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A modelica dynamic model of a supercritical CO2 energy conversion system for EU-DEMO

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Abstract-

Nuclear fusion technology is one of the main valuable candidates for providing a trustable base load in low-carbon future energy scenarios, thanks to its power density, low emissions and flexibility, together with innovative power conversion systems that could improve its performance, as the supercritical CO2 Brayton cycle. Since the nuclear plant will be required to provide variable loads, due to the fluctuating nature of renewable energies, a powerful modelling tool will be necessary to simulate different power outputs. The present paper presents a dynamic model of a supercritical CO2 power cycle developed with Modelica, aimed at the design of control systems to adjust the power production according to the load required. Thanks to the activity of three PI controllers, the system is able to follow a variable load profile while preserving the turbomachinery inlet temperature, to avoid any possible damage of the devices. The work has shown the adequacy and potential interest of the use of Modelica in this kind of analyses.

Index Terms- Supercritical CO2 Brayton cycle; EU DEMO; Modelica; Fusion power; Balance of Plant

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