decivil universidade de aveiro departamento de engenharia civil

EN 1993-1-2: FLEXURAL BUCKLING RESISTANCE OF STAINLESS STEEL COLUMNS IN CASE OF FIRE

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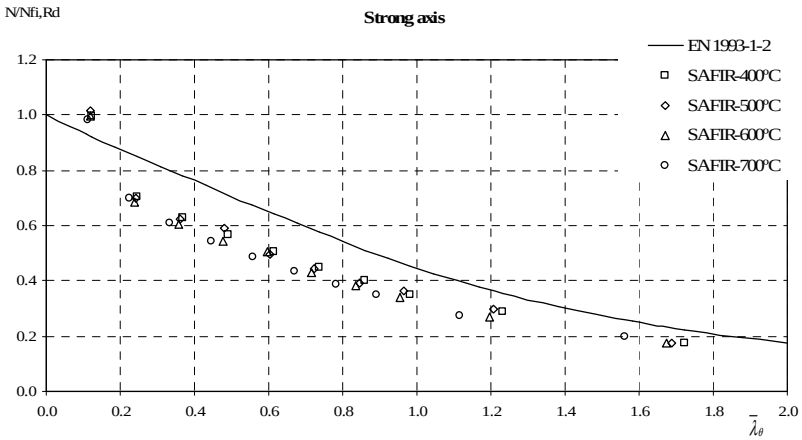
LABEST - Universidade de Aveiro

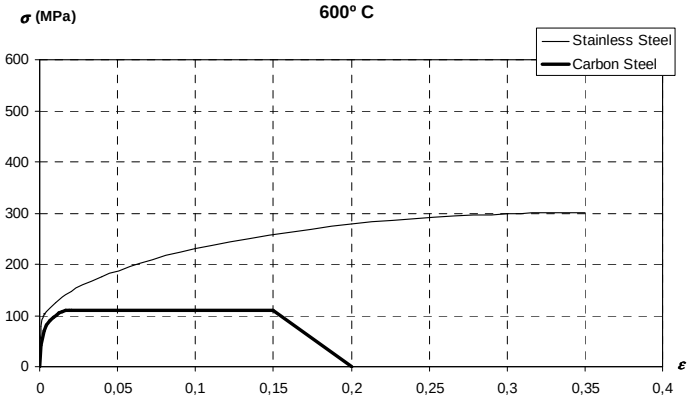
EN1993-1-2 fire resistance formulae

Same formulae developed for carbon steel columns

$$N_{b,fi,t,Rd} = \chi_{\min,fi} A k_{y,\theta} \, f_y / \gamma_{M,fi}$$

$$\chi_{i,fi} = \frac{1}{\phi_{i,\theta} + \sqrt{\phi_{i,\theta}^2 - \overline{\lambda}_{i,\theta}^2}} \quad \text{with} \quad \chi_{i,fi} \le 1$$





$$\phi_{i,\theta} = \frac{1}{2}\left(1 + \alpha\overline{\lambda}_{i,\theta} + \overline{\lambda}_{i,\theta}^2\right)$$

$$\alpha = 0.65\sqrt{235 / f_y}$$

New proposal

Developed for stainless steel Class 1 and 2 I-sections

"full" proposal

$$\phi_\theta = \frac{1}{2}\left[1 + \alpha\bar{\lambda}_\theta + \beta\bar{\lambda}_\theta^{\,2}\right]$$

$$\chi_{fi} = \frac{1}{\phi_\theta + \sqrt{\phi_\theta^{\,2} - \beta\bar{\lambda}_\theta^{\,2}}}$$

	β
Strong axis	1.0
Weak axis	1.5

$$\alpha = \eta\sqrt{\frac{235}{f_y}}\sqrt{\frac{E}{210000}}\sqrt{\frac{k_{E,\theta}}{k_{y,\theta}}}$$

