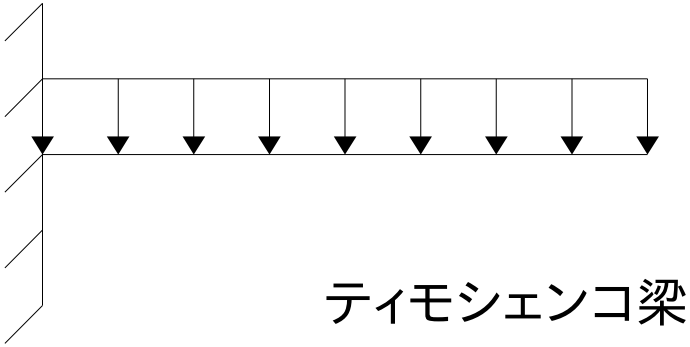
等分布荷重を受けるティモシェンコ梁解について

7510730　大道一馬

等分布荷重



ティモシェンコ梁

境界値問題による解法

$$\delta = \frac{q\ell^4}{8EI} + \frac{q\ell^2}{KGA}$$

単位荷重法

$$\delta = \frac{q\ell^4}{8EI} + \frac{q\ell^2}{2KGA}$$

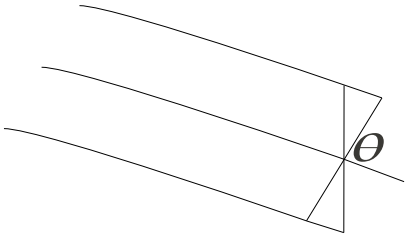
解が異なる

有限要素で解析

境界値問題による解法

$$-EI\nu'' = M$$

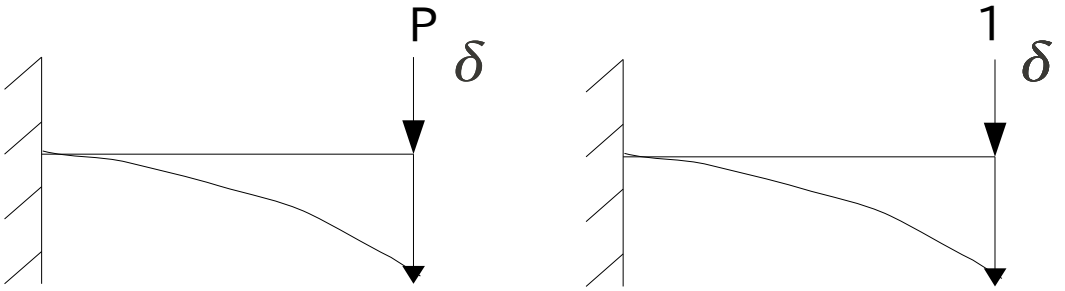
$$\theta = -\nu' + \frac{M'}{kGA}$$



単位荷重法

$$\delta = \int \frac{M\bar{M}}{EI}\,dx + \int \frac{S\bar{S}}{kGA}\,dx$$

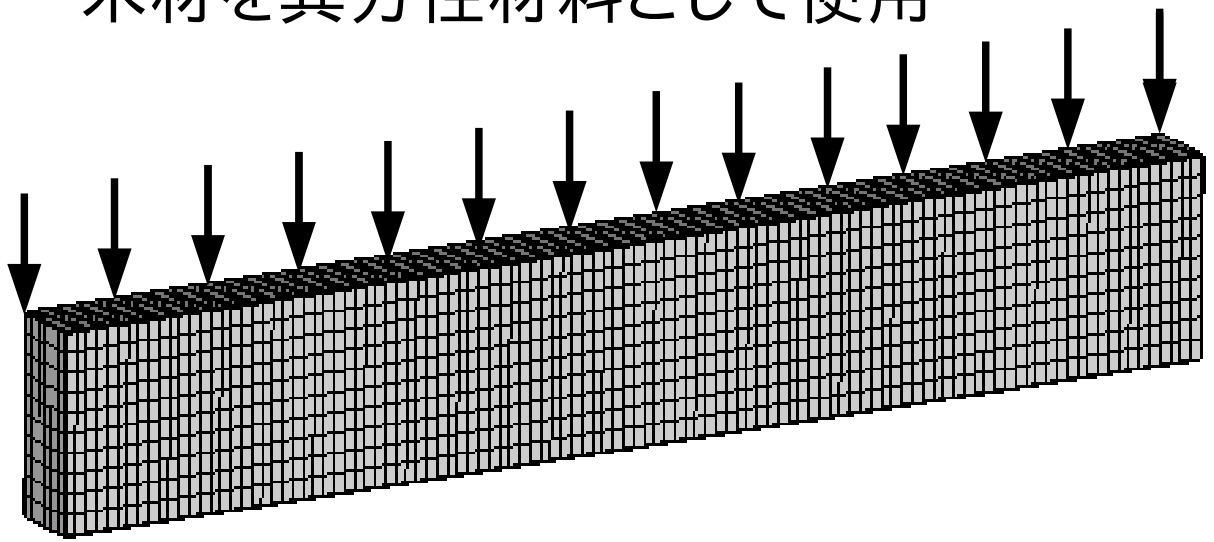
西野
長谷川(1983)



