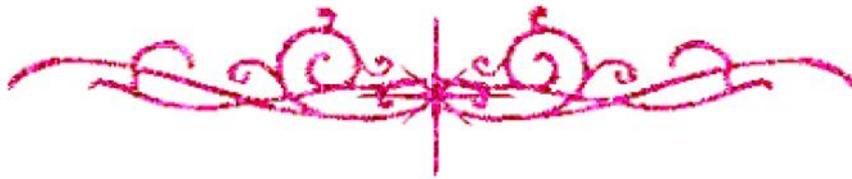


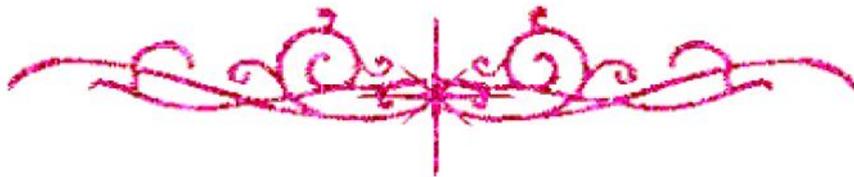
# بِسْمِ اللّٰهِ الرَّحْمٰنِ الرَّحِیْمِ



**HOSSAM MAGHRABY**



# شبكة المعلومات الجامعية التوثيق الالكتروني والميكروفيلم



**HOSSAM MAGHRABY**

# جامعة عين شمس

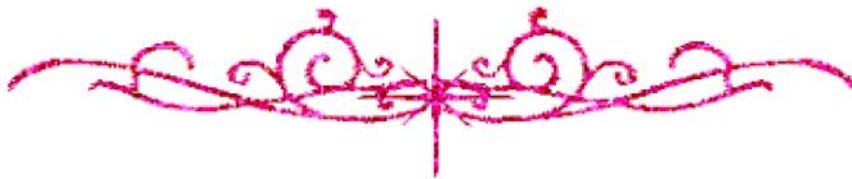
التوثيق الإلكتروني والميكروفيلم  
قسم

نقسم بالله العظيم أن المادة التي تم توثيقها وتسجيلها  
علي هذه الأقراص المدمجة قد أعدت دون أية تغييرات



يجب أن

تحفظ هذه الأقراص المدمجة بعيدا عن الغبار

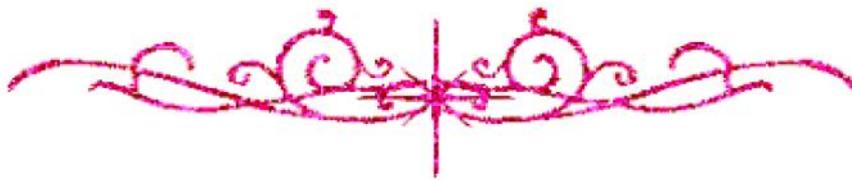


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بعض الوثائق

الأصلية تالفة

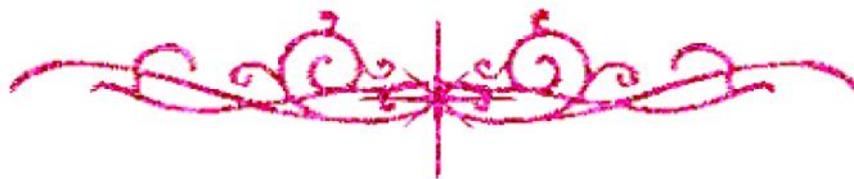


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بالرسالة صفحات

لم ترد بالأصل



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**EXPERIMENTAL STUDY OF TURBULENT  
FLOW IN AN ANNULAR  
SECTOR DUCT**

B16471

Presented By

**Mohamed Abd El-Azim Attia El-Moattar**

A thesis Submitted to the  
Faculty of Engineering at Cairo University  
in Partial Fulfillment of the Requirements

