Lagrangian particles evolution through expansion fan, from Yann's work

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Outline

1. Reminder of different refraction structures
2. Evolution of a Lagrangian particle in RRE struture
3. Use of CHEMKIN II to compute chemistry calculus

From Henderson 1976 and 1978

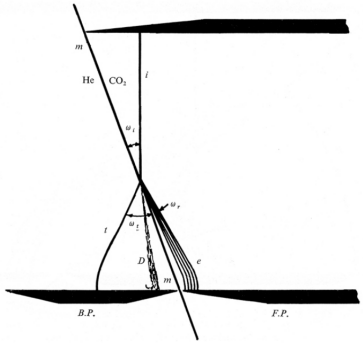
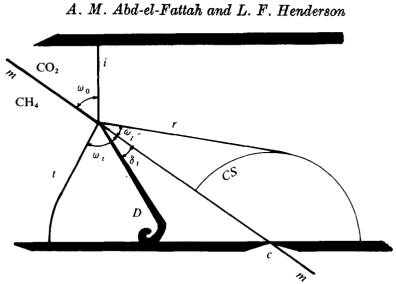


FIGURE 9. Regular refraction of a plane shock at a contaminated carbon dioxide–helium interface. For symbols see caption to figure 3.

(a) RRE struture



(b) RRR struture

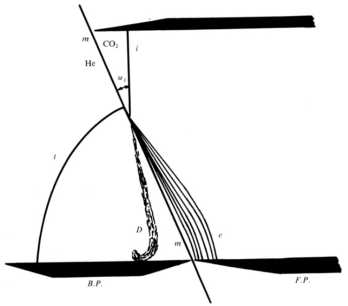


FIGURE 13. Bound-precursor irregular refraction of a plane shock at a contaminated carbon dioxide–helium interface. For symbols see captions to figures 3 and 10.

(c) BPR structure

Figure 1: Three of the already known refraction structures : RRE and BPR schemes are from Henderson, Abd-el-Fattah & Lozzi 1976; RRR scheme is from Henderson & Abd-el-Fattah 1978.

Evolution of a Lagrangian particle in the $H_2 - O_2$ phase

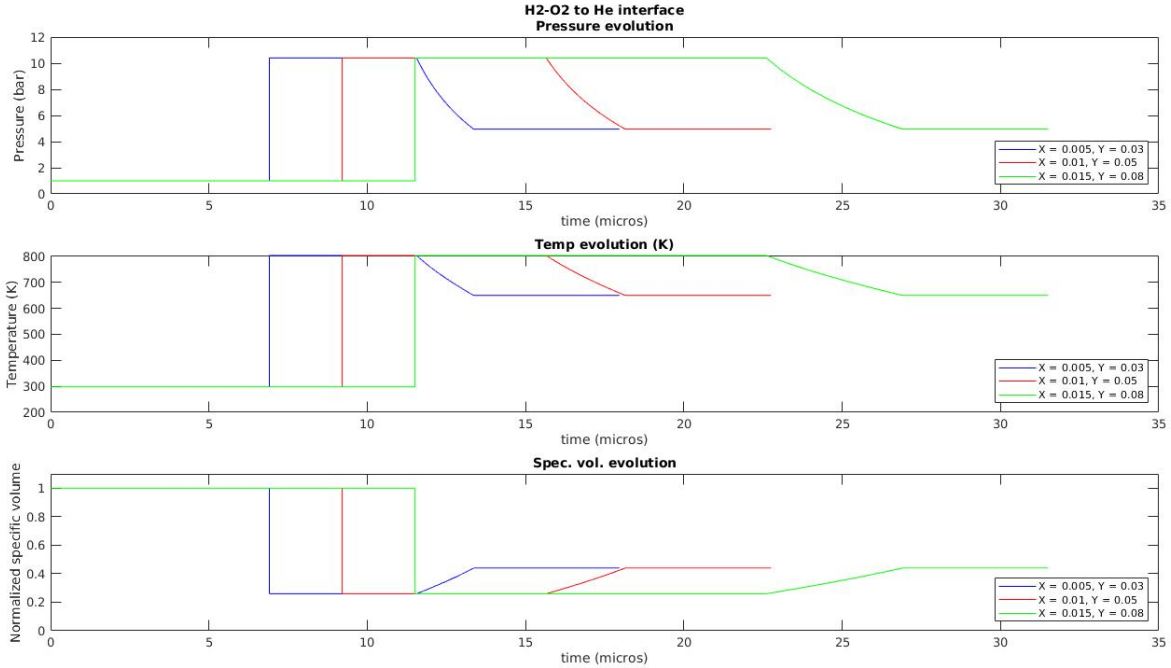
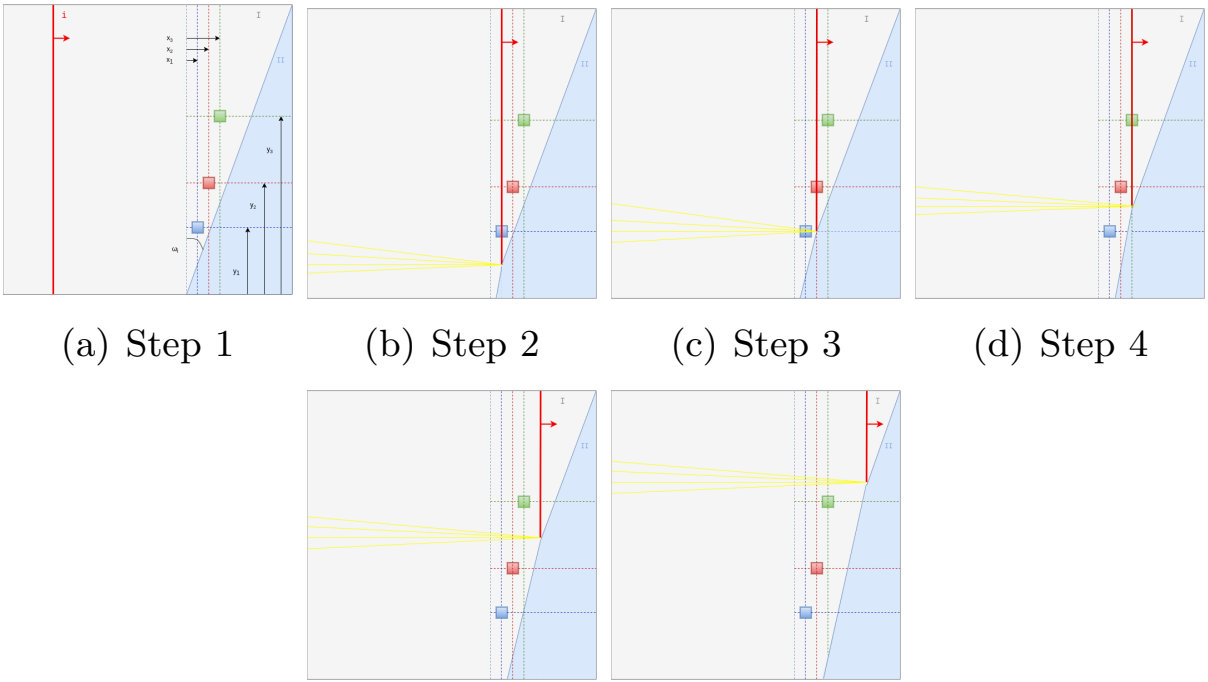


