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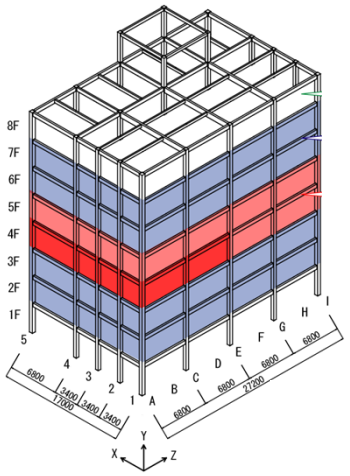
An approximation method for critical temperatures of steel members and horizontal displacements of columns

Topics



Structural fire safety design

Steel frames

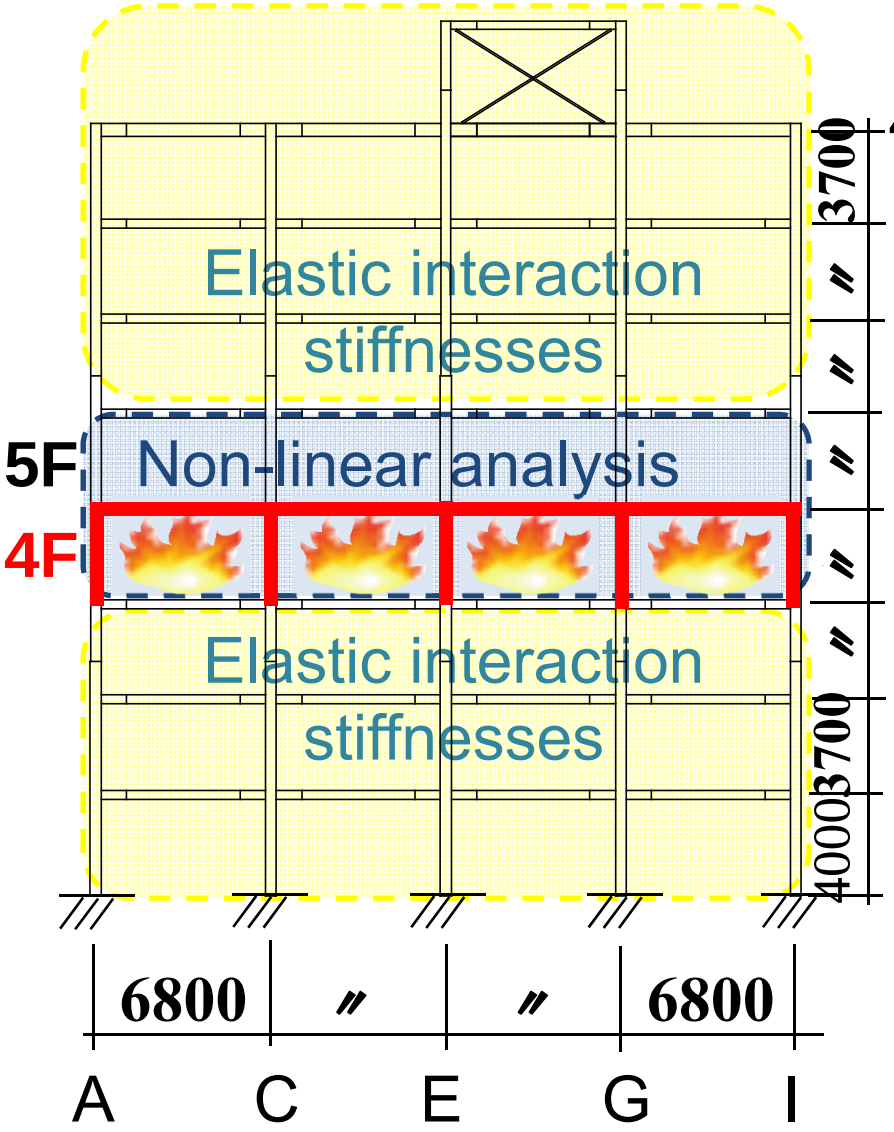
An approximation method and FE analysis

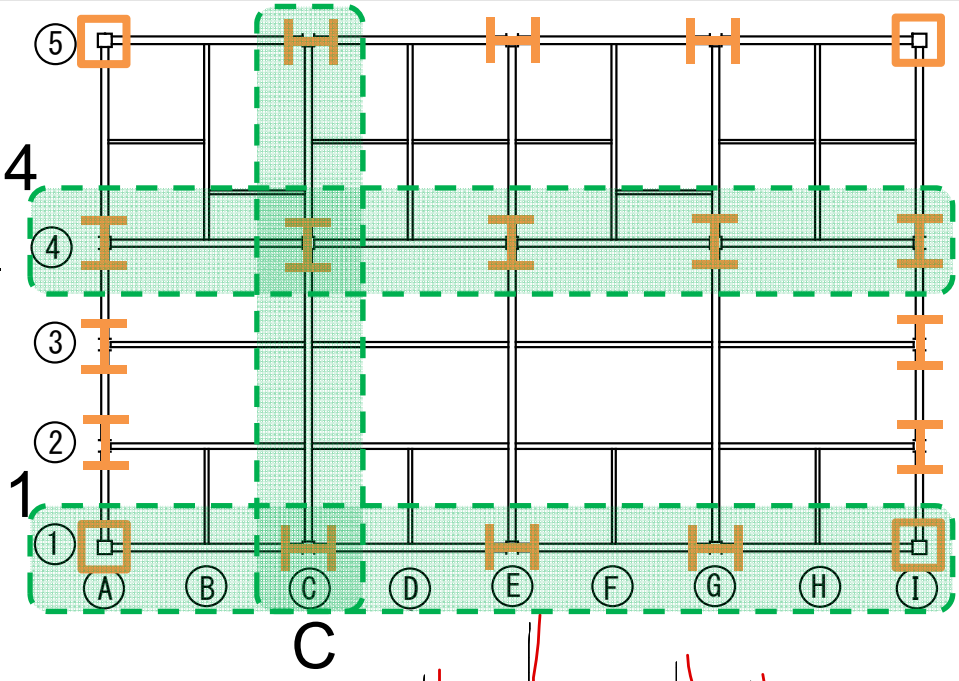
