

AERODYNAMIC ANALYSIS OF RETURN CHANNEL VANES IN CENTRIFUGAL COMPRESSORS

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ABSTRACT

A compressor is a device capable of efficiently transferring energy to the fluid medium so that it can be delivered in large quantities at elevated pressure condition. Compressors have numerous applications ranging from aircraft and process industries to household appliances such as refrigerators and air conditioners. There are numerous types of compressors, each suitable for a particular application. The return channel provides the connection and carries the flow between two stages of a multistage centrifugal compressor. These return channel vanes are located between the two stages through which the fluid passes from one stage to another stage in a centrifugal compressor. Its main function is to rectify the outlet swirling flow from the former stage with possible little flow loss before it enters the impeller of next stage. There are many complexities involve designing the return channel passages, namely; the total pressure loss coefficient, static pressure recovery coefficient and uniform blade loading. The design parameter of a return channel on the performance of a multistage centrifugal compressor is studied through numerical investigations. To find an optimum configuration of compressor with minimization of losses the CFD analysis is performed by changing the design parameter. In the present work a new return channel vane profile is designed and its performance is evaluated using CFD code FLUENT. The aerodynamic studies include the geometry generation of the return channel vanes, meshing, CFD-calculations and performance evaluation. The parameters such as total pressure loss coefficient, static pressure recovery coefficient, vane load distribution on the return channel passages are studied.

KEYWORDS: Multi Stage Compressor, Return Channel Vane, Flow Separation, Divergence Angle