	1.4301, 1.4401, 1.4404, 1.4571, 1.4301	1.4462
η	1.3	0.9

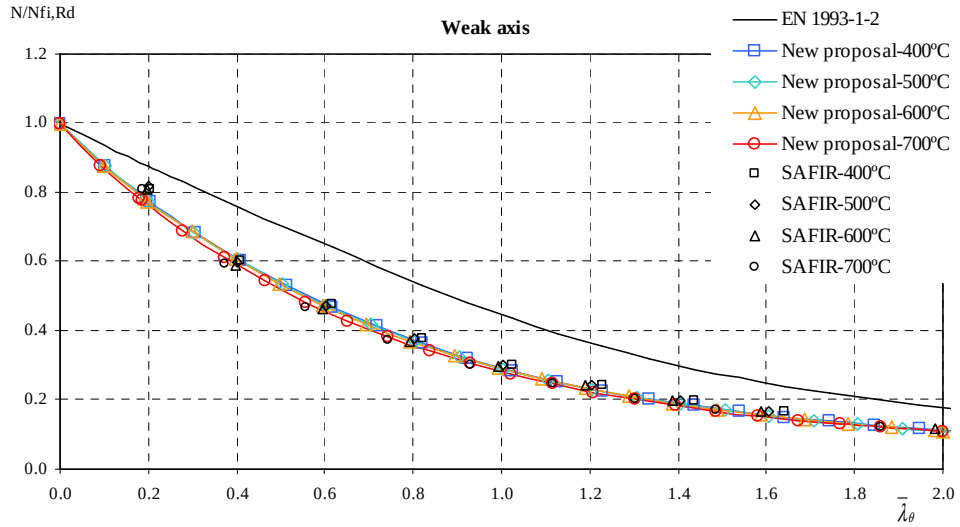
Simplified proposal

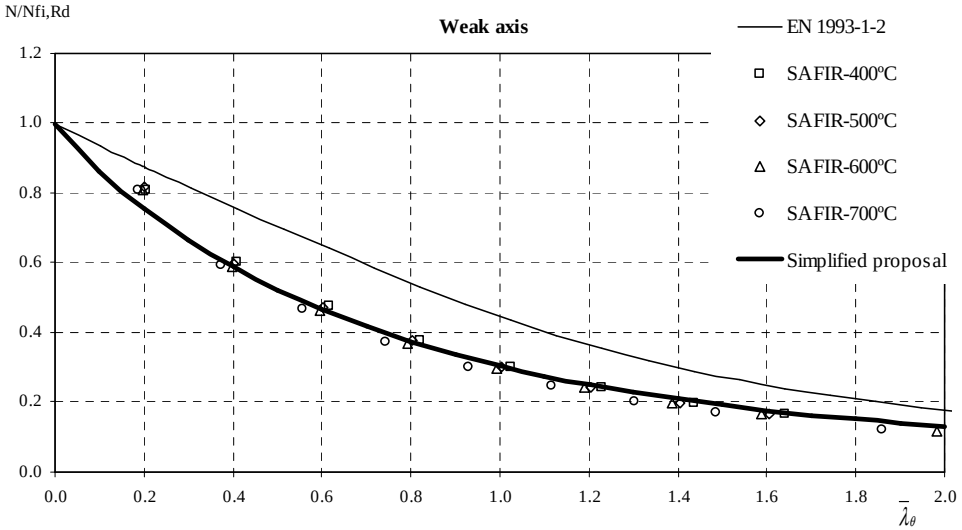
$$\alpha = \beta\sqrt{235/f_y}$$

	Carbon Steel	Stainless Steel
β	0.65	1.5

Lopes, N.; Vila Real, P.; Simões da Silva, L.; Franssen, J.-M. *"Axially loaded stainless steel columns in case of fire"*, Journal of Structural Fire Engineering, Multi-Science Publishing Co. Ltd, volume 1/1, pp 43-59, ISSN 2040-2317, March of 2010.

