ERROR FILES AND THE CONSISTENT METHOD

(by A. Gandini and M. Salvatores)

A paramount difficulty encountered in the adjustment procedure of cross-sections relevant to fast reactor analysis turns out to be the proper assessment of their dispersion matrix, which results mandatory if acceptable values, i.e. exploiting the whole information available on the microscopic data, are to be obtained.

Since the covariant terms relative to intercorrelations between different group cross sections should result directly from the theoretical assumptions and experimental peculiarities of the differential data adopted in the cross section group reduction, a formidable effort of detailed analysis and review work appears to be required to cope with this task. There seem to be, however, a number of drawbacks within this group procedure, a major one consisting in the lack of flexibility of a few group adjusted cross section library. In other words, if, for instance, a calculation of a reactor parameter with a different group structure should be required, a somehow arbitrary redistribution of corrections and errors should be made with a consequent loss of reliability of the adjusted data. Besides, if, as another example, a new set of integral data is added for a further adjustment, which requires a different group schematization, it would also become rather difficult to start properly from the data previously adjusted. In order to avoid all these difficulties, a "consistent method" of correlation has been proposed /1/ which is based on correcting directly the nuclear parameters in a way which should result consistent with the more or less sophisticated theoretical models adopted by the code used for the group cross section generation. These adjusted parameters should then replace the older ones so that any type of adjusted cross section library may thereafter be formed.

The availability of a dispersion matrix of all the nuclear parameters considered in the correlation is directly required if the consistent method should be adopted. Therefore, also under this respect, the inclusion of errors and error covariances in the next version of ENDF/B files is greatly welcome. At present it does not seem that the proposed consistent method should put any peculiar requirement on the way in which the errors should be assigned (and this adds to its merit), since it uses, in an inverted order, the same algorithms and procedures adopted for the generation of the group cross section uncertainties, which is claimed as the main objective. The only limitation might come from the number of nuclear parameters to be entered into the adjustment, which might result too high. But this difficulty should be avoided by means of a previous gross sensitivity analysis (in which the error weighting should also be included) by which retaining in detail only the most important parameters, and allowing for some semplification (in the sense of reduction of their number) of those left out. In any case, for what concerns the usual problem of matrix inversion encountered in the adjustment methods, it should be remainded that in their version adopting the method of the Lagrange multipliers the order of such matrix corresponds to the number of the integral experiments considered. A difficulty, if any, under this respect, would only rise if some systematic errors within the cross section parameters are to be allowed for. In fact, in this circumstance, the method of reduction by elements (requiring the inversion of a matrix of the order of the number of the microscopic data) should be adopted to avoid problems inherent with the singularity of the modified dispersion matrix which is obtained in this case /2/

REFERENCES

/1/ A. Gandini, M. Salvatores - RT/FI(74)3 (1974)

/2/ A. Gandini - RT/FI(73)22 (1973).