

Thermal simulation for cryogenic storage systems

Reducing greenhouse gases is an important factor for future aircraft concepts. For this reason leading aircraft manufacturers are working on alternative energy supply concepts replacing the existing auxiliary power unit with hydrogen fuel cell systems. Hereby liquid hydrogen offers the highest energy density and the best mass to volume ratio for this kind of systems.

The scope of this paper is the thermal simulation of a hydrogen supply system for future aircraft applications. The thermal model treats a whole cryogenic tank system including components for heating, feeding and safety devices as well as its environmental and operational conditions. The main focus is to represent interactions and influence of these components getting a better understanding of operational conditions and possible failure modes.

The simulation platform for the thermal model is based on a MATLAB/Simulink program. This code is well suited for performing parametric studies and handling large volumes of data (e.g. fluid properties). Therefore additional software is not necessary resulting in fast and stable simulation runs.

The main goal is supporting components and system design in the early concept phase of development. In future applications derived knowledge can be implemented into the control electronics.