/ Horizontal displacements of columns

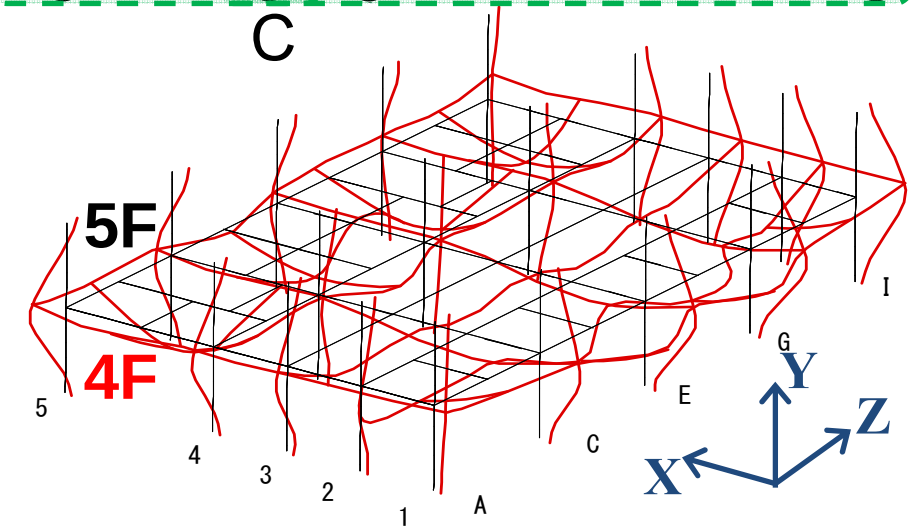
/ Critical temperatures

(AIJ recommendation and Eurocode 3)

FE analysis of a frame







steel temperature 600°C

Horizontal displacements of columns

$$\delta_1 = \varepsilon_{b1}^{th} \frac{k_{b1} \cdot \ell_{b1} - C_2 \cdot k_{c2} \cdot \ell_{b2}}{k_{b1} + k_{c1} + C_2 \cdot k_{c2}} \quad (3)$$

