Thermal distribution modelling for Typhoon HIL

Master thesis project

Summary:

This thesis aims to enable the modelling of heat pumps and thermal distribution systems for real-time simulations of smart homes.

Problem definition:

The University of Twente is in possession of a number of Typhoon HIL devices which can be used to model power electronics, power systems and machines in real-time. Thermal distribution grids are an important part of smart energy systems, but the standard library does not include the modelling components required to describe such a thermal system of a smart home. The assignment is to design a library of these components for the Typhoon HIL. A balance should be found between the complexity and accuracy of the components while satisfying the constraints of the real-time simulator hardware. At the core of such a system are heat pumps which convert electrical energy into heat. Detailed models of such devices already exist in literature which can be used as a benchmark.
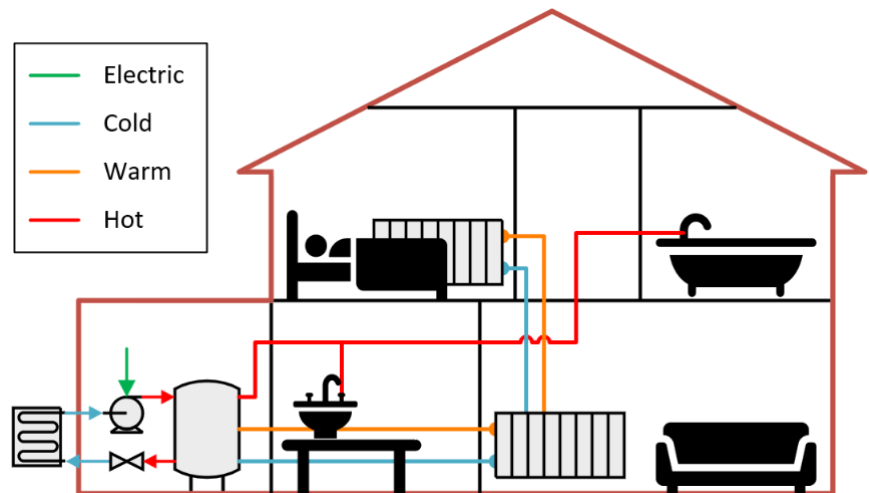
Method:

Initially, non-real time simulations on thermal distribution systems can be used to create the benchmark models from literature. These simulations can be created in Simulink+Simscape, or an equivalent alternative, as this environment already offers an expansive modelling library for these systems. Once the benchmark is designed, the models should be converted to elements that work on the Typhoon HIL, using the Typhoon HIL signal processing toolbox or by repurposing electrical domain components.

Research objectives:

Design a component library for the Typhoon HIL to model the thermal distribution systems found in smart homes.

Courses and supervision:

The standard courses of the Power Electronics track, with the addition of Electric Machines and Drives are desired to make full use of the standard library of the Typhoon HIL. A good grasp of multi-domain dynamical systems as taught in the Modelling and Simulation or an equivalent course is also desired in relation to the thermal domain modelling. This research would be in support of a PhD project and the PhD student will be the daily supervisor.

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