for the Degree of

**MASTER OF SCIENCE**

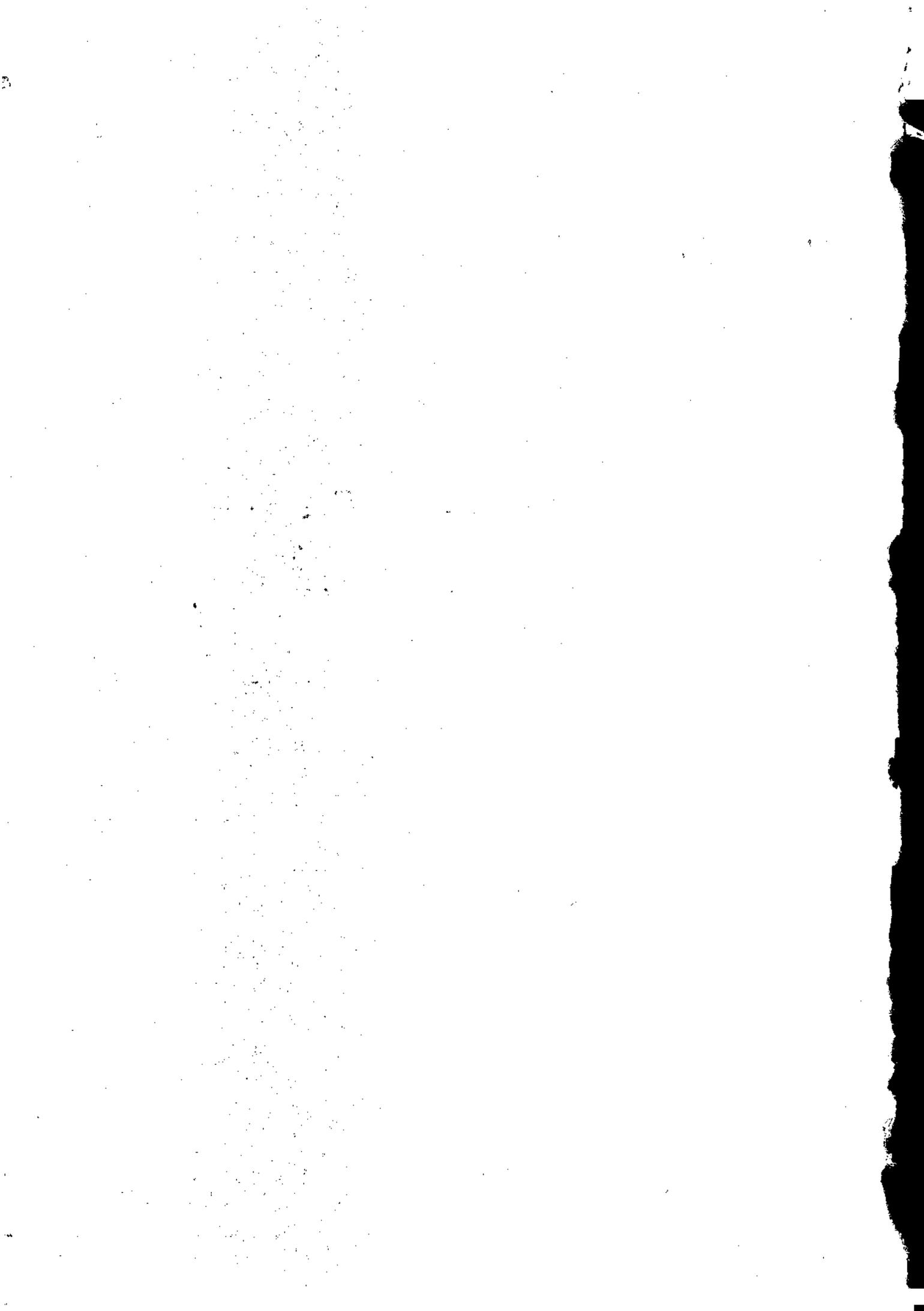
in

**Mechanical Power Engineering**

**FACULTY OF ENGINEERING, CAIRO UNIVERSITY**

**GIZA, EGYPT**

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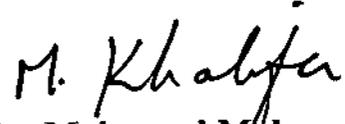


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م. الخليفة

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**Approved by the Examining Committee:**

