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MORSE: Present Capabilities and Future Directions

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The Multigroup Oak Ridge Stochastic Experiment code (MORSE) (Emmett, 1985) is a 3-D multipurpose neutron and gamma-ray transport code that has been in use for nearly 30 years and has undergone several evolutions during that time. Oak Ridge National Laboratory (ORNL) has two versions that are distributed by the Radiation Safety Information Computational Center (RSICC): MORSE-CGA and MORSE-SGC. MORSE-SGC is part of the SCALE computer code system (SCALE, 1997), both as a stand-alone program and as part of two of the shielding analysis sequences, SAS3 and SAS4.

Both SGC and CGA use the Multiple Array System (MARS) geometry package. The primary difference in the two versions is the cross-section structure. MORSE-SGC has a supergrouping capability that allows a problem to run with only part of the cross-section groups in core, rather than the entire energy range. Because of the amount of memory available in today's computers, this feature is not nearly as important now as it was when the code was originally developed. The other major difference in the two versions is that SGC has built-in routines for the source selection and estimation routines, whereas the user can supply his own routines and override the provided versions in CGA.

SAS4 was developed to solve spent fuel shipping cask problems and, as a result, has an automated geometry modeling procedure. When developing the SAS4 shielding analysis sequence, one of the objectives was to automate the selection of biasing parameters for MORSE and the preparation of cross- section data. As a result of this, SAS4 runs cross-section modules from AMPX and an adjoint XSDRN case prior to executing the MORSE module. The adjoint XSDRN results are used to generate biasing parameters for MORSE. Another feature of SAS4 is that the PICTURE program that generates 2-D color plots or printer plots can be run from within SAS4. A number of changes were required for MORSE-SGC in order to implement a new SAS4 option for surface detectors and subdetectors.

The SAS3 shielding analysis sequence runs the cross-section modules and MORSE. At present there is no automated selection of biasing parameters. SAS3 can, however, solve many problems that the specialized SAS4 cannot handle. Examples of such problems are streaming through ventilation ducts and cask penetrations, dose rate analysis from a large array of casks, and applications to more generalized shielding problems, such as criticality alarm systems. Currently SAS3 or MORSE-SGC can treat any of these applications; however, the user must generate and input very detailed biasing parameters.

All codes discussed here run on multiple computer platforms, including DEC-Alpha, IBM RISC 6000 series, Sun and HP workstations and on personal computers. Those codes in the SCALE system are under configuration control and have been validated and verified.

Future development whose time frame depends on funding considerations will include a GUI interface for the input data, additional biasing options for SAS4 and introducing some automated biasing into SAS3. The biasing options will involve changes to both the SAS sequences and MORSE.

References

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