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Present status and challenges of disruption load modelling

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One of the high priority research needs for the ITER project is the development of a solid physics basis of plasma disruptions and their mitigation. The thermal and electromagnetic loads taking place during these events pose important constraints on the lifetime of tokamak components [1, 2]. The extrapolation of these loads from experimental data to new machines entails large uncertainties, thus, detailed load modelling and validation is essential for the success of future tokamaks such as ITER and DEMO.

In this talk, we present a summary of previous efforts on disruption load modelling and validation as well as the present status for the different load types. Thermal loads can result from plasma convective and conductive losses, radiated plasma energy or deposition of runaway electron kinetic energy into the plasma facing components. Electromagnetic loads arise on the conducting structures due to eddy and halo currents induced by MHD instabilities. A review of the main codes and frameworks used for the simulation for each of these loads is presented. Special attention is paid to the main modelling assumptions, present capabilities and main physical and numerical limitations. Finally, we review and discuss the main needs, challenges and planned efforts in order to simulate the relevant disruptive loads for future devices.

[1] Hender, T. C., et al. "MHD stability, operational limits and disruptions." Nuclear fusion 47.6 (2007): S128
[2] Lehnen, Michael, et al. "Disruptions in ITER and strategies for their control and mitigation." Journal of Nuclear Materials 463 (2015): 39-48.

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