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OLYMPE, a multi-physic platform for fusion magnet design

Design studies on tokamak superconducting magnets require a first step of pre-dimensioning followed by detailed analyses. Such analyses aim at verifying that the predefined design criteria are met in nominal and in off-normal conditions. These studies involve different physics and thus several specific numerical codes. In order to ease the process of performing these analyses, the development of a multi-physic platform is underway. This platform, called OLYMPE, integrates different solvers in a single interface.
In this paper, the structure of the platform is described, detailing the different links and coupling between the codes. The integration of the pre-dimensioning tool (MADMACS-TF) is presented, as well as the generation of a data model compiling all the information used by the codes for the analyses (geometry, loads, scenario⋯). Then the automatic generation of inputs for the different codes (electromagnetic, thermic, thermo-hydraulics, cryodistribution) and the post-processing of the results are detailed.
The last part of the paper presents the application of the tool on two projects. The first one is the modeling of the experimental tests performed on the JT-60SA Toroidal Field coils tested in the Cold Test Facility. Parametric studies on some defined parameters are performed to fit the experimental data (e.g. impact on the thermal loads of the winding pack detachment from the casing due to electromagnetic forces, effect of critical current law parameters used for each conductor of a given coil.) The second application focuses on the latest CEA design proposals for EU-DEMO TF magnets, in burn and quench conditions.

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