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Design Approach of the Turbocompressor for Aerospace Industry

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Abstract

Subsequent to the design of the compact centrifugal compressor which is specifically intended to be used in aviation platforms, the process has been evaluated within the context of this study. A trade-off study matrix for future studies has been formed after making comparison between the design and the previous studies taking part in literature. The working fluid will be refrigerant. Properties such as thermodynamic properties and Global Warming Potential(GWP)-Ozone Depletion Potential(ODP) Values of the fluid have been taken into consideration during the selection process of the refrigerant. Some design and analysis softwares have been used in the part of conceptual design and R1233ZD has been selected as the refrigerant. Real-gas Computational Fluid Dynamic(CFD) analysis has been carried out with different cubic equations of state in the ANSYS CFX solver so as to figure out the most suitable solution method. These equations are named as “The Redlich Kwong”, “Soave Redlich Kwong”, and “Peng Robinson.” By being used the mentioned solution equations in the same compressor configuration, analysis also have been carried out with two gases having different characteristics. As a result of the 9 analysis carried out with three different refrigerants and three different solution equations mentioned above, the most accurate solution method has been selected by comparing the densities of the gases at different pressure and temperature points. The results have been analyzed with the selected equation. The results are about a trade-off study matrix presenting a comparison regarding the compact centrifugal compressor operating with the refrigerant to be designed and density errors that is between analysis and real. This comparison is between some design parameters determined before the design and their values in the literature.