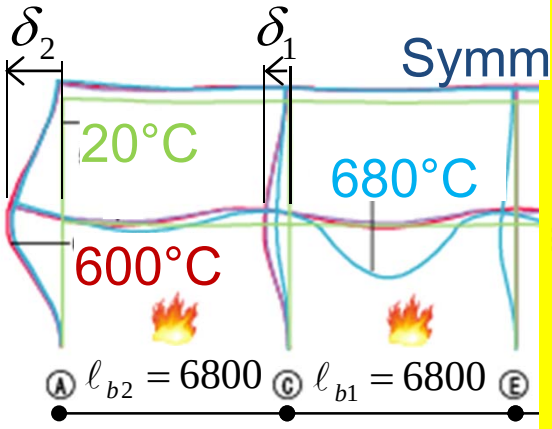
$$\delta_2 = C_2 \left(\delta_1 + \varepsilon_{b2}^{th} \cdot \ell_{b2} \right),$$

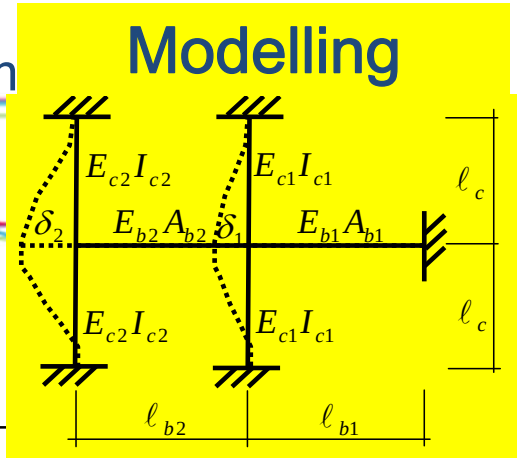
$$C_i = \frac{k_{bi}}{k_{bi} + k_{ci}},$$

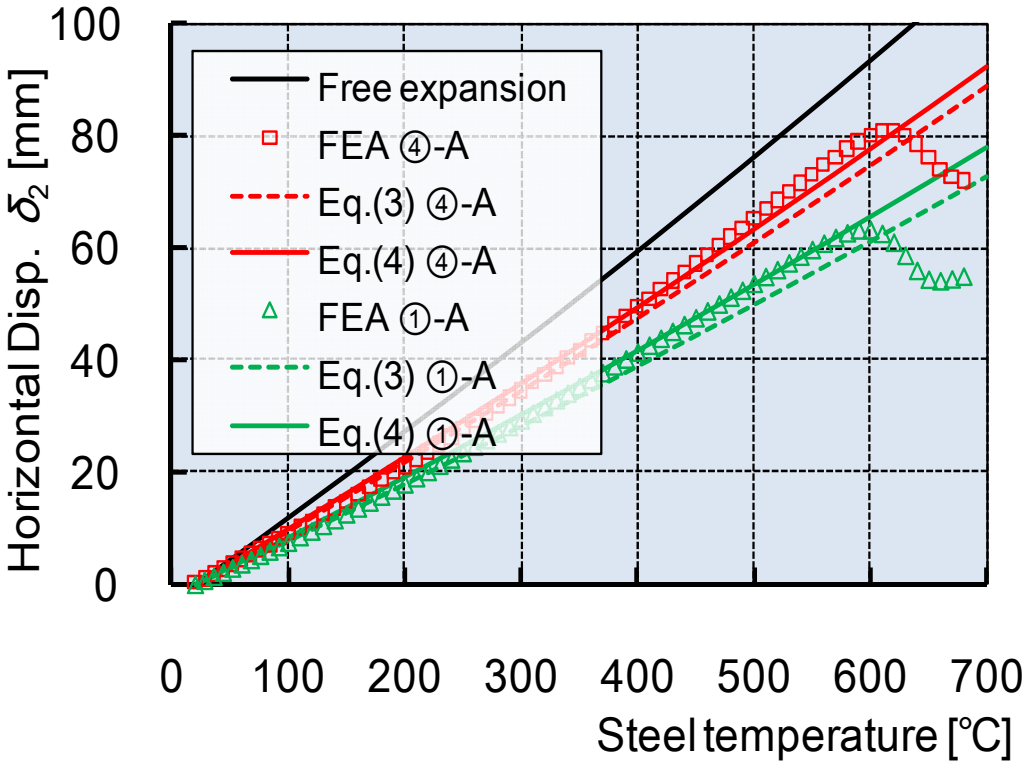
$$\delta_1 = \frac{k_{b1}}{k_{b1} + k_{c1} + k_{c2}} \varepsilon_{b1}^{th} \cdot \ell_{b1} \quad (4)$$

$$\delta_n = C_n \left(\sum_{i=1}^{n-1} \delta_i + \varepsilon_{bn}^{th} \cdot \ell_{bn} \right),$$

