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A collision scheme for hybrid fluid-particle simulation of plasmas
CHRISTINE NGUYEN, CHUL-HYUN LIM, JOHN VERBONCOEUR, University of California, Berkeley — Desorption phenomena at the wall of a tokamak can lead to the introduction of impurities at the edge of a thermonuclear plasma. In particular, the use of carbon as a constituent of the tokamak wall, as planned for ITER, requires the study of carbon and hydrocarbon transport in the plasma, including understanding of collisional interaction with the plasma. These collisions can result in new hydrocarbons, hydrogen, secondary electrons and so on. Computational modeling is a primary tool for studying these phenomena. XOOPIC [1] and OOPD1 are widely used computer modeling tools for the simulation of plasmas. Both are particle type codes. Particle simulation gives more kinetic information than fluid simulation, but more computation time is required. In order to reduce this disadvantage, hybrid simulation has been developed, and applied to the modeling of collisions. Present particle simulation tools such as XOOPIC and OODP1 employ a Monte Carlo model for the collisions between particle species and a neutral background gas defined by its temperature and pressure. In fluid-particle hybrid plasma models, collisions include combinations of particle and fluid interactions categorized by projectile-target pairing: particle-particle, particle-fluid, and fluid-fluid. For verification of this hybrid collision scheme, we compare simulation results to analytic solutions for classical plasma models. [1] Verboncoeur et al. Comput. Phys. Comm. 87, 199 (1995).

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