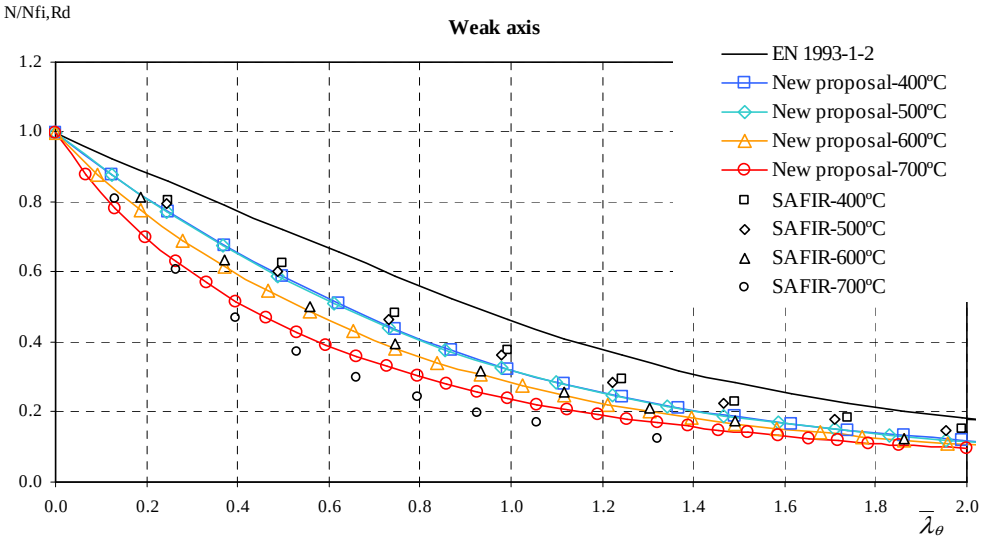
Validation

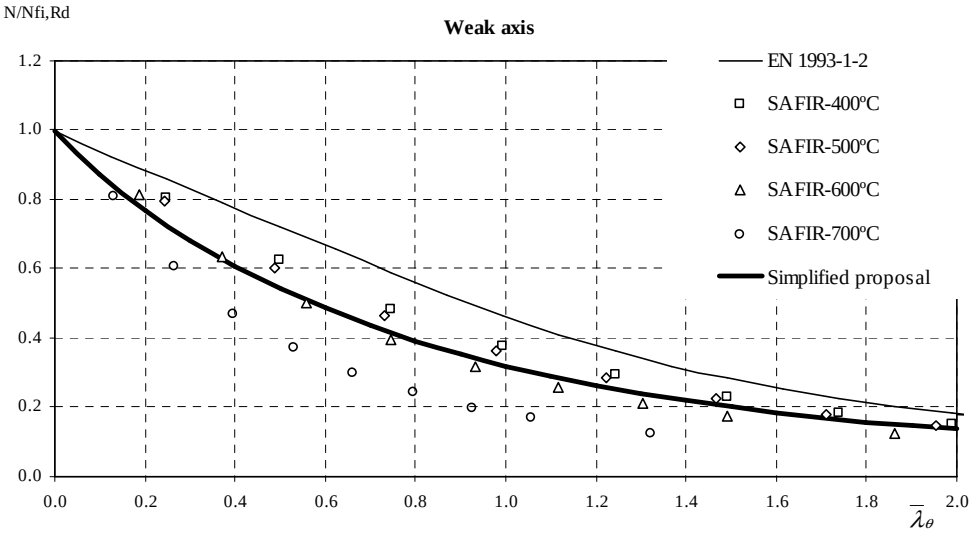




HEB200 1.4301

Validation





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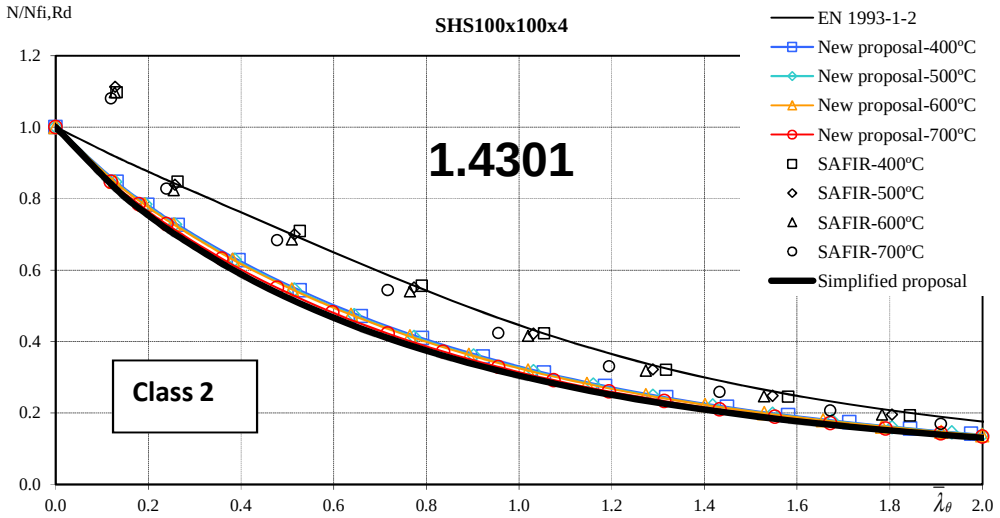
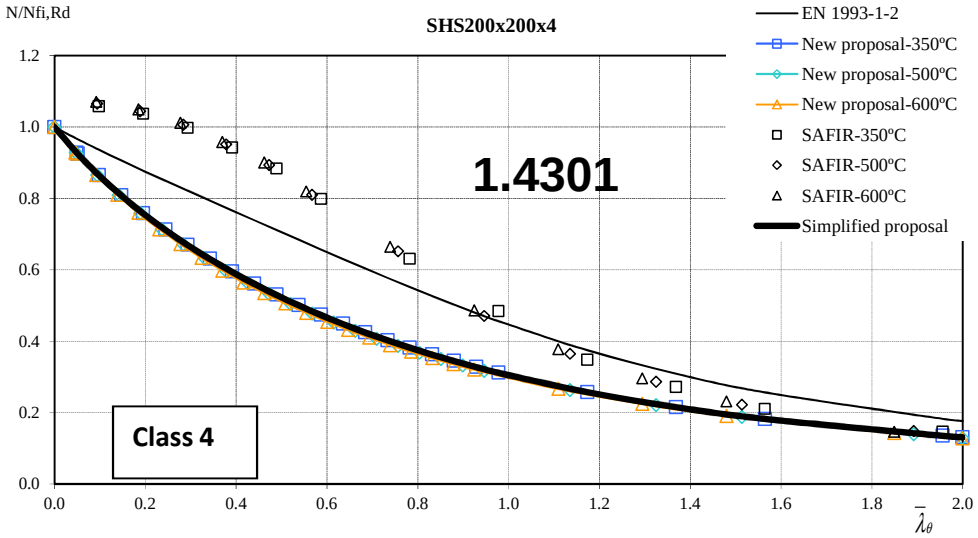
Future developments

- **Square hollow sections (SHS)**
- **Class 4 sections**
  - **SHS**
  - **I-shaped**





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Thank you for your attention

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