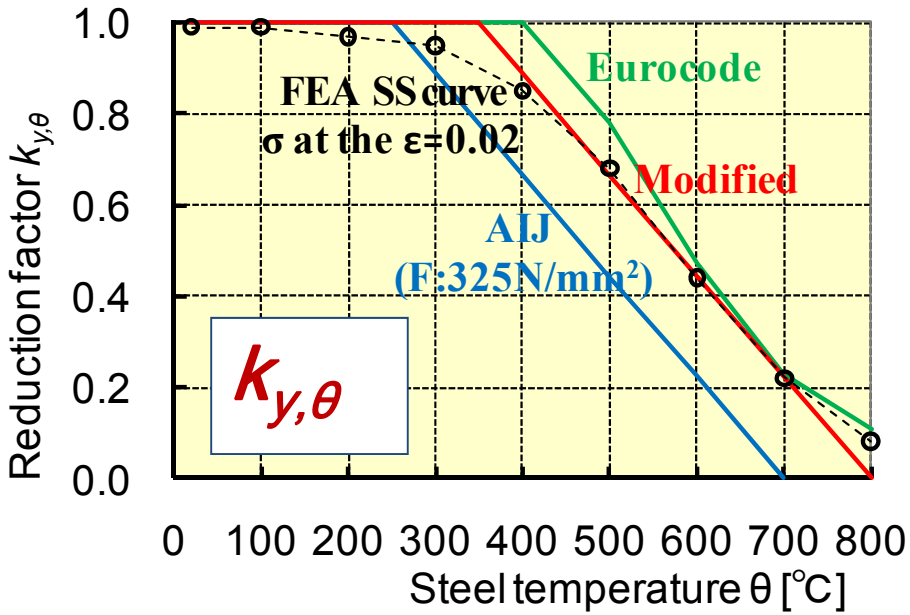
$$\delta_k = \frac{k_{bk}}{k_{bk} + \sum_{i=k}^{n} k_{ci}} \varepsilon_{bk}^{th} \cdot \ell_{bk} \quad (5)$$