FEM解析

有限要素のcalculixで立体要素解析

木材を異方性材料として使用



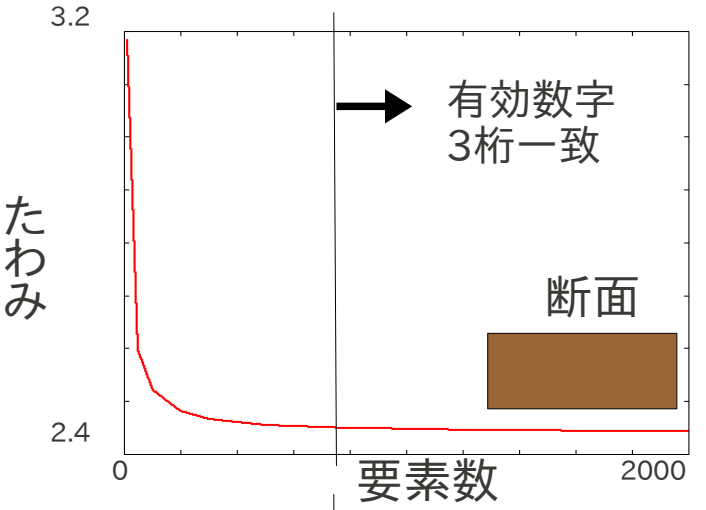
片持ち梁

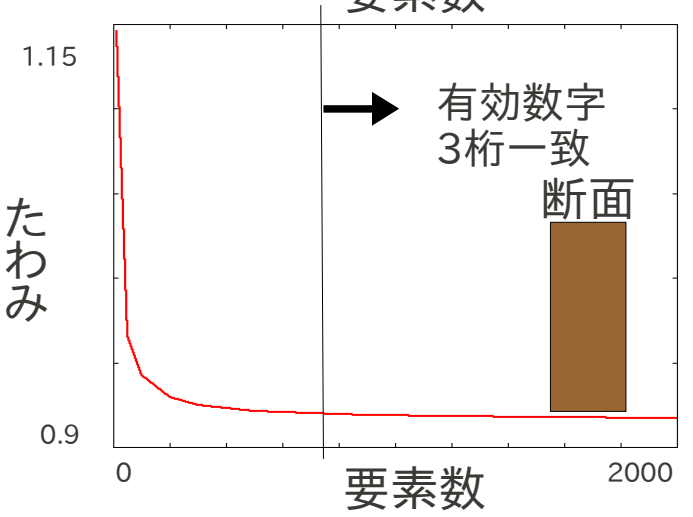
幅6×高さ10×軸2000

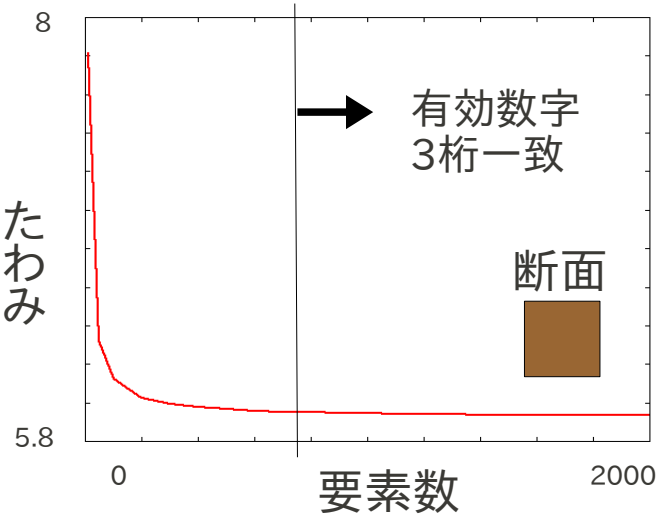
単純梁等

幅6×高さ10×軸1000

収束する



