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**Politechnika
Śląska**

Analiza warunków pracy i dobór parametrów geometrycznych separatora powietrzno-olejowego dla turbiny gazowej

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Gliwice 2023

Gliwice, 30.03.2023
(miejsowość, data)

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Abstract

Topic: Analysis of working conditions and selection of geometrical parameters of an air-oil separator for a gas turbine

The aim of this study was to develop a calculation methodology for an air-oil separator in an aircraft gas turbine. The paper carried out a literature analysis of cyclone separators. The developed numerical model used the VOF two-phase fluid model with the RNG $k - \varepsilon$ turbulence model. The first part of the paper describes the preliminary research carried out, which aimed at building a numerical model. The parameters measured on the test bench were mapped – oil quality, separation efficiency and pressure drop. The actual calculations were preceded by the validation of the computational model based on experimental data. After verifying the reference model, a model was made to study the impact of geometric parameters used for optimization. The prepared model was used to analyse the influence of the dimensions of the separator inlet (height and width) and the diameter of the cylindrical part. Based on the designed experiment, the response surface was obtained, and optimizations were performed. Then, for the obtained geometry, a study of the influence of the length of the cylindrical part and the diameter of the central pipe was performed. For optimal geometry, an analysis of the impact of boundary changes on operating parameters was also carried out.

The conclusions of this work concern scientific and utilitarian areas. The conducted analyses showed that there are possibilities to increase the operating parameters of the separator tested at the measuring station. The proposed changes to geometric dimensions are in the available design space. The Pareto analysis indicated which parameters significantly affect the operation of the separator. The optimized geometry showed an improvement in oil quality and a reduced pressure drop compared to the geometry tested on the bench. The conducted research will allow to develop a procedure in the case of designing a new aircraft separator for civil aircraft engines.