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MODEL REDUCTION, CALIBRATION AND OPTIMAL CONTROL FOR PLASMAS

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ABSTRACT

Fusion based on magnetic confinement aims at producing power by using the energy liberated by fusing deuterium and tritium nuclei at extremely high temperature, within a plasma confined by magnetic fields in machines of toroidal shape known as tokamaks. Numerous technological and scientific challenges remain, that require a sustained research effort. Foremost among these challenges is the issue of power exhaust. The control of heat fluxes onto the tokamak walls in high energy confinement configurations and for both steady-state and transient regimes must be addressed to successfully run future ITER experiments. A major challenge nowadays for low-fidelity models for power exhaust simulations is the improvement of the turbulence modelling related to the heat transport. The nonlinearities of the governing PDEs, and the computational cost of performing optimal control on such systems, improving the numerical convergence of the optimisation procedure is crucial. The assimilation of experimental or numerical data from measurements and high-fidelity models, respectively, have the potential to reduce uncertainties on the free parameters inherently occurring in the models, used to close the averaged fluxes and stresses due to fluctuations. In this session we aim at sharing recent theoretical and numerical results on model reduction, model calibration and parameter estimation, optimal control approaches applied to reduced models, for heat transport in plasmas, to predict model solutions in real-life conditions.

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