الآية الكريمة

قوله تعالى:

{فَتَعَالَى اللَّهُ الْمَلِكُ الْحَقُّ وَلَا تَعْجَلْ بِالْقُرْآَنِ مِنْ قَبْلِ أَنْ يُقْضَى إِلَيْكَ وَحْيُهُ وَقُلْ رَبِّ زِدْنِي عِلْمًا } [طه١١٤]

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Dedication

To……

My Mother

To……

Soul My Father

To……

My Brothers

and

My Sister

To……

Anyone Who Helped Me And

Encouraged me to Achieve This Research

Researcher MORAHED

Abstract

The present research aims to study the effects of tip leakage flow phenomena on the performance of the axial flow rotor. To understand the effect of this phenomena, three different tip clearance sizes, 0, 4, and 6mm at different rotation speeds studies. The understand includes investigation of detailed tip clearance flow structures and representation of different flow parameters at different regions inside the rotor. The steady, viscous, compressible flow three dimensional governing equations representing the flow field coupled with standard $K-\varepsilon$ turbulence model are solved using computational fluid dynamic code. The analysis of the results shows, the rotor blade with zero gap has higher efficiency and higher total pressure. Increasing tip clearance, leads to decrease of both efficiency and total pressure. Also the result show the increase of tip clearance from 4mm, to 6mm strong vortex formed for tip 6mm than that for tip4mm.Also the rotation speed has great influence on the tip leakage flow and vortex. A comparison between the predicted results and available literature results indicates that the different phenomena inside the tip region and their effects are properly predicted.

مستخلص

يهدف هذا البحث لدراسة تأثير تدفق تسريب الخلوص في الجزء الدوار محوري السريان علي اداء الجزء الدوار. لتحقيق الفهم العام لأثر التدفق علي الاداء. ثلاث ابعاد من الخلوص وسرعات دوران مختلفة اخذت. باستخدام ديناميكا االموائع الحسابية لحل معادلات السرايان المضطرب .تحليل النتائج تبين اثر زيادة الخلوص علي كفاءة والضغط الكلي للجزء الدوار حيث اعلي كفاء وضغط في حالة النموزج بدون خلوص وتنخفض الكفاء بزيادة الخلوص .واثرزيادة الخلوص من 4 الي6 ملم في كمية تسريب الوسيط العامل .وكذلك توضح النتائج ان هنال دوامات كبيرة تتشكل في جزء الضغط المنخفض من ريشة الجزء الدوار وتزداد هذة الدوامة بزيادة الخلوص من 4 الي 6 وكذلك تتاثر بزيادة السرعة الدورانية. المقارنة بين النتائج المتوقعة والنتائج االدراسات السابقة المتاحة تشير إلى أن الظواهر المختلفة داخل المنطقة طرف وآثارها وتوقع بشكل صحيح .

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NOMENCLATURE

English symbols

u, v, w *velocity components*

P_0 *total pressure*

X axial coordinate (m)

Y Tangential coordinate (m)

Greek symbol

μ dynamic viscosity $\left(\frac{\mathrm{kg}}{\mathrm{m.s}}\right)$

ρ density $\left(\frac{\mathrm{kg}}{\mathrm{m}^3}\right)$

μ_t Turbulence dynamic viscosity$\left(\frac{\mathrm{kg}}{\mathrm{m.s}}\right)$

ε Turbulence dissipation Rate $= \rho C_3 \frac{k^2}{\mu_t}, \left(\frac{m^2}{s^3}\right)$

K Turbulence kinetic energy

η Efficiency

Abbreviations

CFD computational fluid dynamics

L.E leading edge

PS pressure side

SS suction side

T.C tip clearance

T.E trailing edge

TP total pressure

Definitions

$\nabla = \frac{\partial}{\partial x} \mathrm{i} + \frac{\partial}{\partial y} \mathrm{j} + \frac{\partial}{\partial z} \mathrm{k}$