

AN INVESTIGATION OF THE FLOW DISTRIBUTION INSIDE A RADIAL SIDESTREAM INLET OF A CENTRIFUGAL COMPRESSOR

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ABSTRACT

A radial sidestream inlet is commonly utilized in multi-stage centrifugal compressors to introduce additional gas into the mid-stage of the compressor. The flow distribution after the junction of the sidestream and the main return channel of the upstream stage can significantly affect the performance of the next stage. In this study, the mixing between the fluid from the sidestream component and the fluid from the main return channel was investigated numerically using Computational Fluid Dynamics (CFD). A variety of CFD models of different geometry, different boundary conditions, and different grid density were developed to analyze the uniformity of the flow entering the impeller of the next stage. The flow distribution difference between the sidestream CFD model and the CFD model with the sidestream coupled to the main return channel suggests that both the return channel and the sidestream have to be modeled together to get meaningful results. The results of this effort were used in conjunction with production test data to help resolve a performance shortfall of a multi-stage centrifugal compressor with sidestream injection. The test data from the final design is also provided to show the resulting improvement in head rise.

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