**Prof. Dr. Salah Kamel Eldandoosh**



**Member**

**Prof. Dr. Samy Mourad Morcos**



**Member**

**Ass. Prof. Dr. Mostafa Abdel-Hamid Rizk**

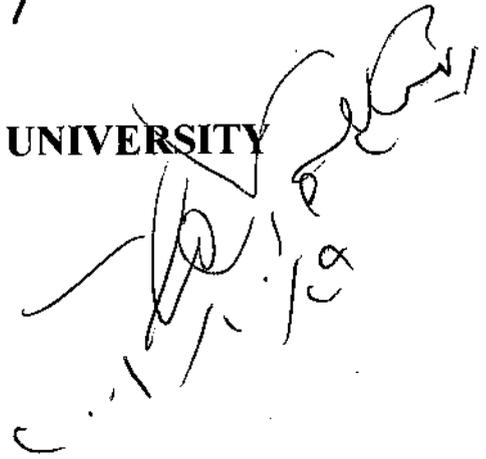


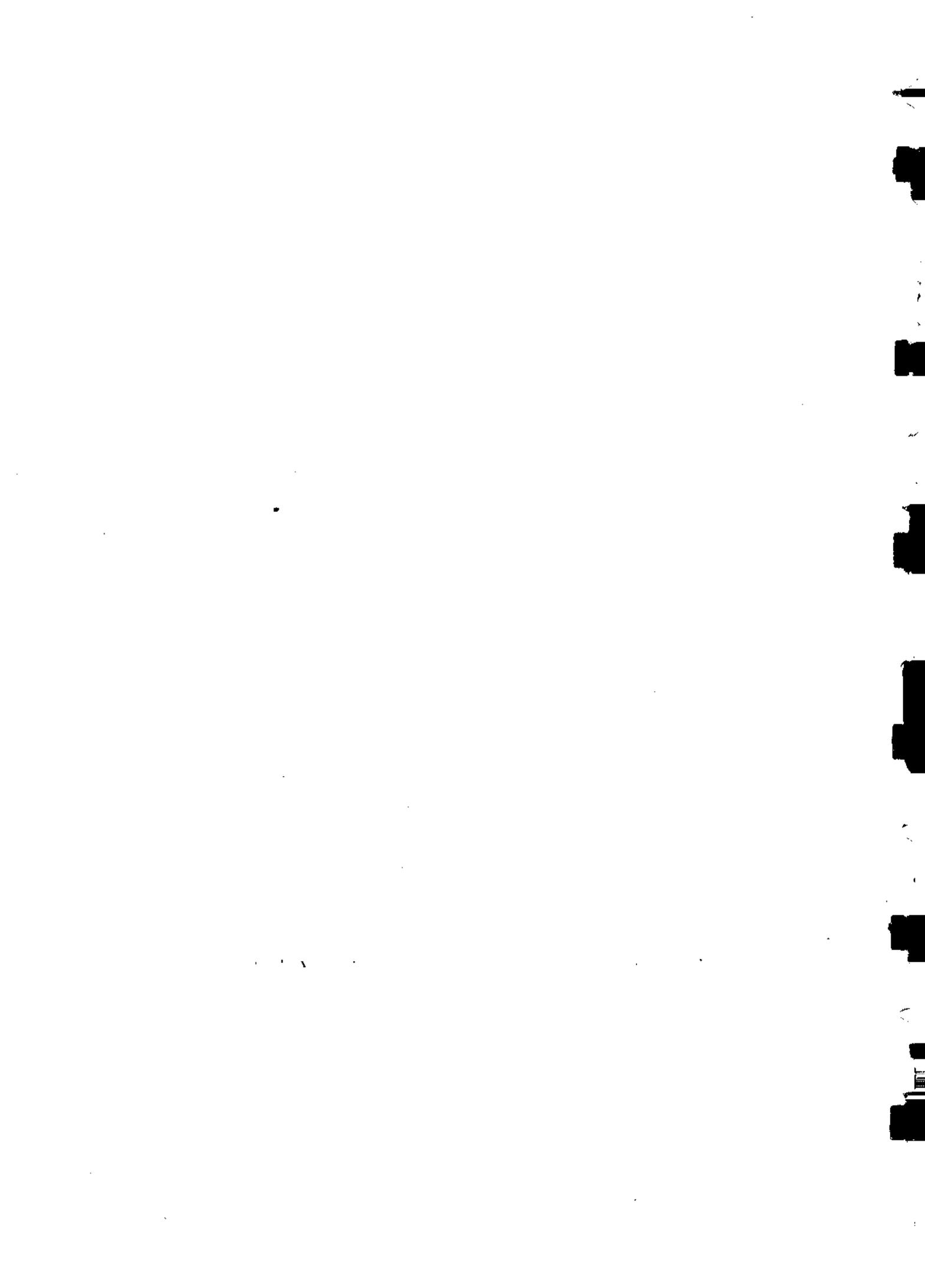
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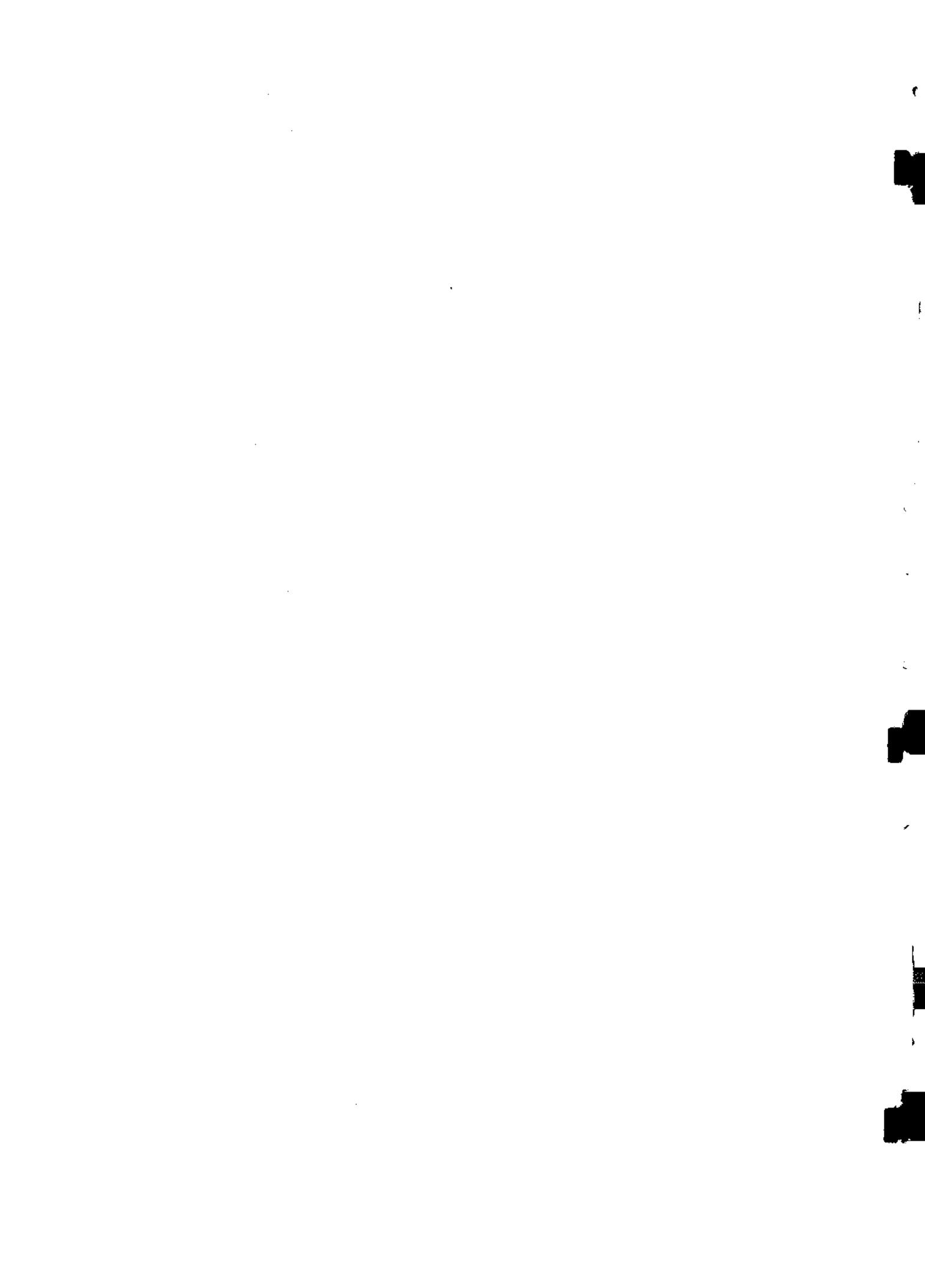