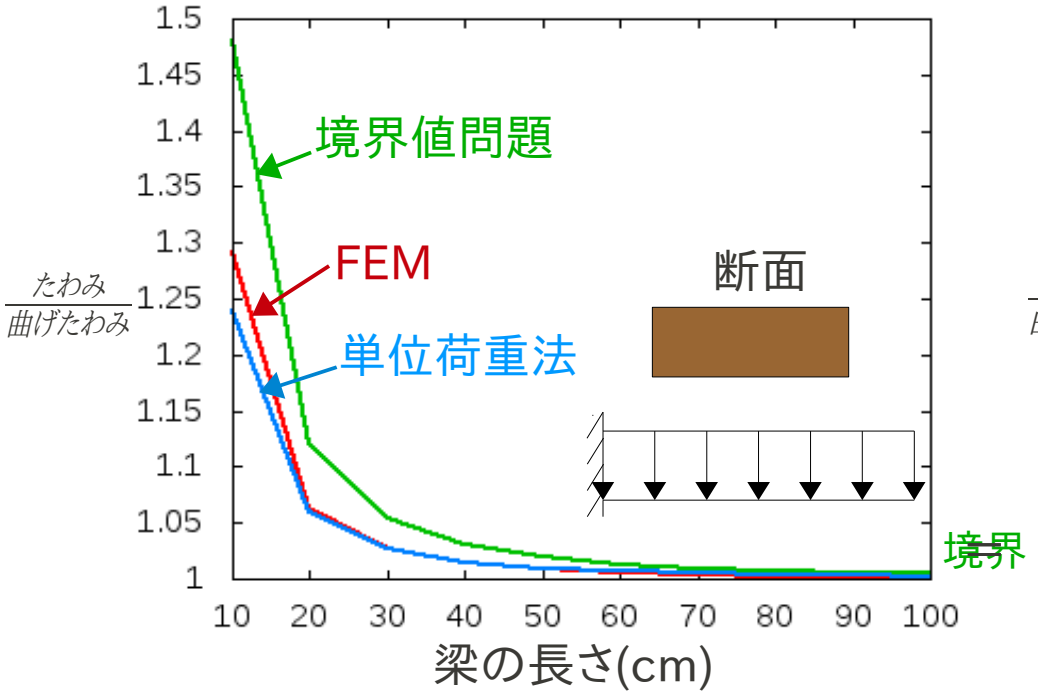


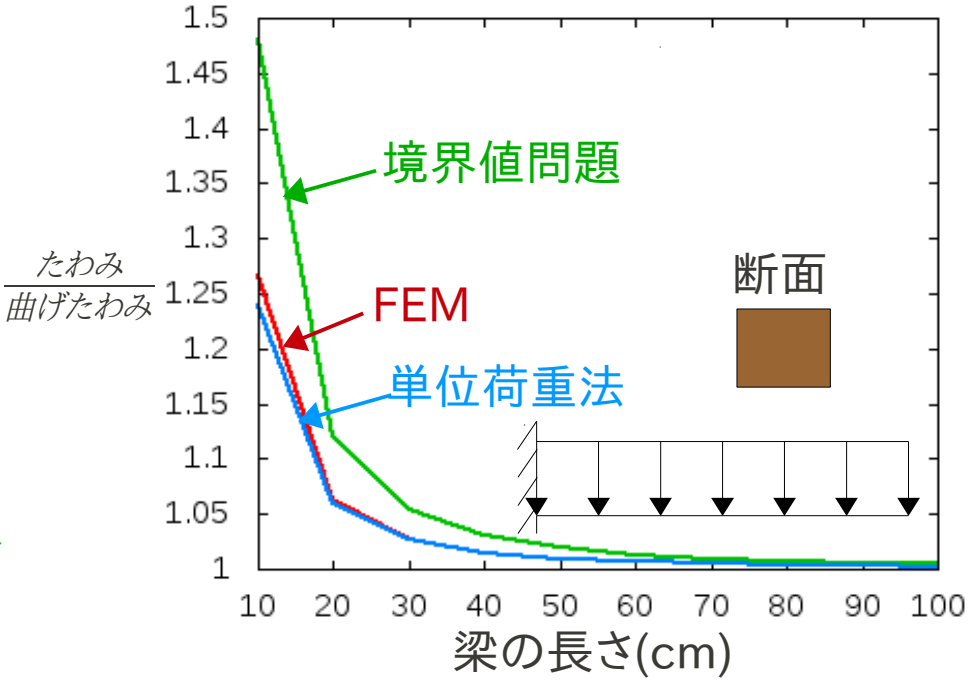


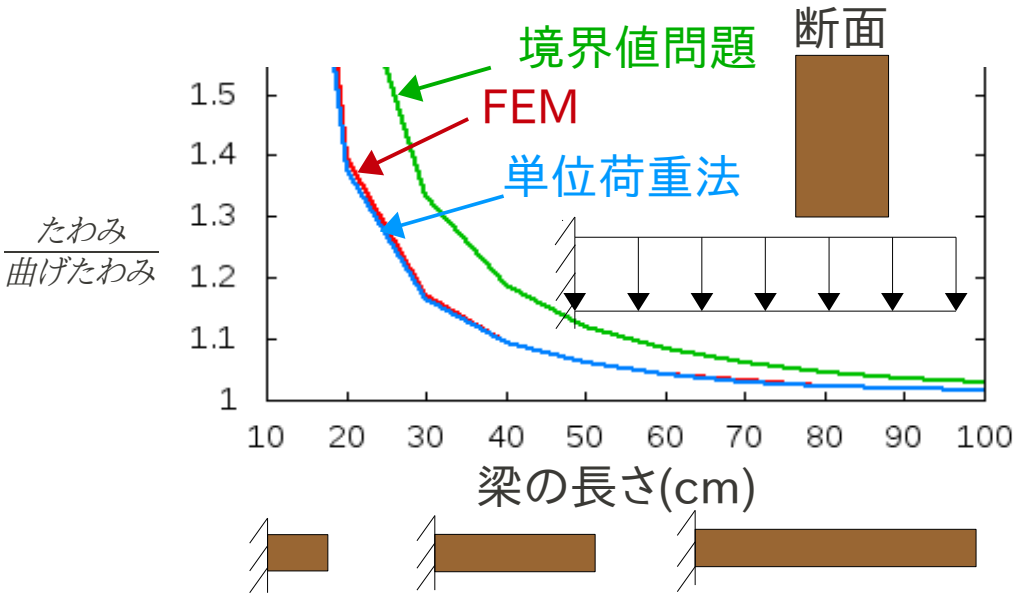
片持ち梁等分布荷重

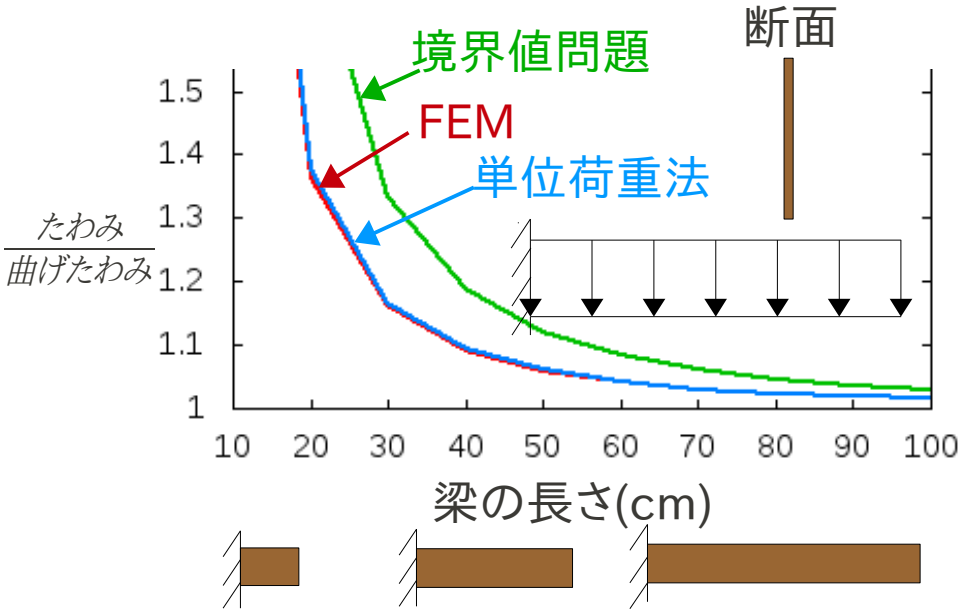
$$\delta_{境界} = \frac{q\ell^4}{8EI} + \frac{q\ell^2}{KGA}$$

