Assignment

Evaluate the flame velocity and flame structure for methane-air premixed laminar flame

Using Chemkin to set up a simple model and calculate flame speed of CH_4-air mixture at various conditions.

Model description:

- Use Premixed Laminar Flame-Speed Calculation sub-model
- Use the attached chemical reaction mechanism, thermodynamics and gas transport data files
    - The chemical reaction mechanism consists of a simplified mechanism for methane combustion: 17 species and 58 reactions
- Inlet set up
    - mass rate: 20 g/cm2-sec
    - Fuel: pure methane
    - Oxidiser: air
    - Equivalence ratio: 0.8-1.3 with 0.1 increment

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- Reactor set up
  - Unburned gas temperature: 300 K
  - Pressure: 1 atm -7 atm in 2 atm increment (use the option of “Vary each parameter independently so that only one parameter varies on each run”. You will have 24 runs.
  - Ambient temperature: 298 K
  - Grid setup
    - Starting axial position 0
    - Ending axial position 6
    - Others leave default
  - Species specific properties use auto populate

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- Plot the following
  - Flame speed vs. equivalence ratio at each pressure
  - Flame structure of p=7 bar Φ=0.8
    - Temperature, net heat production, OH, unburned fuel fraction and O2 concentration vs distance (you might want to re-scale the x and use different y scale to show details)

- Now use a diluted fuel (80% methane and 20% CO_2) and repeat the whole calculation. Repeat all the data processing. If there are cases failed calculation, this might mean combustion won't occur. Simply don't include the point in the data processing.

- Analyse and discuss your results in a report.

Assignment

Report

- Your report should be submitted no later than Friday 5pm W16 (12/06/2020).
- Your report should be maximum 4 pages excluding covering page, content page and reference page.
- Your report should have a proper structure and decent tone of a technical report.
- You should present and describe your results using diagrams and text. You should also discuss your observations using the knowledge learned from the course.

Assignment

Marking criteria:

- **Report structure, format, referencing and writing (30%)**

sensibly structured mini-report with suitable headings written in good clear English containing all the required sections and within the page limit; properly referenced without copying. Figures and tables are with captions and referenced in the text.

- **Results and presentation (40%)**

Correct results properly presented. Appropriate units on all quantities. Figures are clear to read with good size text and clear legend if applicable.

- **Discussion and conclusion (30%)**

Discussion of validity of assumptions and hypothesis (if any), reliability of findings. Explanation of the results and use reference to support your findings. Clear, specific, quantitative (if applicable) and concise conclusions.