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A Simulink Library of cryogenic components to automatically generate control schemes for large Cryorefrigerators.

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In this article, we present a new Simulink library of cryogenics components (such as valve, phase separator, mixer, heat exchanger...) to assemble to generate model-based control schemes. Every component is described by its algebraic or differential equation and can be assembled with others to build the dynamical model of a complete refrigerator or the model of a subpart of it. The obtained model can be used to automatically design advanced model based control scheme. It also can be used to design a model based PI controller.

Advanced control schemes aim to replace classical user experience designed approaches usually based on many independent PI controllers. This is particularly useful in the case where cryoplants are submitted to large pulsed thermal loads, expected to take place in future fusion reactors such as those expected in the cryogenic cooling systems of the International Thermonuclear Experimental Reactor (ITER) or the Japan Torus-60 Super Advanced Fusion Experiment (JT-60SA).

The paper gives the example of the generation of the dynamical model of the 400W@1.8K refrigerator and shows how to build a Constrained Model Predictive Control for it. Based on the scheme, experimental results will be given.

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