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Numerical Modeling in Magnetohydrodynamics for coupled applications involving Magnetised Plasmas.

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ABSTRACT

Fusion based on magnetic confinement aims at producing power by using the energy liberated by deuterium and tritium nuclei reacting at extremely high temperatures (107 - 108 K), thus resulting in a plasma that is confined by magnetic fields in machines of the toroidal shape known as tokamaks. Plasma/material interactions significantly affects existing magnetic fusion devices and will critically impact the design, performance, and economic feasibility of DEMO and future commercial fusion tokamak reactors. In this session, we discuss selected scientific issues and challenges in modeling plasma/surface interactions in the context of plasma edge/scrape-off layer (SOL) solutions, surface material response to the steady-state and transient plasma, and resulting plasma and material evolution. Because individual codes have their own various extensive physics, and different algorithms and methods for parallel calculations, the challenge is to employ computational strategies with advanced algorithms and optimization methods to address the coupling of these codes over extremely broad physical phenomena length and time scales. We review numerical difficulties and highlight some recent axes of improvements.