Figure 2: Pressure, temperature and specific volume evolution for 3 different Lagrangian particles, in a $H_2 - O_2$ phase

Scheme of different steps of the evolution of Lagrangian particles



(a) Step 1 (b) Step 2 (c) Step 3 (d) Step 4

(e) Step 5 (f) Step 6

Figure 3: Different steps in the evolution of 3 Lagrangian particles

Zone of computation in the $\chi - \omega_i$ plane

1st step : Compute the evolution of Lagrangian particles in a Refraction with Reflected Expansion structure

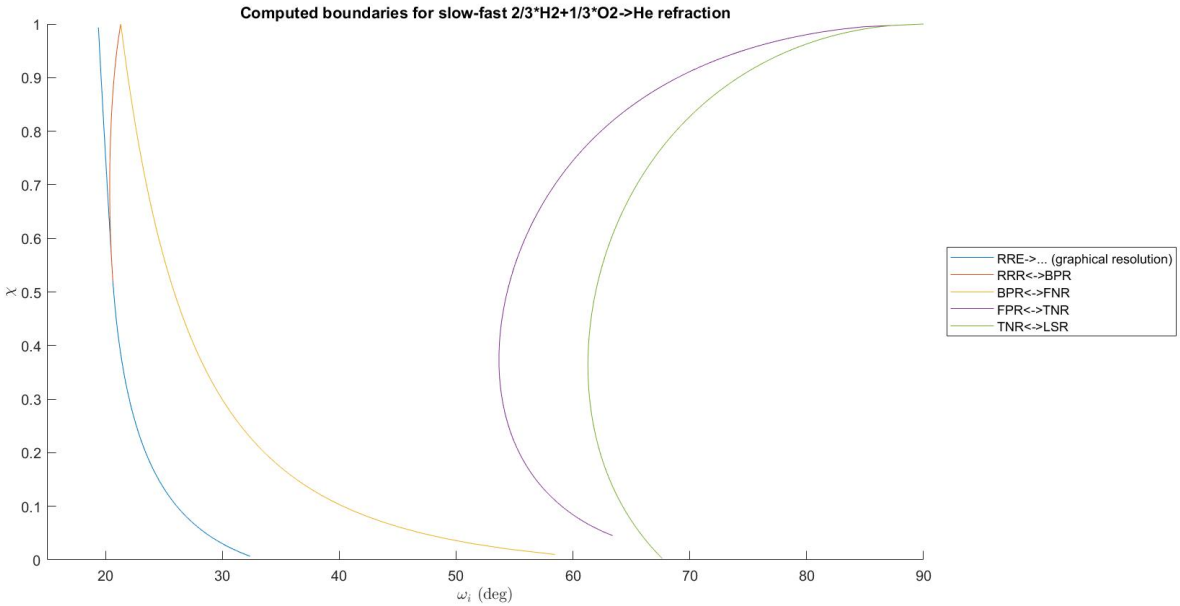


Figure 4: Refraction structure boundaries for a $H_2 - O_2/He$ system

Main steps

- Calculate evolution of specific volume of different Lagrangian particles, for $\omega_i = 18°$, for different Mach numbers, between 3.2 and 9.5
- Use of CHEMKIN II to calculate chemical reactions in the reactive phase
- Outputs of CHEMKIN II : evolution of pressure, temperature and ratios of chemical species
- Temperature jump in CHEMKIN II output = detonation