

SPACE PROPULSION SYMPOSIUM (C4)
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NUMERICAL STUDY OF TUBULAR HEAT EXCHANGER IN THE AIR-BREATHING ENGINE
WITH MANIFOLD**Abstract**

In the air breathing engine, the bleed air of the high pressure compressor is used for the turbine blade cooling. Recently, the turbine blade cooling has become harder owing to the increasing the pressure ratio of the compressor. The turbine blade cooling air cooling heat exchanger is called cooling air cooler. The cooling air cooler used the surrounding environment air to cooling the bleed air. A tubular heat exchanger is recommended to be used in the very high temperature and high pressure system such as cooling air cooler. The present study is concerned with the heat transfer and pressure drop characteristics in the tubular heat exchanger. Two kinds of tube shape applied to the model, i.e., straight plain tubes and plain U-tubes, are calculated and compared. Effects of different fluid flow patterns, inlet Reynolds number and geometry on the heat transfer and pressure drop characteristics are performed. Increase pressure drop and some reduction of the heat transfer rate are produced due to the non-uniform flow distribution in the manifold. Considering the improved performance of the heat exchanger, the alternative designs are suggested that there should be area ratio changing between manifold inlet and outlet. The effects of various area ratio on the heat transfer and pressure drop characteristics are discussed as well. Based on the results, the suitable area ratio is proposed.