Combustion-DNS Strategy & Data Analysis Workshop

May 22-23, 2018, Sorrento, Italy

The workshop will take place right before the Joint Meeting of the German and Italian Section of the Combustion Institute, to be held in Sorrento, May 23-26, 2018.
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Aim

The rapid growth of computational power and the development of efficient numerical algorithms has enabled a number of Direct Numerical Simulation studies of turbulent combustion at conditions approaching practical relevance. Since DNS datasets are characterized by a high degree of details and completeness that is impossible to achieve in experiments, DNS data are helpful for the development and validation of turbulent combustion models for LES and RANS. However, it is often difficult to define a **DNS simulation strategy** that ideally addresses a given question, **systematic data analysis** can be challenging, and the way **from data to model** is often not clear.

The aim of the workshop is to discuss these issues to improve the ways in which DNS can lead to understanding of combustion physics and the development of models for turbulent combustion. The discussion will be supported by contributed posters and some presentations.

Topics and objectives

- **Quality and relevance of DNS data sets**
  - Assessment of database quality. Resolution, computational domain size, chemical mechanism, statistical convergence, effects of boundary/initial conditions.
  - DNS of experimental configurations? What is the added value?
  - Bridging the gap between DNS and reality: Assessment and quantification of relevance for real applications, e.g., Reynolds, Karlovitz, and Damköhler numbers, turbulent integral scale over flame thickness, residence time.
  - "*Hero"* simulation vs parametric study.
  - Universality and redundancy. Analysis of the same phenomenon in different conditions: with/ without shear, swirl, temporally/spatially evolving, different geometries
- **Data analysis and systematic model development methods**
  - A-priori and a-posteriori model analysis and development (including cold flow, scalar mixing)
  - Optimal estimator, CEMA, CSP, principal components, DMD, AI, dissipation elements
  - Can we optimize the design of DNS to be easily reproduced by LES and/or RANS?
- **Model development: Examples**
  - Gas flames: premixed, non-premixed, partially-premixed/stratified
  - Multiphase combustion: spray, coal
  - Pollutant modeling: PAH, soot, NO_x, CO