Abstract Submitted
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Parallel mesh support for particle-in-cell methods in magnetic fusion simulations EISUNG YOON, MARK S. SHEPHARD, E. SEEGYOUNG SEOL, KAUSHIK KALYANARAMAN, DANIEL IBANEZ, Rensselaer Polytech Institute — As supercomputing power continues to increase Particle-In-Cell (PIC) methods are being widely adopted for transport simulations of magnetic fusion devices. Current implementations place a copy of the entire continuum mesh and its fields used in the PIC calculations on every node. This is in general not a scalable solution as computational power continues to grow faster than node level memory. To address this scalability issue, while still maintaining sufficient mesh per node to control costly inter-node communication, a new unstructured mesh distribution methods and associated mesh based PIC calculation procedure is being developed building on the parallel unstructured mesh infrastructure (PUMI) [1]. Key components to be outlined in the presentation include (i) the mesh distribution strategy, (ii) how the particles are tracked during a push cycle taking advantage of the unstructured mesh adjacency structures and searches based on that structure, and (iii) how the field solve steps and particle migration are controlled. Performance comparisons to the current approach will also be presented. [1] D.A. Ibanez, E.S. Seol, C.W. Smith, M.S. Shephard, PUMI: Parallel Unstructured Mesh Infrastructure, ACM Transactions on Mathematical Software, 42(3), Article No. 17 (2016)

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