$$\delta_{単位} = \frac{q\ell^4}{8EI} + \frac{q\ell^2}{2KGA}$$





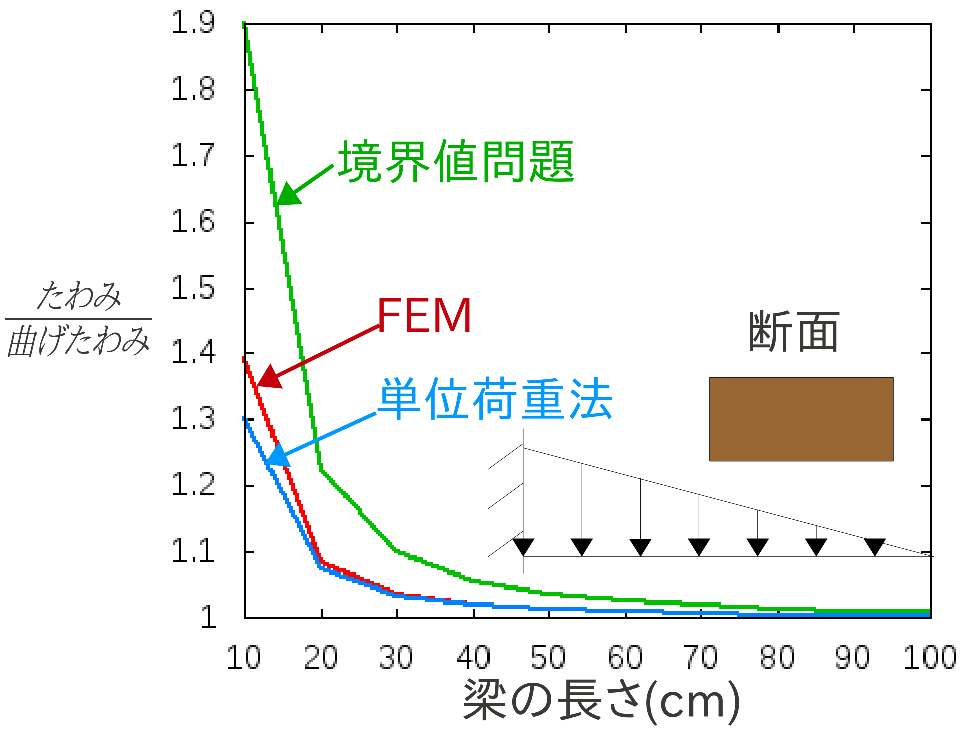


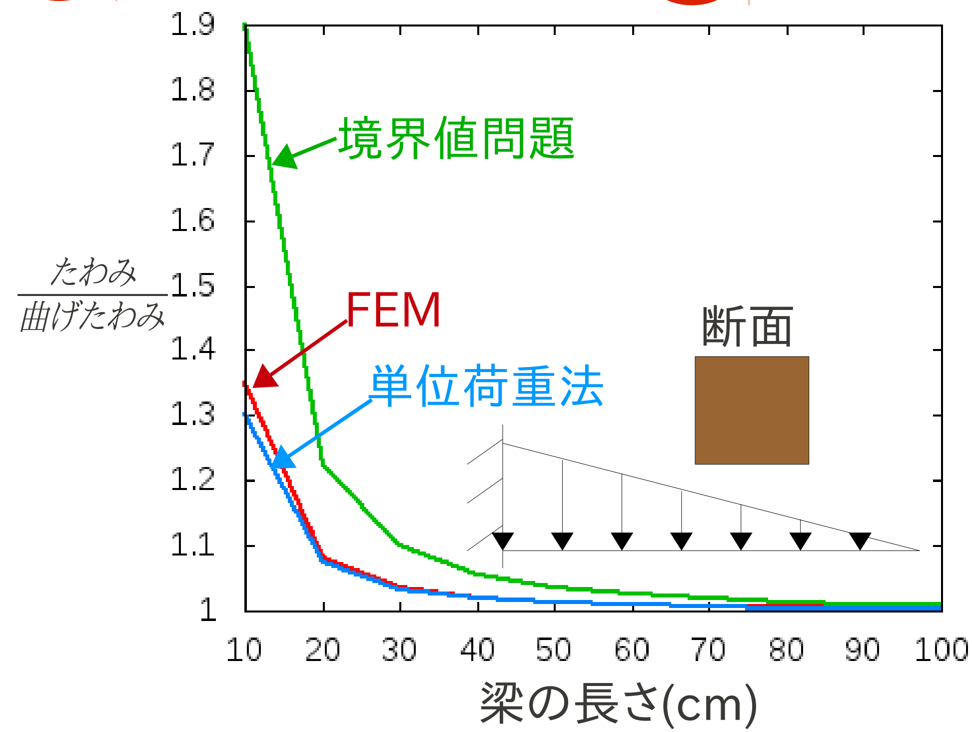


