Evaluating input parameter uncertainty affecting the Global Braginskii Solver

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Spectral methods, developed in the 70s, have proved to be robust techniques to solve differential equations. In the present work a spectral method is used to investigate the functional relationship between input and output uncertainty in the simulation of plasma turbulence at the edge of tokamak devices. The structure of the new fully spectral code will follow that of the Global Braginskii Solver (GBS) code, already developed at the Ecole Polytechnique Federale de Lausanne. The Chebyshev polynomials-based semi-analytic solution of the drift-reduced Braginskii equations is used for resolving time and parameter space, thus allowing to obtain an accurate estimation of the component of the numerical error which arises from input parameters uncertainty. The surface response methodology, as well as comparison with experimental data coming from the TORPEX device, are used to produce an overall quantitative estimation of the agreement between GBS simulations and experimental measurements, for different initial configurations of the plasma. The basic elements of the plasma edge dynamics will be discussed and a brief introduction on the mathematical principles at the base of the spectral method considered will be given, such that an audience with no specific background in plasma physics will be able to appreciate the meaning and importance of the problems which have been addressed.

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