IEC-45

MULTIGROUP CROSS SECTION PROCESSING AT ENEA BOLOGNA

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A large activity of nuclear data processing into multigroup libraries in underway at ENEA Bologna based upon the existing evaluated nuclear data files and using the standard procedures available in NJOY. The work is aimed at different purposes in the various field of application of group transport libraries: in particular we mention here the future (safe) reactor design, the fusion machine blanket damage and the shielding problems.

Going into the details the following projects are completed, in progress or planned:

1. A library of structural materials has been prepared for the ECCO code; among its features the number of groups (1968) is remarkable. Because of the very high precision criteria required, this library required a large amount of cpu time. The source of the data is JEF 2.2 (20 materials).

2. In the framework of the Subtask NDB1-3 of the Task Nuclear Data Base of the European Fusion Technology Programme a P_5 VITAMIN-J library is being produced at 1 to 5 temperatures and 1 to 6 σ_0 values. The library includes 80 nuclides from the european evaluations (EFF 2.2 and JEF 2.2); kerma, DPA and gas production cross sections are given. The libray is comprehensive of neutron data, γ-production data and photon interaction data, whose source is EPDL.

3. A group library has been completed and is in use for flux calculations in the detectors of the Large Hadron Collider machine of CERN (Geneve). The library is based upon a non-standard 72 neutron plus 22 γ structure, includes 70 nuclides and is based upon JEF 1.1 and other evaluations (ENDF/B-VI, LLNL); it has been used in order to setup codes and methods; a second version is being designed based upon JEF 2.2 and adopting some standard group structure.

4. In the field of ENEA-CEA Cooperation for Future Reactors a shielding library (ASPILIB) is being produced based upon the VITAMIN-J scheme and using as basic data JEF 2.2 (40 materials).

5. Within the same task a group library of Fission Products based upon the X-MAS scheme and using JEF 2.2 is foreseen subdived into two parts; the first one (FP affecting the reactivity loss) includes 80 nuclides.

NJOY has been (or is being) used to process all the basic nuclear data, so that we got a considerable amount of information both in the aswers of the code and in the correctness of the data.

Since all the computations are performed on an IBM 3090/300 with 32 bit words, a double precision version of NJOY has been implemented including all computational modules (RECONR, BROADR, HEATR, THERMR, UNRESR, GROUPR, GAMINR plus MODER), so as two versions exist: the first one for

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$g_0(E,E')$	energy spectrum
$f(E,E',cos\theta)$	angular distribution

with the conditions:

$$\int f(E,E',cos\theta)\, d\cos\theta = 1$$

and:

$$\int g_0(E, E') \int f(E,E',cos\theta)\, d\cos\theta\, dE' = 1$$

We found at times:

1. non constant energy dependent yield for the $(n, 2n)$ reaction;
2. some angular distributions normalized to 0 instead of 1.

Moreover the lumped reaction MF 6, MT 10 (continuum neutron emission, i.e. sum of all reactions emitting neutrons minus MT 2, elastic scattering, and MT 51 to 90, inelastic scattering by level) is not correctly processed by the HEATR module; we are in addition doubtful wether this reaction is properly treated in the MATXS format.

Additional clerical errors were discovered by the use of NJOY and we normally note that the focal point to detect incorrect or inconsistent data formulation is the kerma computation, whic so far represents an excellent benchmark for the evaluated nuclear data files.

We are doubtful about the 10% of drawbacks we attribute to the code due in particular to:

1. the unresolved resonance data treatment and
2. the thermal data treatment,

but both problems need at the moment further investigations.