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Design and First Applications of the ITER Integrated Modelling & Analysis Suite

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The ITER Integrated Modelling & Analysis Suite (IMAS) will support both plasma operation and research activities on the ITER tokamak experiment. The IMAS will be accessible to all ITER Members as a key tool for the scientific exploitation of ITER. It will allow collective development of Integrated Modelling tools, by sharing data, code components and, ultimately, workflows based on coupling together various code components. Its design started in 2011 and a first prototype of the IMAS infrastructure has already been implemented at the ITER Organization (IO). The purpose of this paper is to describe the essential features of the IMAS design, the implemented prototype, as well as the first physics applications which have been developed under the IMAS infrastructure.

The IMAS infrastructure is based on a standardized data model that covers experimental and simulated data with the same representation. The standard data model is device-generic and can be used to describe data from existing experiments. Since the data model will progressively cover a large number of areas (plasma, diagnostics, actuators, other tokamak subsystems, ⋯) and will be developed by many contributors, a set of data model design rules and guidelines have been established to ensure consistency and homogeneity of the data model. Physics components, once interfaced to the data model, can be coupled into an Integrated Modelling workflow orchestrated by a workflow engine. A first implementation of all these infrastructure elements has been carried out and is described in this paper.

First applications have been integrated under the prototype IMAS infrastructure to allow their performance to be tested and to demonstrate the expected functionalities of the infrastructure. Transport solvers with free boundary equilibrium capabilities have been integrated to the IMAS infrastructure, namely CORSICA and DINA. ITER pulse simulations have been carried out by coupling the Plasma Control System (PCS), which in ITER has a dedicated and distinct simulation platform based on the Simulink® software, to the physics solvers. This has required the development of an original co-simulation technique between the plasma and plant simulator (under IMAS) and the dedicated PCS simulator. First results of full tokamak simulations under the IMAS infrastructure will be described in the paper.

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