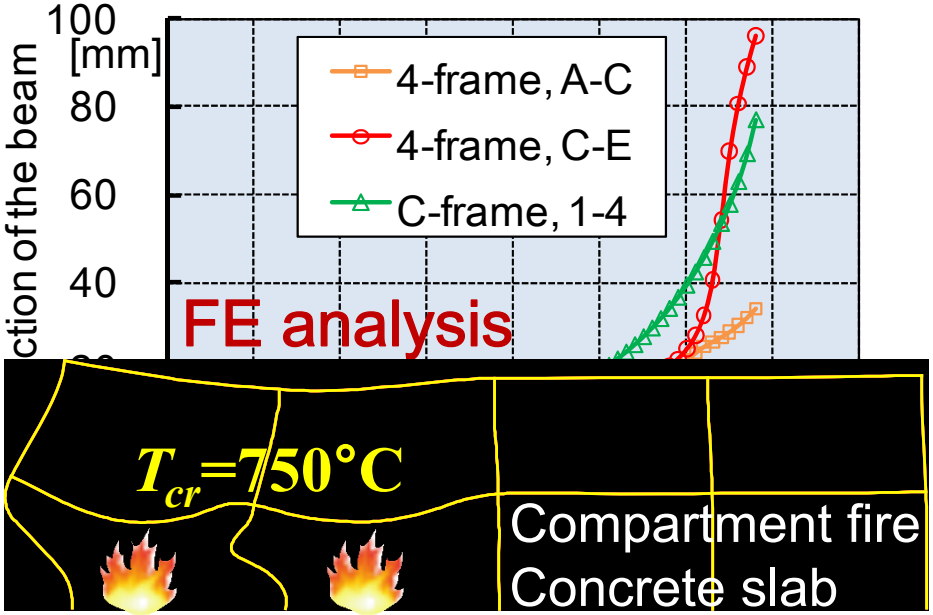


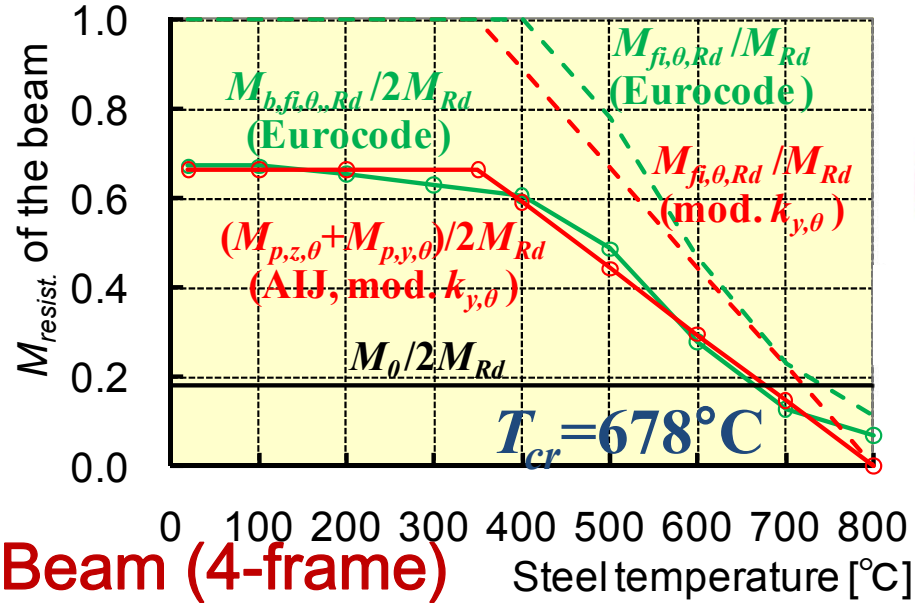


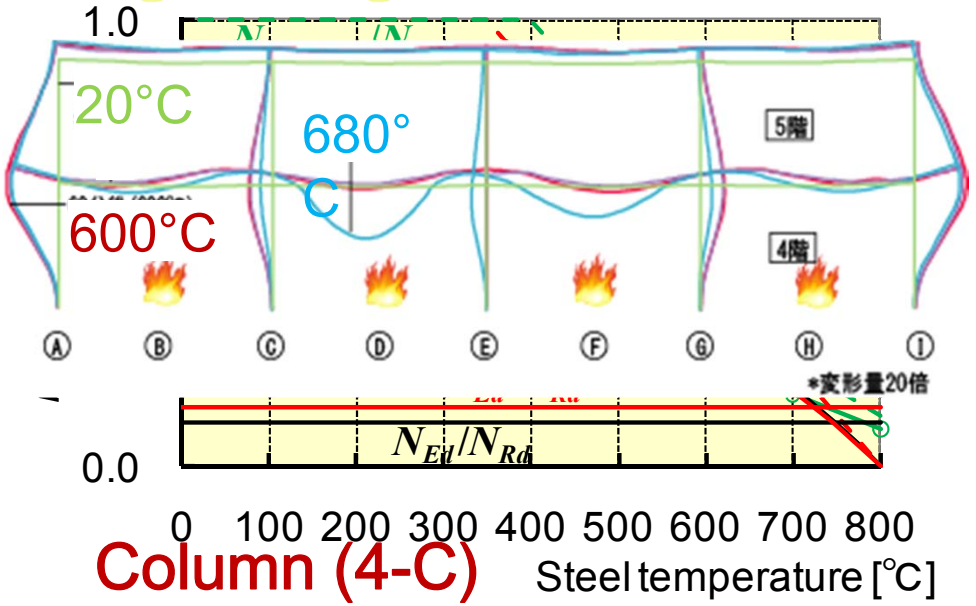


Critical Temperatures









Beam (4-frame)

Column (4-C)