The next step in systems modelling: The integration of a simple 1D transport and equilibrium solver

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Systems codes are used in the conceptual phases of fusion reactors design. They employ a multitude of simplified models to simulate an entire power plant and ensure that designs are self-consistent, viable and optimised with respect to a given figure of merit. Their strength is the fast determination of an overall design. However, their output should be viewed with caution due to model simplicity and requires verification via more detailed physics and engineering analysis.

The PROCESS systems code is predominantly used to model the European demonstration power plant, DEMO. As such, it is under constant development to improve its capabilities. In this work, we describe the integration of a simple, 1D transport and equilibrium model known as PLASMOD [1] into PROCESS. This represents a significant step up in physical realism with the creation of self-consistent radial profiles including electron density and temperature.

PLASMOD is a time-independent transport model combined with an equilibrium solver from ASTRA. It has been benchmarked against both a standalone version of ASTRA and running within PROCESS. We present initial results from PLASMOD integrated with PROCESS, highlighting the impact on the calculated power plant design and performance of the newly implemented transport model.

References:

[1] E. Fable et al., submitted to Fus Eng and Design (2018)