Trabalho de formatura / Iniciação científica

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Numerical investigations of flame propagation in metal particles dusts

Metal combustion stands out as a promising energy transformation process in CCS (Carbon Capture and Storage) technologies. The combination of metal particles oxidation in air and subsequent fuel oxidation with metal oxides allows the production of exhaust gases mainly composed by CO_2 and H_2O. As a result, CO_2 can be easily separated and captured from the exhaust stream by simple cooling processes. The novelty of such a technique offers quite challenging research opportunities for technical and scientific communities.
The purpose of this research work concentrates on numerical investigations of flames propagating in metal particles dusts following the procedure adopted in [1]. The experimental and numerical data presented in [2] are planned to be used for code validation. Expected results may contribute to the comprehension of quenching mechanisms existing in general two-phase combustion process as well as the overall understanding of metal combustion issues.

Task Description:

This work consists of:

- Implementation of metal oxide reduction routines following the Euler-Lagrange framework in CHEM1D
- Set up a Matlab script to perform sequential simulations for validation
- Set up a Matlab script to perform sequential simulations for phenomenological analysis

Pre requisites:

- Knowledge on thermodynamics
- Knowledge on fluid mechanics
- Interest on programming

Do you have interest on it? Mail or easily come to a talk!

Contact:

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References:

[1] F. L. Sacomano Filho, N. Speelman, J. A. van Oijen, L. P. H. de Goey, A. Sadiki, and J. Janicka, “Numerical analyses of laminar flames propagating in droplet mists using detailed and tabulated chemistry,” *Combust. Theory Model.*, 2018.

[2] H. Doo-Hee and S. Hong-Gye, “A numerical study on heterogeneous aluminum dust combustion including particle surface and gas-phase reaction,” *Combust. Flame*, vol. 206, pp. 112–122, 2019.