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MULTI-PHYSICS SIMULATION OF HEAT HARVEST IN FUSION REACTORS WITH ALYA HPC SOFTWARE

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The complexity of physics phenomena involved in fusion nuclear reactors together with their interdependence make their modelling a challenge. For their simulation, involved numerical models leading to costly computations in several time and space scales are required. Moreover, integration of these multi-physics models is key to understand the interdependence of different processes. Furthermore, for the desired goal of whole domain simulations, High Performance Computing (HPC) is required. These high efficiency simulations are mandatory to validate the coupled physic models and integrate them in the community tools.

In order to ensure HPC efficiency the chosen tool is Alya's computational mechanics multi-physics HPC software [1]. Alya main advantages are its supercomputing resource optimisation and its in-built modular multi-physics implementation that overcomes the necessity of data converters which can significantly hamper a multi-physics simulation.

This work highlights the current development state of the main Alya modules applied to fusion, i.e. those of magnetism, hydraulics, thermodynamics and neutron transport. Then the focus is put on the simulation of heat harvest and dissipation on ITER's first wall. This problem is an excellent example of the multiple physics interdependence since it involves a heat source determined by neutron transport and deposition as well as a heat interchange in the contact surface between the solid first wall and the fluid coolant flowing inside it.

REFERENCES

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