AxSTREAM SYSTEM SIMULATION

Rocket Nozzle Cooling System Modeling

Case Study Summary

Goal:

Create an accurate model of a liquid rocket engine's nozzle cooling system, accounting for the phase transitions and supercritical hydrogen parameters within the nozzle's cooling jacket.

Requirements:

Estimate the cooling jacket outlet's boundary conditions for subsequent turbine design.

Parameters:

Pinlet = 27.19 psi
Tinlet = -421.078 ºF
P in comb chamber = 464.12 psi
Heat flux distribution.

Constraints:

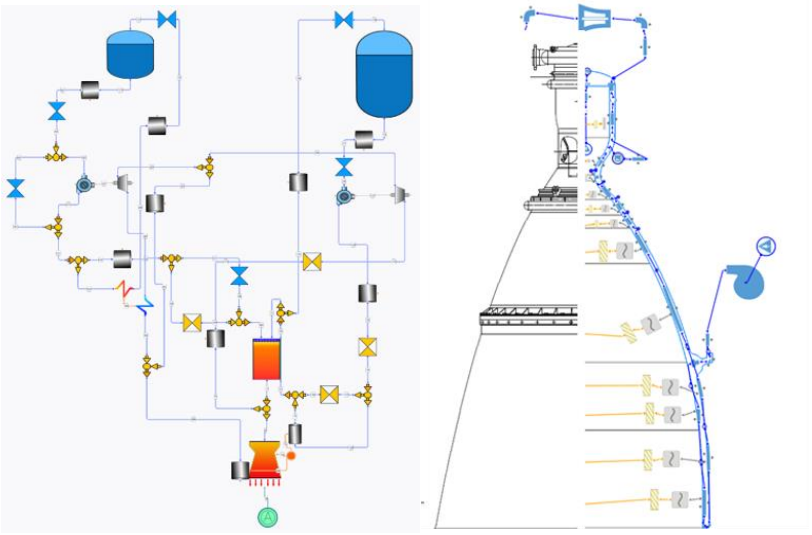
Wall temperature distribution.

Results of the Study:

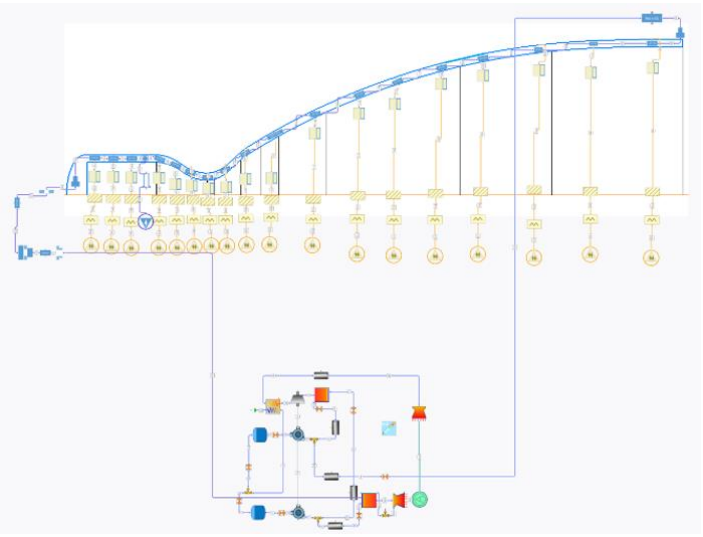
The wall temperature and heat transfer coefficients for a system with heat flux boundary conditions were obtained for further thermal and structural analysis of the wall materials.

Nozzle Cooling System Analysis

A liquid rocket engine with an expander cycle was modeled. The liquid hydrogen flows through the fuel pump where it is compressed.



After being compressed, the hydrogen passes through the nozzle cooling jacket where it heats up and changes phase before passing through the turbine which drives the liquid hydrogen pump.



AxSTREAM System Simulation allows coupling the main propulsion system to its auxiliary systems in order to perform their conceptual design or run analyses on frozen geometries. Here, for example, the expander cycle and the regenerative nozzle were modeled together to holistically evaluate their interactions.