بسم الله الرحمن الرحيم

MONA MAGHRABY

شبكة المعلومات الجامعية

التوثيق الالكتروني والميكروفيلم

MONA MAGHRABY

شبكة المعلومات الجامعية

التوثيق الإلكتروني والميكروفيلم

جامعة عين شمس

التوثيق الإلكتروني والميكروفيلم

قسم

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

يجب أن

تحفظ هذه الأقراص المدمجة بعيدا عن الغبار

MONA MAGHRABY

`

AIN SHAMS UNIVERSITY

FACULTY OF ENGINEERING

Mechanical Power Engineering

PULSATING FLOW EFFECTS ON THE COMBUSTION CHARACTERISTICS

A Thesis submitted in partial fulfillment of the requirements of the degree of

Doctoral of Philosophy In Mechanical Engineering

(Mechanical Power Engineering)

BY

Ahmed Mohamed Mustafa Sayed

Master of Science in Mechanical Engineering

(Mechanical Engineering)

Faculty of Engineering, Cairo University, 2016

Supervised By

Prof. Dr. Mahmoud Mohamed Kamal
Associate. Prof. Dr. Ashraf Mostafa Hamed
Associate. Prof. Dr. Ahmed Mohamed Taher

CAIRO, EGYPT
(2021)

AIN SHAMS UNIVERSITY

FACULTY OF ENGINEERING

Mechanical Power Engineering

PULSATING FLOW EFFECTS ON THE COMBUSTION CHARACTERISTICS

BY

Ahmed Mohamed Mustafa Sayed

Master of Science in Mechanical Engineering

(Mechanical Engineering)

Faculty of Engineering, Cairo University, 2016

Examiners Committee

Name and Affiliation Signature

Prof.Dr. Mahmoud Abdel Fattah EL-Qady .....
Mechanical Power, El Azhar University

Prof.Dr. Mahmoud Abdel Rasheed Nosier ……
Faculty of Engineering, Ain Shams University

Prof.Dr.Mahmoud Mohamed Kamal ……..
Faculty of Engineering,Ain Shams University

A.Prof. Dr. Ashraf Mustafa Hamed
Faculty of Engineering, Ain Shams University ……

CAIRO, EGYPT
2021

Statement

This thesis is submitted as a partial fulfillment of Doctoral of Philosophy In Mechanical Engineering Faculty of Engineering, Ain shams University.

The author carried out the work included in this thesis, and no part of it has been submitted for a degree or a qualification at any other scientific entity.

Ahmed Mohamed Mustafa

Signature

.....

Date:07 September 2021

Researcher Data

Engineer : Ahmed Mohamed Mustafa Sayed.
Date of birth: 07 / 11 / 1984
Place of birth: Cairo.
Last academic: Master of engineering in mechanical engineering.
Field of specialization: Mechanical engineering.
University issued the degree: Cairo University.
Date of issued degree: 2016.
Current job: Teaching Assistant.

Thesis Summary

An investigation was performed to increase the heat transfer rates from methane flames while simultaneously minimizing the soot and NOx emissions at extensive firing rates. The partially premixed flames responded favorably to the strain rate and the increase in temperature-soot interactions across the two reaction zones. Inverse flames with under-ventilation increased the temperature-soot interaction. Shifting the peak turbulent kinetic energy into the lean side in normal flames increased both the radiation and convection heat transfer rates respectively by13 and 9%. On the other hand, shifting the peak turbulent kinetic energy into the rich side reduced the NOx emissions. Exciting two concentric streams increased the turbulent kinetic energy and provided an innovative control of the pulsation effects. The soot growth and oxidation rates were thus controlled by setting the phase shift between the two streams at 20° and the corresponding frequency ratio at 4.0 such that the total

Acknowledgment

All my thanks and praise goes to **ALLAH** for his help during the completing of this work.

I wish to express my thanks and love to ***my Mother (Allah gives her all the best) and my Father***, without their love and support, I would never be able to complete this work.

Sincere thanks to ***Prof. Dr. Mahmoud Mohamed Kamal, Dr. Ahmed Mohamed Taher***, and ***Associate Prof. Dr. Ashraf Mustafa Hamed*** for their kind supervision, encouragement and valuable suggestions throughout this work.

I would like also sincere thanks to *my friend teaching assistant* ***Mahmoud Ahmed Essam*** *at Cairo University, Engineer* ***Hesham Ahmed*** *at Ain Shams University and my friend teaching assistant* ***Ahmed Abdel Naeem*** *at Helwan University for* their help throughout the work.

I would like also sincere thanks to all technical staff in combustion tests laboratories in Ain Shams University for his help during the completing of the experimental work.

Ahmed Mohamed Mustafa
Cairo, Egypt
JUNE. 2021

Table of content

CHAPTER (4): EXPERIMENTAL TEST RIG AND NUMERICALSET-UP

CHAPTER (5): PRELIMINARY RESULTS OF FLAME DOMINAT FREQUCNY AND PULSATION EFFECTS

CHAPTER (6): ADVANCED RESULTS AND DISCUSSIONS

CHAPTER (7): CONCLUSIONS AND FUTURE WORK

List of Tables