МІНІСТЕРСТВО ОСВІТИ І НАУКИ УКРАЇНИ
СУМСЬКИЙ ДЕРЖАВНИЙ УНІВЕРСИТЕТ
ФАКУЛЬТЕТ ІНОЗЕМНОЇ ФІЛОЛОГІЇ
ТА СОЦІАЛЬНИХ КОМУНІКАЦІЙ

СОЦІАЛЬНО-ГУМАНІТАРНІ АСПЕКТИ РОЗВИТКУ СУЧАСНОГО СУСПІЛЬСТВА

МАТЕРІАЛИ ВСЕУКРАЇНСЬКОЇ НАУКОВОЇ КОНФЕРЕНЦІЇ ВИКЛАДАЧІВ, АСПІРАНТІВ, СПІВРОБІТНИКІВ ТА СТУДЕНТІВ

(Суми, 23-24 квітня 2015 року)

COMPUTER ANALYSIS OF THE STRESS-DEFORMATION STATE OF THE CENTRIFUGAL COMPRESSOR AND GAS TURBINE IMPELLERS

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Impellers are rotating components of a centrifugal compressor and gas turbine. Sometimes they have complex forms. They are mainly loaded by centrifugal forces. The wheels are heavy duty parts, often working for long time and their summary stresses may be so large that the analysis of the conditions of their strength is impossible without considering creep. At the same time the wheels are the most critical parts of machines and saving their strength should be provided with complete reliability. All this is defined by special difficulties and responsibilities of the compressor and turbine wheel strength calculating.

In this work the wheels of the centrifugal compressor and the turbine of the turbine expander are considered. The aim of the study was to numerically evaluate the influence of the gas flow and the action of centrifugal forces on the stress-deformation state of the centrifugal compressor and the turbine wheels of the turbine expander by using of numerical simulation in ANSYS software.

The problem of the gas flow in the flow area of the turbine and compressor wheels was solved; the stress-deformation state of the wheels including the tension, the action of the centrifugal forces and the gas flow were calculated. The results of the investigation of the gas flow influence and the action of centrifugal forces on the stress-deformation state of the impellers are presented in this article.

Calculations have shown that the stresses in the wheels, as well as the gas flow, are approximately two times higher than without gas. The gas flow and pressure created on the wall of blades and discs lead to a significant increase of the calculated stress as compared to the results of calculations by traditional methods. This testifies to the potential danger of destruction and shows the need for more detailed further theoretical and experimental study of the distribution of stresses and margin of safety in the wheels of turbine expander under complex loading.

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