DOI: 10.20396/revpibic.

The effect of dissipative length scales in the flame front wrinkling.

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Abstract

In order to predict the consequences of an accidental explosion in a chemical plant, dedicated computational codes are applied. Stokes is a code that has been developed at UNICAMP to simulate explosions in confined areas. Comparing with experimental data, the original code showed great agreement with its parameters SF as 0.16 and CC1 1.5. Aimig to improve the combustion model, by reducing the level of empiricism, the code has been modified. The use of the Kolmogorov length scale leads to extinction of the flame and the use of the fractal approach resulted in its faster propagation.

Key words:

Computational simulation, explosion, combustion model.

Introduction

Stokes is a code that has been developed at UNICAMP to simulate cases of explosion. The present work focused at first in doing a sensibility test of its software parameters. Afterwards, the objective turned to improving the combustion model implemented. Since it has 11 empirical constants, it is noticeable the lack of physical fundamentation of the phenomena. Aiming to have the number of this constants reduced, relied on theoretical studies at the literature, the code has been modified and the results acquired will be presented.

Results and Discussion

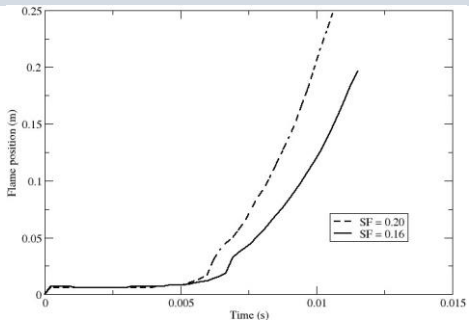

Image 1. Flame propagation as function of *smooth factor* (SF).

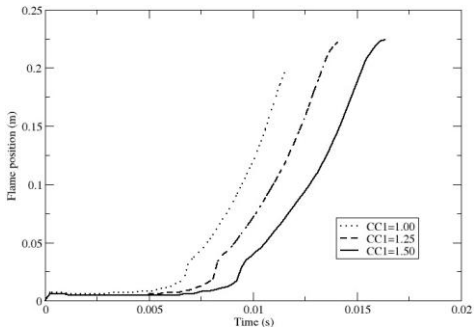

Image 2. Flame propagation as function of *CC1*.

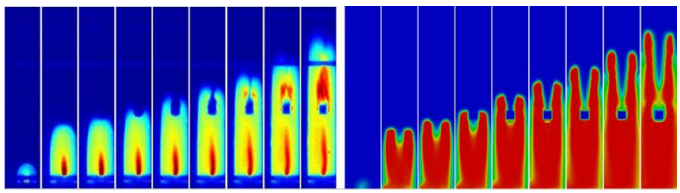

Image 3. Comparison between the experiment (left) and the simulation (right).

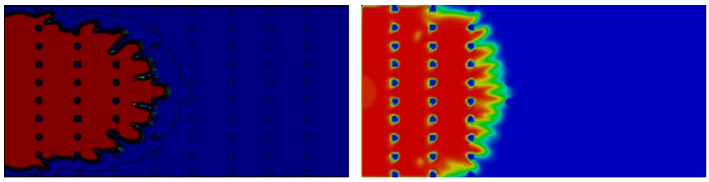

Image 4. Qualitative comparison between the softwares *FLACS* (left) and *Stokes* (right).

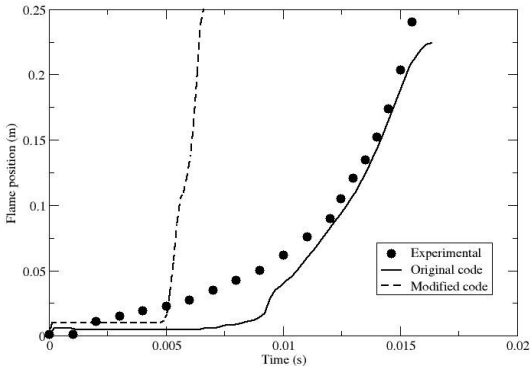

Image 5. Comparison beetween the best set-up for the original code and the actual one with the experimental data.

Conclusions

Comparison of numerical findings with experimental suggests a smooth factor of 0.16 and CC1 set as 1.5.

Consideration of the Komolgorov length scale led to flame extinction.

Application of the new model based on fractals emerges as a promising approach despite the faster flame propagation for the test case considered.

Acknowledgement

FAPESP – Fundação de Amparo à Pesquisa do Estado de São Paulo

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