SENSITIVITY OF WEIGHING FUNCTIONS IN GENETIC ALGORITHM FOR EFFICIENCY AND PRESSURE RATIO OPTIMIZATION IN TRANSONIC AXIAL FLOW COMPRESSOR

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Abstract

Axial flow compressor design is a multi-objective problem with objectives such as maximization of efficiency, total pressure ratio, mass flow rate and minimization of weight. In this work, validated meanline design process is integrated with genetic algorithm to optimize the compressor design. Fitness function used to evaluate effectiveness of candidate design solutions is arithmetic summation of combination of objective functions and respective weighing functions. Objective functions considered are pressure ratio, efficiency and operating margin in terms of De-Haller Number and Diffusion Factor. The summation of all the weighing functions is unity in all the iterations carried out. Weighing functions of the objective functions used in fitness function dictate the performance. Sensitivity study of weighing functions for multi-objective fitness function has been conducted for the intended mass flow and total pressure ratio. Effect of sensitivity of weighing functions in multi-objective fitness function on efficiency and pressure ratio in transonic axial flow compressor design is studied and discussed. The study carried out shows maximum value of weighing function does not yield maximum value of the objective function. Design trial of weighing function combination of (0.3 pressure ratio and 0.3 efficiency) yields an optimum pressure ratio of 1.588 and 88.1% efficiency for optimized fitness function. The iterative data generated is useful for assigning weighing function value based on design requirement.

Keywords: Compressor Design Optimization, Genetic Algorithm, Fitness Function, Weighing Function, Meanline Design