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بالرسالة صفحات

لم ترد بالأصل

HOSSAM MAGHRABY

Mathematical Imaging of Nonpremixed Methane-Air Flames

BY

Eng. Amr Mohamed Ali El-Azhary

A Thesis Submitted To The
Faculty of Engineering, Cairo University
in Partial Fulfillment of the Requirements for the Degree of
MASTER OF SCIENCE
in Mechanical Power Engineering

Faculty of Engineering
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Abstract

Through the present work a new concept of a flamelet modeling is taken into consideration. Where the physical 2-D space was transformed to Two-dimensional space where the mixture fraction and reaction progress variable are taken as coordinates in this space instead of the old concept of the very thin flamelet where the two-dimensional physical space was transformed to one-dimensional space where the mixture fraction or the reaction progress variable is taken as a coordinate in this space. The most important gain in this transformation is that each point in the physical space is equivalent to a point in transformed space instead of a contour in the old transformation.

Numerical scheme using UPWIND method with the help of MATLAB as a programming tool is adopted where a new code was written right from scratch to solve the present problem. Four-step kinetic mechanism by *N.Peters [1]* is used to get the distribution field of oxygen, carbon monoxide, water vapor, hydrogen radical, hydrogen molecule, and fuel, which is natural gas in the present work. Energy equation is adopted in the present work to calculate the temperature field as one of the dependent variables. The radiation effect in the present work is neglect.

The study shows the significant effect of the stretching rate in the two-dimensional transformed space, where the heat transfers form a surface area rather than thin sheet *[2]*. This effect reflects on the value of the stretching rate at which the flame reaches the extinction limit. In the present study the flame reaches the extinction limit at a stretching rate equals 7.5 s^{-1} while the flame reaches the extinction limit at a stretching rate 18 s^{-1} in the previous thin flamelet studies.

Finally, the present work can be considered as a extension for the two variable approach, where it takes into consideration some flame features which were neglected by *Janicka* and *Kollmann[3]*.

Acknowledgement

I whole-heartedly acknowledge the efforts of Prof Dr. M. M. M. Abou-Ellail, my M.Sc supervisor, his encouragement and constructive criticism throughout the course of the research served as a constant source of inspiration. I believe that his (very) patient disposition is possibly his finest attribute, and I have benefited considerably from the many discussions that we have had.

Great sincere thanks to Prof Dr. H. Salem my M.Sc supervisor for his guidance and help throughout the search. His advises, to construct the program, made it easy for me to complete the present work in an appropriate way.

I would also like to take the opportunity to acknowledge Prof Dr. O. El-Bahar for his attendance for my presentation and his great advises to write this thesis in a better form.

Last (but definitely not least) I present my most sincere thanks to my family: Ahmad (and Reham). In the case of my parents, for fear of trivializing their contribution any further through set of clichés, I will simply point out that I will never forget your efforts. I dedicate my thesis to you both.

Amr El-Azhary