LES of Combustion Instabilities in Annular Combustors

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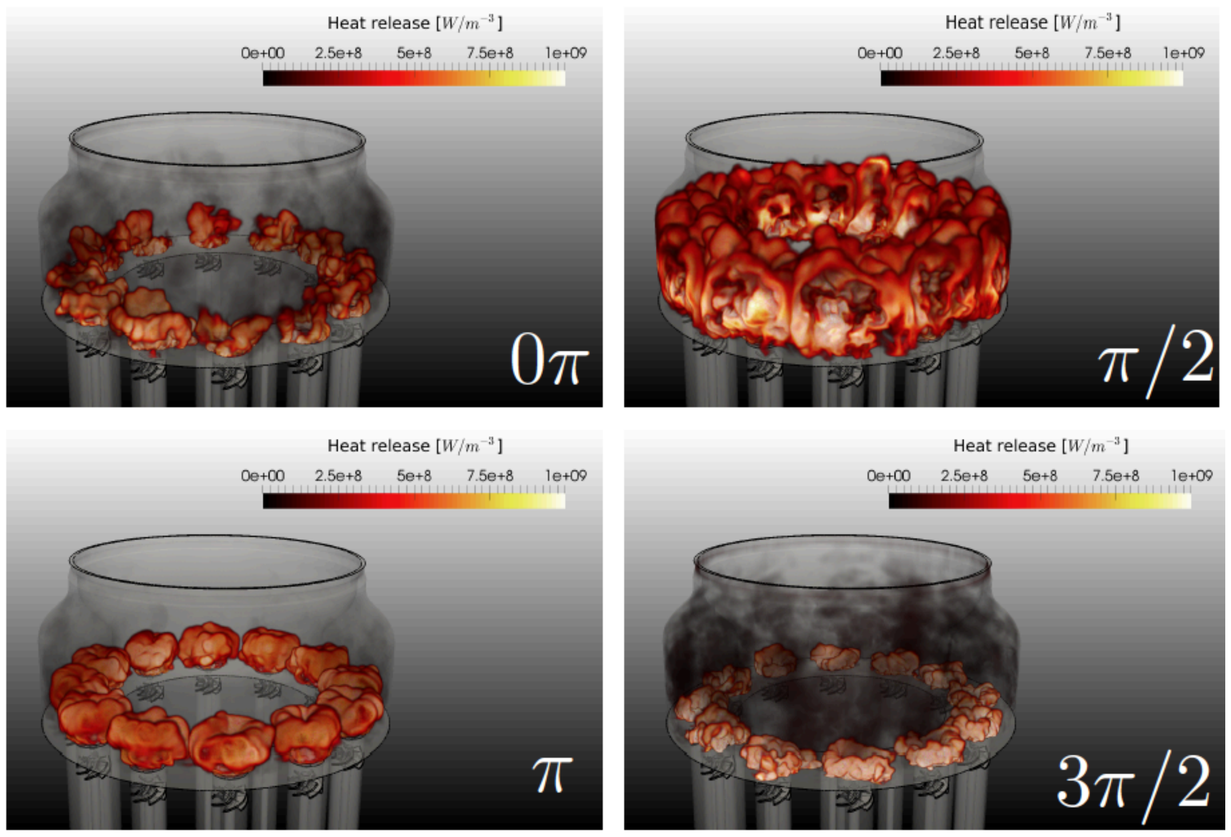
Motivation

- Combustion Instabilities (CI's) mostly studied for isolated flames
- Annular combustors are more realistic with complex flow/flame interactions
- Large Eddy Simulations[1] (LES) of annular rigs are expensive (one CI cycle costs 500 000 CPU hours)

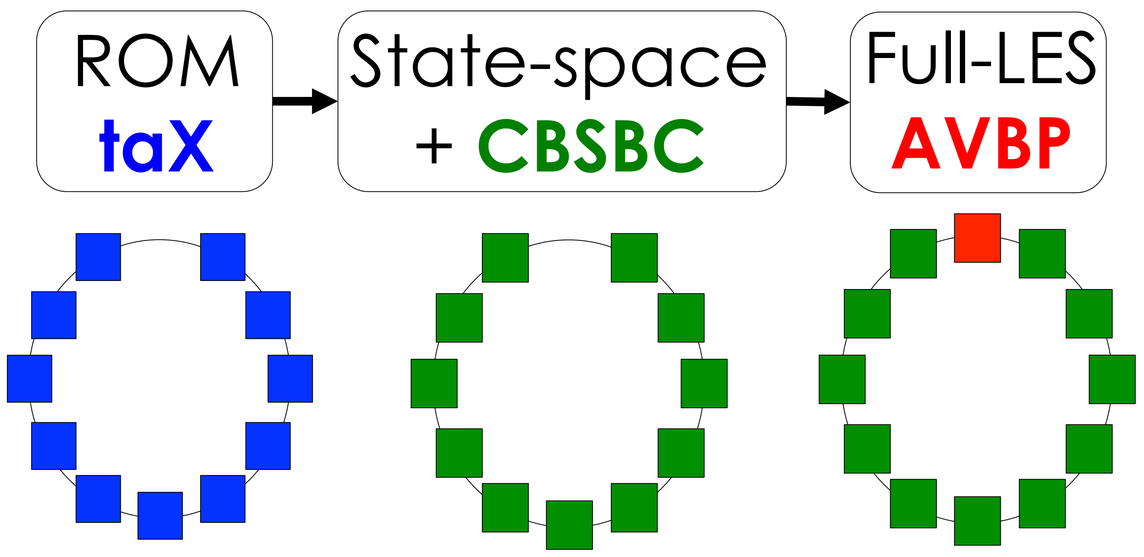


Objective

Reduction of CPU cost by coupling LES with Reduced Order Models (ROM) while preserving limit cycle characteristics

Modelling strategy

- In-house ROM[2] **taX** represents system acoustics and flame dynamics with a state-space interconnect approach
- **C**haracteristic **B**ased **S**tate-space **B**oundary **C**onditions[3] (**CBSBC**) couple **AVBP** with **taX**



Current status

- Coupling of high-fidelity LES with computationally efficient ROM is a promising approach for studying full-annular combustors
- Methodology has been successfully validated on a canonical test case: annular plenum connected to 4 laminar flames
- LES of a sector and of the full geometry of the NTNU test rig completed
- Ongoing work: coupling of one LES sector connected with 1 ROM

References

1 www.cerfacs.fr/avbp7x
2 Emmert, Meindl, Jaensch, Polifke. Acta Acoustica united with Acustica 102 (5), 2016
3 Jaensch, Sovardi, Polifke. Journal of Computational Physics 314 (1), 2016