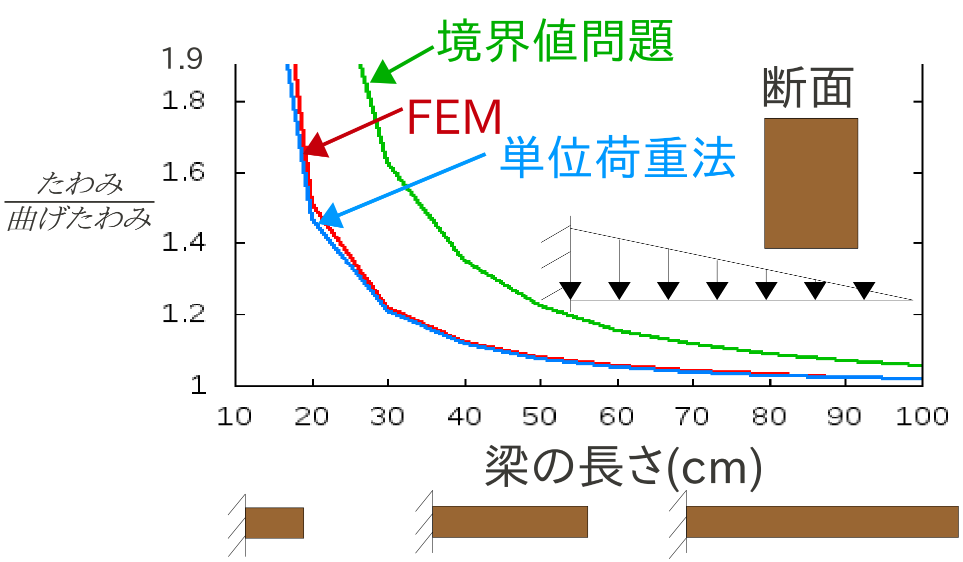
片持ち梁三角形等分布荷重

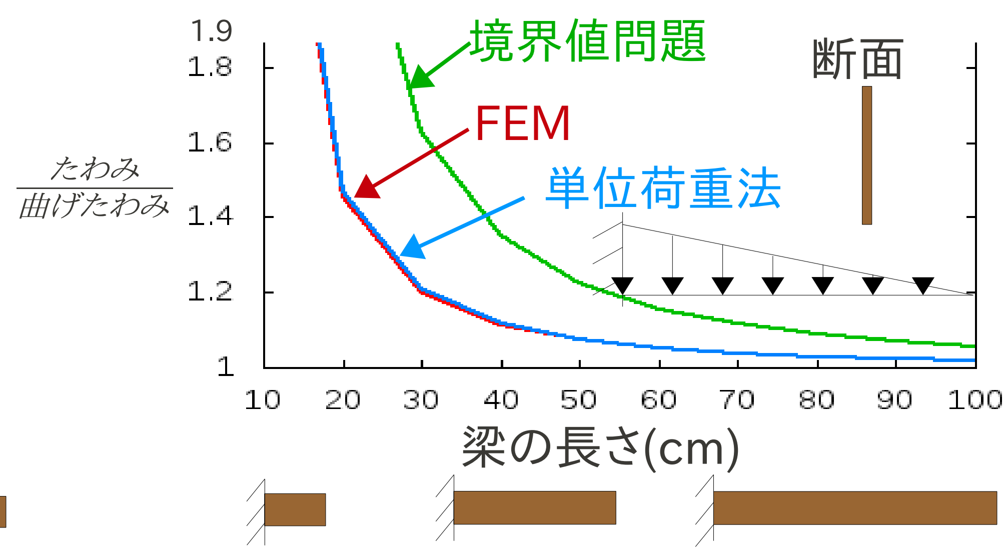
$$\delta_{境界} = \frac{q\ell^4}{30EI} + \frac{q\ell^2}{2KGA}$$

