NACE CODE C24, C25, C28, C30, D35

# SIMULATIONS OF THERMO-FLUIDYNAMIC PROCESSES IN REACTIVE AND NON-REACTIVE SYSTEMS

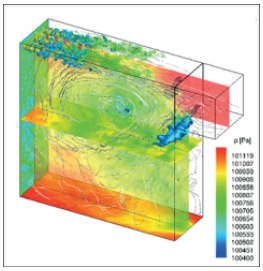
**Innovations and Benefits -** In house CFD codes aimed at simulating thermo-fluid dynamic processes (as the ENEA's HeaRT suite) are typically more advanced than commercial ones; they can accurately provide steady and dynamic descriptions of the complex physico-chemical phenomena of turbulent reactive and non-reactive flows. Such tools can be of help for the development of energy technologies characterized by lower consumption, reduced environmental impact and high flexibility. Numerical simulation of thermo-fluid dynamic processes can be a service adaptable to different specifications and contexts.

**Uses -**

- Numerical simulations, both steady and unsteady, of compressible and incompressible fluids, single- and multi- phase (liquid-gas, liquid-gas-solid) at low and high Mach number, at ideal and real gas conditions (high pressure, trans- and super- critical regimes).
- Design and optimization of components from the energy and environmental point of view. Studies of new combustion technologies and new fuels.
- Analysis of fluid dynamic and thermo-acoustic instabilities to define and identify precursor phenomena, aimed at developing advanced monitoring sensors and control systems for power plants (furnaces, boilers, gas turbines) and small and medium generation systems (boilers, thermal treatments, domestic generation).
- Studies of supersonic combustion systems in aerospace applications.

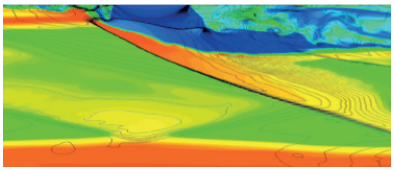
**Past and Present Activities -**

Project funded by CIRA (Italian Aerospace Center): numerical and physical modelling for HPC simulations (LES) of reactive and non-reactive flows in trans- and super-critical conditions for LOx/HC space propulsion applications.

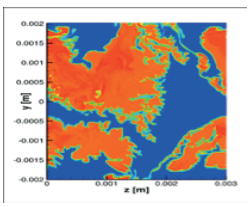


Thermo-acoustics in a Trapped Vortex Combustor

Ch4/Air premixed flame



Crossflow injection of a sonic hydrogen jet in a supersonic air (combustion for SCRAMJET propulsion)



CH4/O2 non-premixed supercritical combustion at 150 bar

Characteristics:

CUSTOM Thanks to its flexibility, the simulations of thermo-fluidynamic service can be adjusted to different needs and contexts

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