TITLE

Experimental results and validation of a method to reconstruct forces on the ITER Test Blanket Modules

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PAPER

The Test Blanket Modules (TBMs), which will be located inside the equatorial port plugs of ITER, are connected to the shield by an attachment system. One of the most demanding loading conditions will be high electromagnetic forces acting on the TBM box during operation. In order to estimate these forces during operation in ITER, a force reconstruction method is developed. The reconstruction is based on measurements of strain sensors on the attachment system. Finally, the force estimates can be used to validate the results obtained by FEM software.

A testing device with a modular setup has been built to support the development of the method. It is able to apply different loading conditions to a corresponding mock-up, representing a TBM with attachment system. The attachment system is equipped with a set of strain sensors. Two force reconstruction methods, the Augmented Kalman Filter and an optimization algorithm, have been selected and adapted to estimate the excitation forces. Different test cases have been defined to represent a complete set of possible excitations of the systems.

This paper demonstrates the feasibility of the application of the method to reconstruct forces on the TBM structure. This is supported by results of the force reconstruction with experimentally obtained strain recordings as well as with simulated strain data. As the algorithms are based on a model of the system, the simulated strain recordings are used to show the impact of modelling errors on the accuracy of the estimated forces.