# Development of Three-dimensional Activation Code System Based on Exponential Euler Method

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High energy neutrons produced in fusion reactors or accelerator driven subcritical reactors (ADS) have strong activation effects on components, neutron activation analysis is significant in reactor design and safety analysis. Because of the increasing complexity of the reactor structure, one-dimensional (1D) and two-dimensional (2D) activation methods have difficulties in achieving accurate results. The 3D activation method based on Monte Carlo code has limitations of solving the deep penetration or 3D distribution problem. Furthermore, the fission reaction of actinides increases the difficulty of nuclide inventory calculation. Therefore, based on 3D discrete ordinate (SN) method and exponential Euler method, a study of new activation method has been carried out.

In this research, an interface code has been developed to couple a 3D SN transport code in VisualBUS[1] system with FISPACT[2] code. The interface code automatically prepared cross-section data and run transport code, then extracted neutron flux data and combined with material information to generate FISPACT input file. Material changes can be sent back to transport calculation to carried out 3D burn-up calculation. Because FISPACT code adopted exponential Euler method and more nuclides and kinds of reaction into account, the burn-up and activation calculation was faster and more accurate.

The coupled activation code system has been verified by using IAEA-ADS benchmark[3]. The calculation results agreed well with average of all other participants, and the activity results of fuel zones were more convincing than other code, which showed the validity of the code system. Further benchmarking and applications needed to be carried out of this code system.

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[2] Forest R A, et al. FISPACT-99: User manual, 1998.

[3] Slessarev I, Tchistiakov A, IAEA ADS-BENCHMARK Results and Analysis, TCM-Meeting, Madrid, 1999.