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FTP/P7-19: KIT Fusion Neutronics R&D Activities and Related Design Applications

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The availability of suitable computational methods, tools, models and data, qualified for design applications, is a pre-requisite to enable reliable nuclear design and performance analyses of future fusion devices. Various efforts are being conducted worldwide to develop and extend the capabilities of the neutronics simulation tools including the capabilities to model the problem geometry in true 3D representation and taking advantage of the high performance parallel computing resources available nowadays.
At the Karlsruhe Institute of Technology (KIT), Institute for Neutron Physics and Reactor Technology (INR), the efforts focus on the development of various computational schemes based on the Monte Carlo technique for the particle transport simulation, by adapting and coupling available codes, and extending their capabilities to specific application requirements. This includes, among others, a coupled programme system for the Monte Carlo based calculation of shut-down dose rate distributions in full 3D geometry, and an enhanced version of the MCNP code, called McDeLicious, with the ability to sample in the transport calculation the generation of d-Li source neutrons on the basis of tabulated cross-section data. A dedicated effort is being conducted on the development of the in-house geometry conversion software tool McCad to enable the automatic generation of MCNP models from available CAD geometry data.
The objective of this paper is to present the progress achieved recently in the development of the mentioned computational tools and demonstrate their suitability for fusion neutronics calculations in applying them to specific design and performance analyses of the ITER device and the IFMIF neutron source facility.

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