A LEAST-SQUARES METHOD FOR DERIVING REACTION DIFFERENTIAL CROSS SECTION INFORMATION FROM MEASUREMENTS PERFORMED IN DIVERSE NEUTRON FIELDS*

by

Donald L. Smith
Applied Physics Division
Argonne National Laboratory
9700 South Cass Avenue
Argonne, Illinois 60439
USA

ABSTRACT

A generalized least-squares algorithm which refines a prior multi-group energy-differential neutron-reaction cross-section evaluation by addition of new experimental data is described. Complete covariance information for the prior evaluation and for the new experimental information is required in this procedure. The result is a revised best-estimate multi-group cross-section evaluation with complete covariance information. The algorithm tests the consistency of the new and apriori information, and it readily indicates whether the new data significantly improve the knowledge of the differential cross section. These new data need not be specific differential cross sections. Therefore, the experimenter is not limited to measurements which involve only conventional mono-energetic techniques. This opportunity suggests exploration of diverse new experimental methods, e.g., ones which can exploit the high yield and favorable neutron-energy ranges offered by certain unconventional neutron sources which have received little past attention. This method is demonstrated by the detailed analysis of several hypothetical numerical examples. The understanding of the method's potential and limitations which has emerged from the present investigation is discussed.

*This work supported by the U.S. Department of Energy.