

Tools to Support Geometry and Meshing Needs for Fusion Energy System Simulation Codes

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Accurate simulations of the systems being designed and build by the fusion energy companies require consideration of the complex geometries of the system components. Tools being developed to support fusion energy system simulation workflows steps including (i) analysis geometry construction for general 3D configurations, (ii) fully automatic generation of well controlled meshes and adaptive mesh control to ensure simulation result fidelity, (iii) high level tools to support fusion physics analysis will be presented. The geometry construction tools support CAD geometry clean-up and defeaturing, construction of analysis domain geometry combining CAD and physics geometry. The automatic mesh generators support creation of graded anisotropic meshes on arbitrary geometric domains and include specialized mesh generation tool used by specific tokamak and stellarator simulation codes. Adaptive mesh control is support by fully parallel procedures for mesh refinement and coarsening that can be directly coupled into existing simulation codes. Massively parallel unstructured mesh based particle simulations are supported by a distribute mesh infrastructure that can scaling both the particles and mesh. The integration and use of these tools into fusion energy system simulation codes will be demonstrated.

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