$$\delta_{単位} = \frac{q\ell^4}{30EI} + \frac{q\ell^2}{6KGA}$$





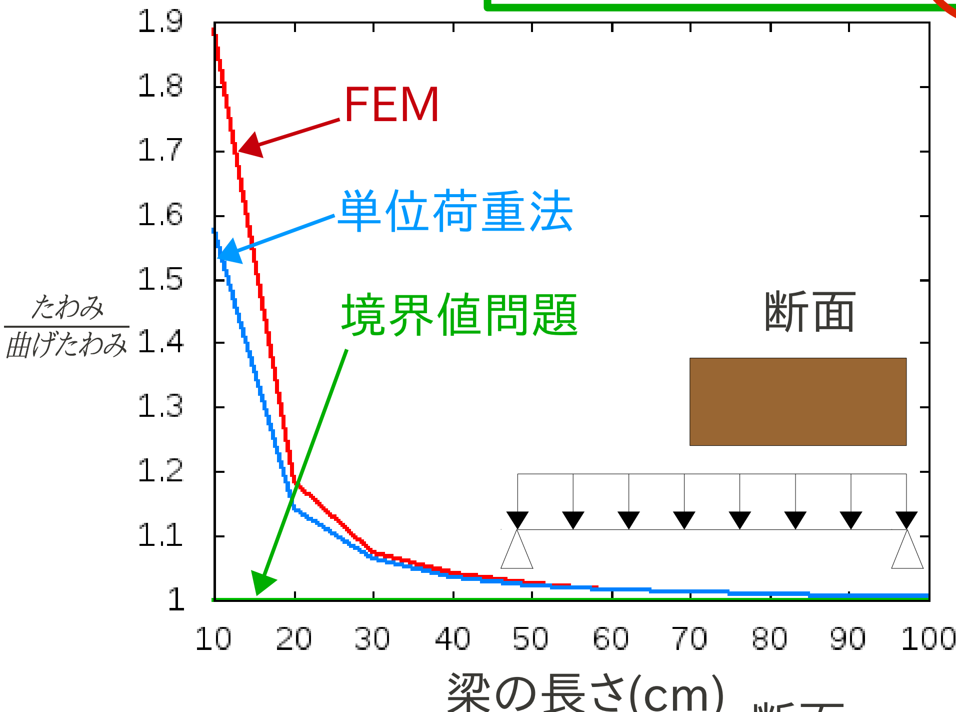


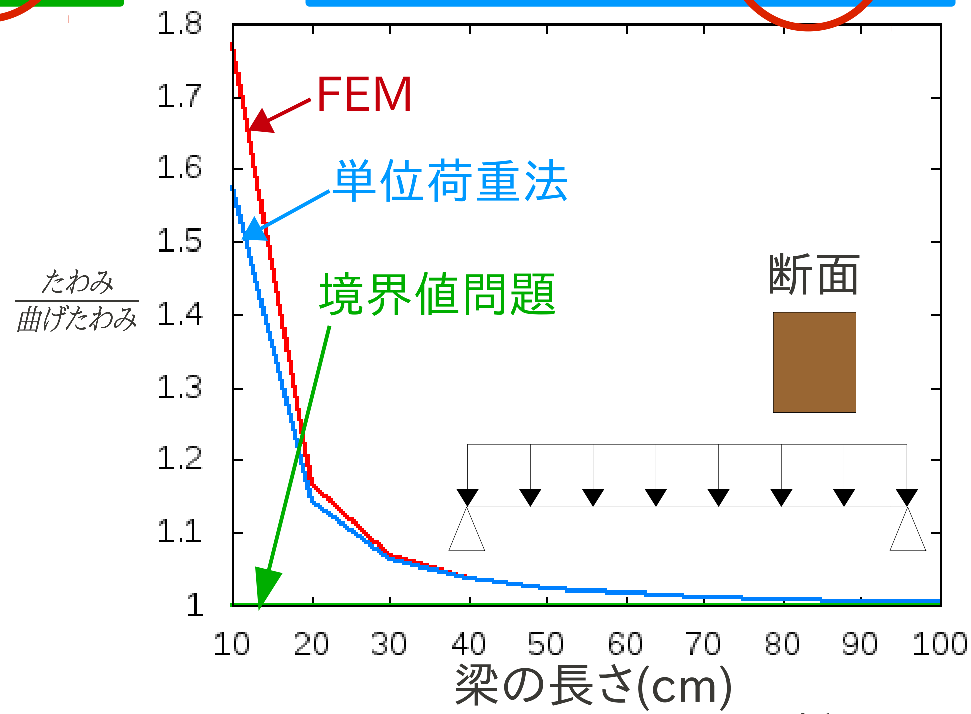


