C.01.01.Z1 – Biblioteca Simplificada de Gás Ideal

Aplicação em FTHA – Finite Time Heat Addition Otto Engine Model

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Compiled on 2020-09-11 18h33m12s UTC

UTFPR

Equação de Estado (EoS): Comportamento $P - T - v$

$$Pv = RT \qquad\qquad P\bar{v} = \bar{R}T \qquad \rightarrow$$

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Cada equação com forma nas bases mássica, e molar, com $R = \bar{R}/M$ — armazenar $\bar{R}$ e M!

Modelo de $\bar{c}_p(T)$ Polinomial:

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Armazenar a_i, T_{min} e T_{max} e saber as conversões (i) $a_i \to b_i$ e (ii) $\bar{c}_{p,v}(T) \to c_{p,v}(T)$.

Modelo de $\bar{c}_p(T)$ Polinomial: $\bar{u}(T)$

$$\bar{u}(T) = \int_{T_{ref}}^{T} \bar{c}_v(T)\,dT = \int_{T_{ref}}^{T} \sum_{i=1}^{4} b_i T^{i-1}\,dT, \qquad T_{min} \leqslant T \leqslant T_{max} \qquad \longrightarrow$$

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Modelo de $\bar{c}_p(T)$ Polinomial: $\bar{h}(T) = \bar{u}(T) + \bar{R}T$

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Modelo de $\bar{c}_p(T)$ Polinomial: $P_r(T)$ e $v_r(T)$

$$\left(\frac{P_2}{P_1}\right)_s = \frac{P_{r2}}{P_{r1}} \qquad\qquad \left(\frac{v_2}{v_1}\right)_s = \frac{v_{r2}}{v_{r1}} \qquad \longrightarrow$$

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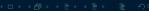
$$P_r(T) \equiv e^{\bar{s}^\circ(T)/\bar{R}} \qquad\qquad P_r(T) = e^{s^\circ(T)/R}$$

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$$v_r(T) \equiv \frac{T}{P_r(T)}.$$

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- **Sem requisitos adicionais** de armazenamento!

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- **Sem requisitos adicionais** de armazenamento!
- **Sem conversões** de base!

Padrões nos Cálculos:

$$\bar{c}_p(T) = a_1 + a_2 T + a_3 T^2 + a_4 T^3, \qquad\qquad T_{min} \leqslant T \leqslant T_{max} \qquad \longrightarrow$$

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- Verificação de limites;

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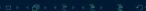
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- Verificação de limites; • Coef./func. próprios; e • Produtos matriciais.

```julia
 1 # Universal gas constant
 2 R̄() = 8.314472 # ± 0.000015 # kJ/kmol·K
 3
 4 # Standard Tref
 5 Tref() = 298.15 # K
 6
 7 # IG (Ideal Gas) structure: values for each gas instance
 8 struct IG
 9     MW                    # Molecular "Weight", kg/kmol
10     CP::Ntuple{4}         # Exactly 4 c̄p(T) coefficients
11     Tmin                  # T_min, K
12     Tmax                  # T_max, K
13     sref                  # s̄°ref, kJ/kmol·K
14 end
```