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## ABSTRACT

The continuing interest in compact heat exchangers has created the need for studying the turbulent flows for different passage shapes. It has been recognized that generally circular tube results are not applicable to non-circular passages even when the hydraulic diameter ( $D_h$ ) is used as the characteristic dimension. Therefore, design data should be generated for each passage shape individually. The new flow passage shape under investigation in the present work is the annular sector duct which is a non circular passage.

The major difference between the annular sector duct and non circular ducts of other geometries is that, the annular sector duct has both concave and convex boundaries. The combination of these combined boundaries would significantly affect the secondary flow pattern in the cross section area of the duct.

In the present work, an annular sector duct of an acute angle of  $60^\circ$  and 0.5 diameter ratio, with an inner diameter of 102 mm and an outer diameter of 203 mm, is studied experimentally. The experimental test section was at a total length of  $113D_h$ .

The experimental work was carried out at two different levels. In the first level, the hydrodynamic characteristics of isothermal flow such as mean axial velocities and axial pressure gradient were measured. In the second level, the turbulence intensities of turbulent flow and turbulent shear stress were measured.

The validation of experimental results was checked through some comparisons with the previous parameters of the tested flow.

The measurements concentrated on the contours of axial velocities and axial pressure gradients. The fully developed friction factor and the local wall shear had been studied and were checked by previous ducts.

Five experimental runs of measurements were performed at Reynolds number ranging from 43787 to 76433 by using pitot tube and hot wire anemometer. Measurements were performed at a cross section of  $113D_h$ .