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Challenges in hydrogen combustion subgrid modeling



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**Aula Pacinotti Polo A
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Lean premixed hydrogen flames exhibit unconventional behaviour compared to hydrocarbon fuels, posing new challenges for modelling and requiring improved reduced-order approaches. A distinctive feature of hydrogen combustion is the strong differential and preferential diffusion effects, characterized by a low Lewis number. In addition to hydrodynamic (Darrieus–Landau) instabilities common to all premixed flames, lean hydrogen flames also develop thermodiffusive instabilities, which strongly wrinkle the flame front and generate cellular structures, affecting the overall flame consumption speed and dynamics.

Developing reduced-order models capable of capturing both chemical kinetics and thermodiffusive effects is therefore essential for next-generation hydrogen combustion technologies. This seminar will present a recently proposed Flamelet-Generated Manifold approach including mixture-averaged diffusion transport to account for cross-diffusion effects, together with recent advances in data-driven modeling.