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V A B I L O

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Vas vljudno vabi na predavanje

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z naslovom:

"Integrated Tokamak Modelling (ITM) and some current issues in fusion research"

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Abstract:
Today's most promising concept for the realisation of controlled thermonuclear fusion is the "tokamak", a toroidal configuration in which hot plasma is contained by means of strong magnetic fields.
The need for predictive tokamak modelling arises from the following arguments. The challenges and costs of fusion research are enormous: 50 years of fusion research have passed already, and the next-step ITER tokamak project may cost about € 20×109 (= 20 billion). Hence, understanding and optimising the ITER discharge to the maximum extent possible is mandatory even before ITER will start operating. This requires, on the one hand, careful exploitation and evaluation of present-day tokamak experiments (JET in Culham, UK, and ASDEX Upgrade in Garching, Germany, and many others). On the other hand, the inherent nonlinearity of plasma behaviour rules out simple extrapolation of these experimental results to a significantly larger device like ITER, so that a massive theoretical and numerical ("modelling") effort aimed at predicting the behaviour of ITER is indispensable as well.

Predictive tokamak modelling must be integrated! Like any other plasma device, the tokamak is a "globally self-consistent" dynamical system, i.e., all of its regions (subsystems) interact in simultaneous coupling with, rather than evolving independently of, each other. Hence, our basic postulate is that any modelling effort aiming at realistically and reliably predicting the overall performance of a tokamak discharge must be integrated in the sense that it correctly and simultaneously describes not only the regions themselves but their mutual coupling as well. In contrast, the conventional and still widely used "regional" approach to tokamak modelling is characterised by treating relevant regions (such as the core) or groups of subregions (such as the scrape-off layer), as separate entities, leading to uncertainties primarily with respect to their coupling.

The integrated-modelling "philosophy" was officially adopted by the EU's Fusion Programme by the setting up in 2003 of the Integrated Tokamak Modelling Task Force (ITM TF) with the goal of creating a complete "numerical tokamak" within one decade or so.A few specific research issues related to ITM will be illustrated, with particular emphasis on the "magnetised plasma-wall transition (MPWT)" region, which establishes the connection between the unperturbed plasma and the wall and is crucial to overall tokamak performance because it largely controls the particle and energy fluxes from and to the wall.

Vljudno vabljeni!

Prof. dr. Jožef Duhovnik
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