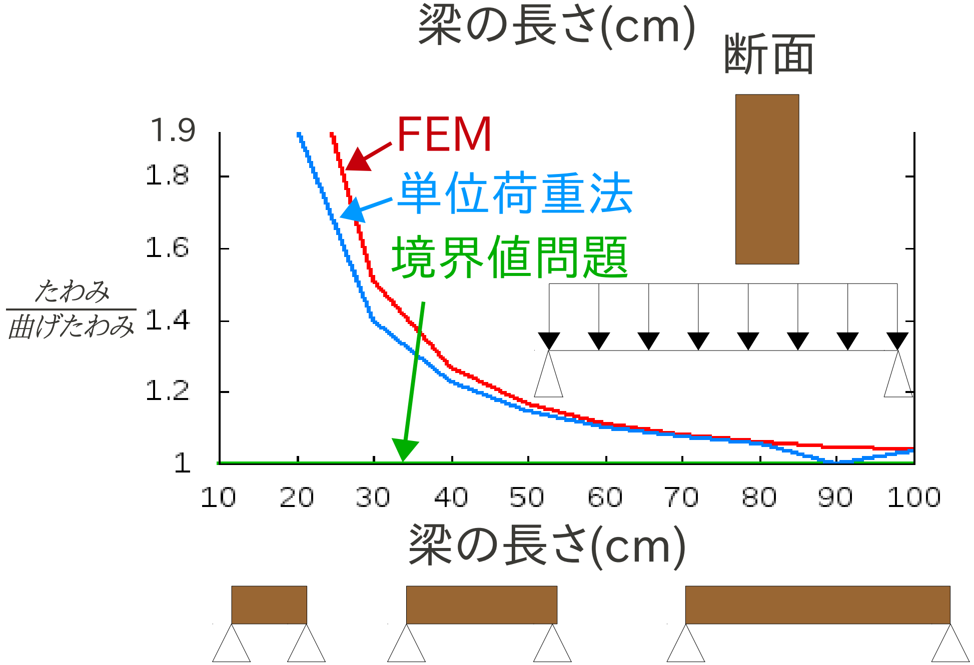
単純梁等分布荷重

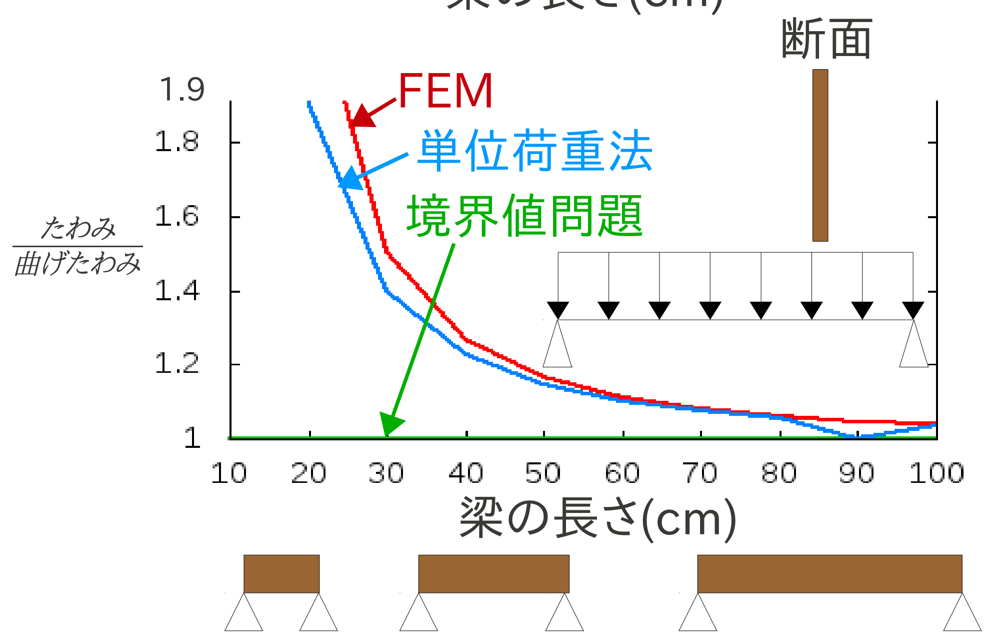
$$\delta_{境界} = \frac{5q\ell^4}{384EI}$$

