Reactive Flow Simulations in the Hyshot II Scramjet: Validation and Quantification of the Margin to Unstart

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1 Introduction & Motivation GI/DS/JL

- scramjet and hyshot
- validation challenges
- unstart by thermal choking
- simulations RANS/LES
- validation & uncertainty quantification
- QMU definitions and objectives
- the PSAAP program at Stanford

2 The Hyshot II Scramjet JL/ME/FP

- the Hyshot configuration
- previous computational & experimental studies
- DLR experiment
- defying the unstart bound (Exp, LES, theory)
- metrics for detecting unstart

3 Physical Modeling and Computational Tools

- The governing equations
  - RANS equations and turbulence models ME/CG
  - Combustion modeling JU/NK/JL
  - Mixing modeling CG/ME
- Computational tools
  - the JOE code FP
  - flamelet solver NK/JU

4   Verification and Validation FP/ME/JL

- Grid convergence study

- Error estimation of numerical errors using adjoints

- Comparisons to experiments

5   Uncertainty Quantification PC/ME/JU

- Aleatory & Epistemic

- Sources of uncertainty

  - Inflow uncertainties
  - Kinetic rates uncertainties
  - Turbulence model uncertainties

- Subsystem decomposition

6   Quantification of Margins and Uncertainties PC/JL/GI

- Uncertainty propagation methodology

  - Plan $\mathcal{A}$
  - Plan $\mathcal{B}$

- Estimation of the margins

7   Conclusions GI/DS/JL

- Summary and main achievements

- Limitations of the present work

- Perspective on QMU