAND II/CSTAPE Documentation" (June 1975).

W. N. McElroy, S. Berg, T. Crockett, R. G. Hawkins, "A Computer-Automated Iterative Method for Neutron Flux Spectra Determination by Foil Activation, Vol. I: A Study of the Iterative Method," AFWL-TR-67-41 (September 1967).

S. Berg and W. N. McElroy, "A Computer-Automated Iterative Method for Neutron Flux Spectra Determination by Foil Activation, Vol. II: SAND II (Spectrum Analysis by Neutron Detectors II) and Associated Codes," AFWL-TR-67-41, Vol. II (September 1967).

W. N. McElroy and S. Berg, "A Computer-Automated Iterative Method for Neutron Flux Spectra Determination by Foil Activation, Vol. IV: Reference Spectrum Library for SAND II," AFWL-TR-67-41, (September 1967).

S. Berg, "Modification of SAND II," BNWL-855 (August 1968).

### **Background information:**

P. J. Griffin, J. G. Kelly, "Status of Neutron Dosimetry Cross Sections," Reactor Dosimetry ASTM STP 1228. Harry Farrar IV, E. Parvin Lippincott, John G. Williams, and David W. Vehar, Eds., American Society for Testing and Materials, Philadelphia (1994).

P. J. Griffin, J. G. Kelly, T. F. Luera, "Effect of New Cross Section Evaluations on Spectrum Determinations," IEEE Transactions on Nuclear Science, Vol. 39, No. 6, pp. 2078-2085 (December 1992).

P. J. Griffin, J. J. G. Kelly, T. F. Luera, "Effect of ENDF/B-VI Cross Sections on Neutron Dosimetry," Proceedings of the Seventh ASTM-Euratom Symposium on Reactor Dosimetry held in Strassbourg, France on August 27-31, 1990 G. Tsotridis, R. Dierckx, P. D'Hondt, Eds., Kluwer Academic Publishers, pp. 669-675 (1992).

P. J. Turner, "ACE/gr User's Manual: Graphics for Exploratory Data Analysis," Center for Coastal and Land-Margin Research, Oregon Graduate Institute of Science and Technology, Software Documentation Series DSS3, 91-3 (1991).

## **11. CONTENTS OF CODE PACKAGE**

The referenced document and 1 on either DC 6150 (150 MB), 4 mm DAT (8 GB), or 8 mm (2.3 GB) cartridge tapes are included. The tape cartridge contains information files, FORTRAN 77 source files, the ACE/gr executable, CSH scripts, and sample input/output.

## **12. DATE OF ABSTRACT**

July 1994; documentation revised April 1996.

**KEYWORDS:** ACTIVATION DETECTORS; UNFOLDING; NEUTRON; WORKSTATION