Research activity at a glance

Prof. F. Creta

people: P. E. Lapenna, R. Lamioni

DIMA meeting  Area Propulsione
February 6, 2017
**Ongoing Research Activities**

- **Numerical investigation of premixed combustion using a hybrid methodology**
  - M. Matalon (UIUC-USA), F. Creta

- **Numerical and Experimental characterization of intrinsic instabilities in turbulent premixed flames**
  - G. Troiani (ENEA), F. Creta, R. Lamioni, P. E. Lapenna

- **The structure of non-premixed flames at supercritical conditions**
  - F. Creta, P. E. Lapenna, P. P. Ciottoli, M. Pfitzner, H. Muller (UBW-GER)

- **Direct and Large Eddy Simulation of Transcritical flows**
  - F. Creta, P. E. Lapenna, D. Cecere (ENEA)
Numerical investigation of premixed combustion using a hybrid methodology

- In this project we implement the “hydrodynamic model” of premixed flames as a hybrid numerical scheme using front tracking, level-set technique embedded in a variable density Navier-Stokes field.

- Laminar/Turbulent flame propagation
- Interaction of intrinsic instabilities and turbulence
- Scaling laws for $S_T$

**Related Journal Articles**
Numerical/Experimental study of intrinsic instabilities in turbulent premixed flames

• In this project we investigate, both numerically (DNS) and experimentally (PIV), the interplay between the intrinsic Darrieus-Landau (DL) of a premixed flame and weak turbulence

  » Definition of an unambiguous marker of presence/absence of DL-induced effects
  » Quantification of the DL effects on the flame propagation
  » Assessment of mitigation/suppression of instabilities due to increasing turbulence

» Related Journal Articles

The structure of non-premixed flames at supercritical conditions

- In this project we develop an efficient multispecies thermodynamic library to account for real gas effects in the context of non-premixed combustion.
- This is used in conjunction with non premixed combustion laminar solvers in the context of flamelet tabulation for high pressure cryogenic LES turbulent combustion solvers.

» RGM library based on comprehensive three parameters real fluid EoS

» Supercritical pressure influence on unsteady flamelet ignition transient

» Effects of fuel composition on LNG/LOx laminar flame structure

Related Journal Articles
Direct and Large Eddy Simulation of Transcritical flows

- In this project we develop a Low-Mach number real fluid version of **nek5000**.
- Highly scalable, spectral element, flow solver with state of the art thermo-physical and transport properties

» Investigation of mixing under severe thermodynamical conditions, usually encountered in LRE
» *A-priori* testing, using DNS, of sub-grid presumed pdf methods at supercritical pressures.
» *A-posteriori* analysis, using LES, of sub-grid modeling and simulation of relevant experimental configurations.

Thank you!

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