$$\delta_{単位} = \frac{5q\ell^4}{384EI} + \frac{q\ell^2}{8KGA}$$

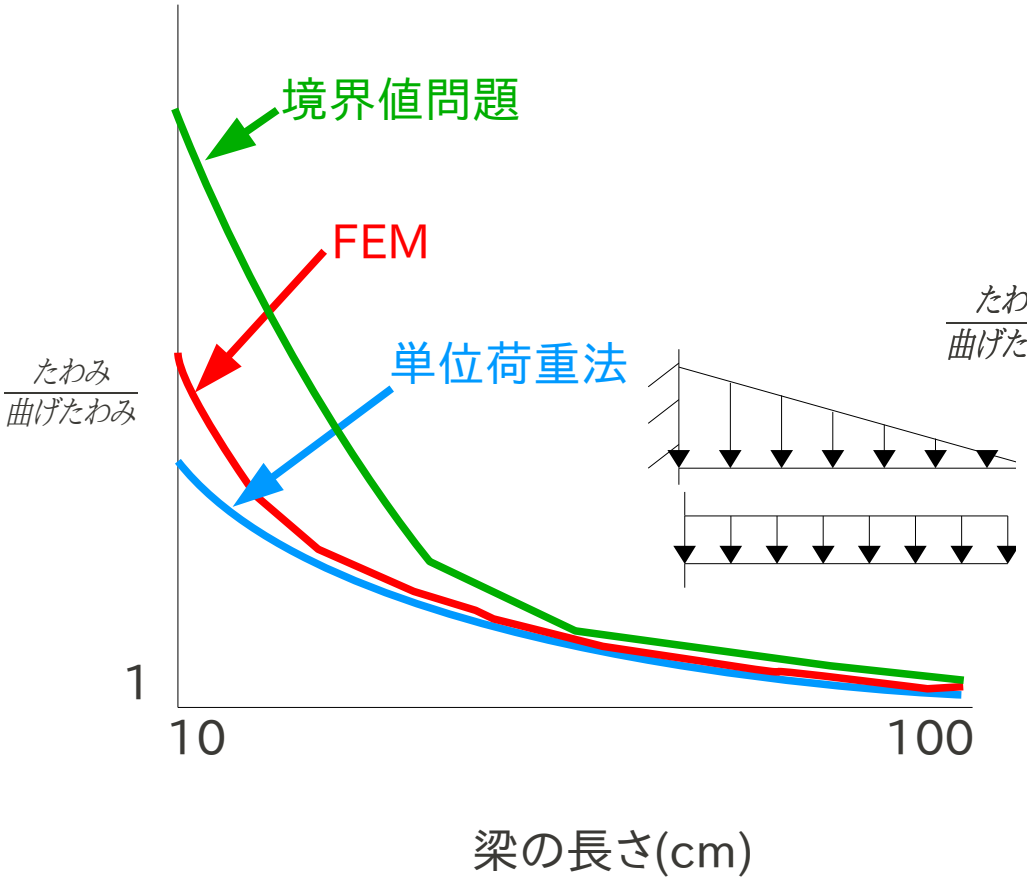


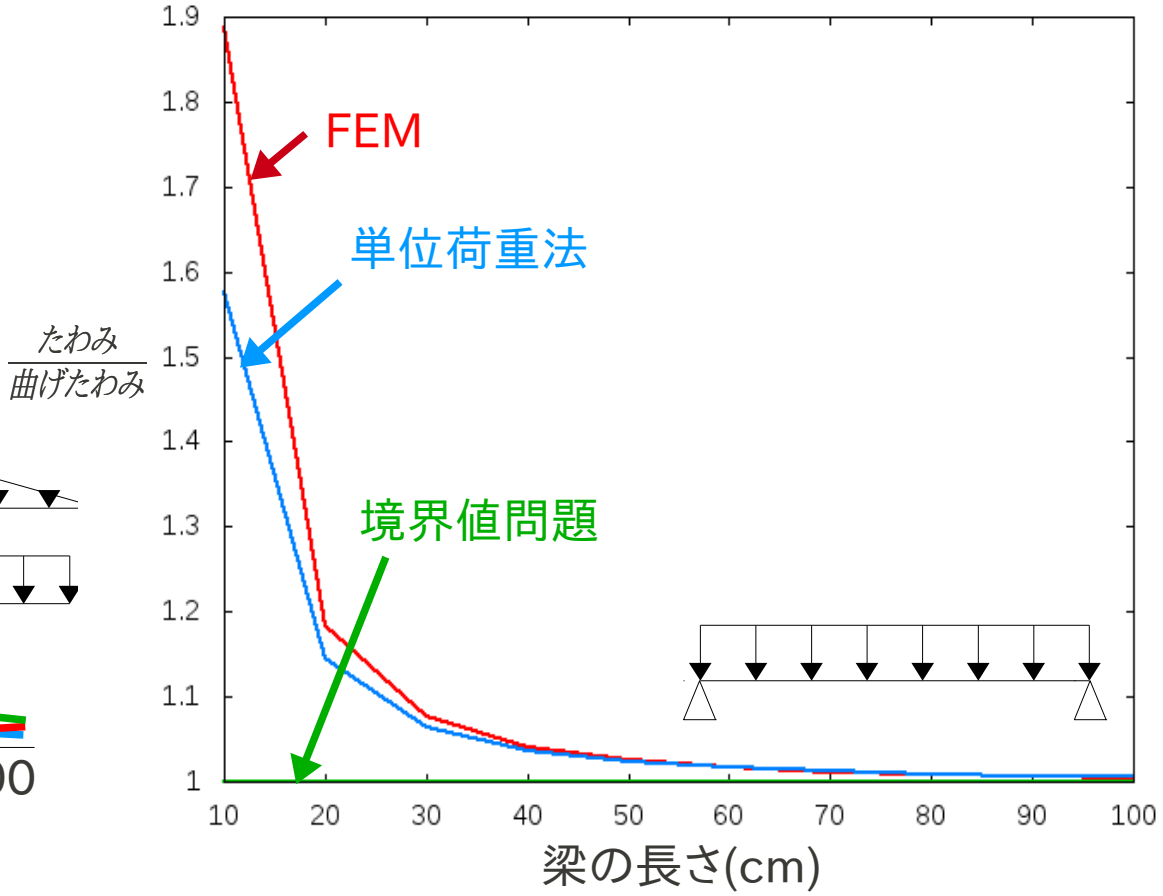






まとめ





境界値問題による解法≠FEM＝単位荷重法

(断面、梁の長さによらず)

なぜ？・・・・・・・・・・今後、三次元弾性論で検討