VIII.D. CONVERTING SAMMY/URR PARAMETERS TO ENDF/B PARAMETERS

Parameters required by the ENDF formats [ENDF-102] are related to the SAMMY (FITACS) input parameters but are not identical. Likewise the cross sections calculated by ENDF processor codes such as NJOY [RM82] may have somewhat different values from those calculated by SAMMY [HD03] because the exact same formulae are not used. (Formulae in SAMMY and FITACS are more accurate than those supported by ENDF.)

The correspondence between the SAMMY and the ENDF parameter values is described below.

Channel radius

The R-matrix channel radius *a* used in SAMMY is related the ENDF scattering radius AP via

$$\mathrm{AP} = R' = a\left(1 - R_c^{\infty}\right) \qquad \text{(VIII D.1)}$$

Note that *a* is input to SAMMY in units of Fermi; AP is specified for ENDF in units of 10^{-12} cm.

Degrees of freedom

ENDF formats require that the number of degrees of freedom be explicitly stated for each channel), for each *l* and *J*. For SAMMY, only for fission channels is the number of degrees of freedom ν_f explicitly given in the input; for neutron channels, ν_n is calculated by the code to be either 1 or 2 (depending on the number of available channel spin values). For capture channels, ν_γ is infinite and therefore not given in the input. [See Eq. (VIII A.5) for use of ν_n .]

Level spacing

In SAMMY the mean level spacing *D* for *l* = 0 is specified in the input, and the energy- and *J*-dependent mean level spacing $D_J(E)$ is derived as described in Section VIII.A, Eqs. (VIII A.9–16). For ENDF, $D_J(E)$ is reported at particular energies.

Neutron widths

In SAMMY the strength function is used to generate the transmission coefficient for neutron channels, according to Eq. (VIII A.7) with the pole strength s_c defined in terms of the input strength function $\tilde{S}_c$. Using the analogous form from Eq. (VIII A.8) and equating to Eq. (VIII A.7), we find

$$2\pi\left\langle \Gamma_n \right\rangle / D_J = \frac{4\pi P_c s_c}{\left|1-\left\langle R_{cc} \right\rangle L_c\right|^2} \quad , \qquad \text{(VIII D.2)}$$

or

$$\left\langle \Gamma_n \right\rangle = \frac{2P_c \tilde{S}_c \sqrt{E}/(2\rho)}{\left|1-\left(R_c^{\infty} + i\pi \tilde{S}_c \sqrt{E}/(2\rho)\right) L_c\right|^2} D_J \quad , \qquad \text{(VIII D.3)}$$

in which the expression for pole strength s_c in terms of strength function $\tilde{S}_c$, Eq. (VIII A.4), has been substituted. The ENDF manual [ENDF-102, page D18] specifies that it is the *reduced* neutron width which is to be reported. This width is related to the neutron width via

$$\left\langle \Gamma_n \right\rangle = \left\langle \Gamma_n^o \right\rangle \sqrt{E}\, P_n / \rho \qquad \text{(VIII D.4)}$$

or (with $c = n$)

$$\left\langle \Gamma_n^o \right\rangle = \frac{\tilde{S}_c}{\left|1-\left(R_c^{\infty} + i\pi S_c \sqrt{E}/(2\rho)\right) L_c\right|^2} D_J \quad , \qquad \text{(VIII D.5)}$$

which is the quantity reported in the ENDF file for a particular energy E.

Inelastic widths

The ENDF manual [ENDF-102] is exceedingly vague with regard to the inelastic widths. Two gross approximations are clearly required by the format: (1) Only a single inelastic width is permitted. (2) Only a single value of orbital angular momentum may be used. To work within these limitations, we have chosen to provide information only for the first inelastic channel, and to use the lowest value of orbital angular momentum l' consistent with the specified l (of the elastic channel) and J. The contribution from the other inelastic channels can be given in File 3. The contribution from higher l' must simply be ignored. No guarantee is made that SAMMY's implementation of ENDF's format is correct here.

Radiation widths

Radiation widths $\left\langle \Gamma_\gamma \right\rangle$ are input to SAMMY at $E = 0$. For ENDF, the widths are reported at particular energies as calculated by the giant dipole resonance model.

Fission widths

Fission widths $\left\langle \Gamma_f \right\rangle$ are likewise input into SAMMY at $E = 0$, and reported in ENDF at particular energies. The energy dependence is given by Eqs. (VIII A .17–18).