NEA-1882 XSUN-2017 Windows Interface Environment for Deterministic n/γ Transport, Cross-Section Sensitivity and Uncertainty Analysis

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SUSD3D code uses the first-order perturbation theory to calculate the sensitivity coefficients and standard deviation in detector responses or reactor design parameters of interest (such as reaction rates, doses, multiplication factor - k_{eff}, effective delayed neutron fraction - β_{eff}) due to input cross sections and their uncertainties. Complex one-, two- and three-dimensional shielding and criticality problems can be studied. The first version of the SUSD3D code was developed in the 1990-ies in the scope of the European Fusion Programme. Several types of uncertainties can be considered, i.e. those due to: (1) neutron/gamma multi-group cross sections, (2) energy-dependent response functions, (3) secondary angular distribution (SAD) or secondary energy distribution (SED) uncertainties.

SUSD3D is available as part of the XSUN-2017 Windows interface developed to facilitate the deterministic radiation transport and cross-section sensitivity-uncertainty calculations. The package assists the users in the preparation of input cards, rapid modification and execution of the complete chain of codes including TRANSX, PARTISN and SUSD3D, all available from the OECD/NEA Data Bank and RSICC. The objective is to make the input and output handling for these codes as user friendly as possible, passing information among the codes internally. XSUN-2017 allows an interactive viewing of results obtained from the PARTISN and SUSD3D programs. Plotting utilities include 2-dimensional (2D) colour schemes of PARTISN geometries, 3D plots of the neutron flux distribution and sensitivity profile plots. The first version of the Windows interface XSUN-2013 was developed in 2013. An updated version, XSUN-2017, was released through OECD/NEA Data Bank Computer Code Collection and RSICC in 2017 as NEA-1882/02 package. The description of the XSUN-2017 and SUSD3D code system, the recent improvements and updates will be presented (such as β_{eff}, SAD, SED S/U analysis). Examples of the use and validation will be demonstrated, including the S/U inter-comparison exercise using the SNEAK-7A and -7B benchmark experiments involving the XSUN-2017 code system comparison with the codes such as TSUNAMI-3D, SERPENT2, MCNP6, ERANOS and XSUSA, several fusion applications and the sensitivity and uncertainty analysis of the k_{eff} and β_{eff} parameters for the MYRRHA accelerator driven system (ADS).