A véges differenciák hibája

2016. október 6.
10:06

Brook Taylor 1685-1731

METHODUS
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LONDINI
Impensis Gulielmi Innys ad Insignia Principis in Cœmeterio D. Pauli.
MDCCXVII.

Colin Maclaurin 1698-1746

$f(x)$

$$\underbrace{T(x)=\sum_{n=0}^{\infty}\frac{f^{n}(a)}{n!}(x-a)^{n}}$$

$T(x)$ fv. felírható egy ∞ sorozattal a-környezetében, ha $T(x)$ ∞-szer deriválható a-ban

$$f(x)=\underbrace{\frac{f(a)}{0!}(x-a)^0+\frac{f'(a)}{1!}(x-a)+\frac{f''(a)}{2!}(x-a)^2+\ldots}_{\text{Taylor sor}}$$

$$= f(a) + f'(a)(x-a)$$

$$\underbrace{f(x)\Big|_{a=0}=\sum_{n=0}^{\infty}\frac{f^{n}(0)}{n!}x^n=f(0)+f'(0)x+f''(0)\frac{x^2}{2}+\ldots}_{\text{Maclaurin sor}}$$

pl 1.

$$e^x\Big|_{a=0}=\frac{e^0}{0!}x^0+\frac{e^{0'}}{1!}x^1+\frac{e^{0''}}{2!}x^2+\frac{e^{0'''}}{3!}x^3+\ldots$$

$$= 1 + x + \frac{x^2}{2} + \frac{x^3}{6} + \frac{x^4}{24}\ldots$$

$$\underbrace{1 + x + \frac{x^2}{2} + \frac{x^3}{6} + \frac{x^4}{24} \dots}$$

$$e^x\Big|_{a=1} = e \doteq \underbrace{1 + 1 + \frac{1}{2} + \frac{1}{6} + \frac{1}{24}}_{\text{Taylor polinom}} + \dots$$

$N=5 \rightarrow e \approx 2.7083$

$$\underbrace{\qquad\qquad\qquad}_{\text{Taylor sor}}$$

$e = 2.718281828\dots$

No. 2

$$\cos(x)\Big|_{x=0} = \frac{\cos(0)}{0!}x^0 + \frac{-\sin(0)}{1!}x + \frac{-\cos(0)}{2!}x^2 + \frac{\sin(0)}{3!}x^3 + \dots$$

$$1 \qquad \cancel{0} \qquad -\frac{x^2}{2} \qquad \emptyset \qquad \frac{x^4}{24} \qquad \emptyset \qquad \frac{x^6}{720}$$

Taylor sor = Taylor polinom + hiba

order

$$\cos(x) = \underbrace{1 - \frac{x^2}{2!} + \frac{x^4}{4!} - \frac{x^6}{6!}} + \underbrace{O(x^8)}_{\text{hiba}}$$

$$f''(x) = \frac{f(x+dx) - 2f(x) + f(x+dx)}{dx^2}$$

$$f(x+dx) = f(x) + \frac{f'(x)}{1!}(x+dx-x)^1 + \frac{f''(x)}{2!}(x+dx-x)^2 + \frac{f'''(x)}{3!}(x+dx-x)^3 + \frac{f''''(x)}{4!}(x+dx-x)^4 + \dots$$

$$f(x+dx) = f(x) + \frac{f'(x)}{1!}(x+dx-x)^1 + \frac{f''(x)}{2!}(x+dx-x)^2 + \frac{f'''(x)}{3!}(x+dx-x)^3 + \frac{f''''(x)}{4!}(x+dx-x)^4 + \dots$$

$a = x$

$x = x+dx$

$$f(x) + dx\, f'(x) + \frac{dx^2}{2} f''(x) + \frac{dx^3}{6} f'''(x) + \frac{dx^4}{24} f''''(x)$$

$$f(x-dx) = f(x) - dx\, f'(x) + \frac{dx^2}{2} f''(x) - \frac{dx^3}{6} f'''(x) + \frac{dx^4}{24} f''''(x)$$

$$\frac{f(x+dx) - 2f(x) + f(x-dx)}{dx^2} = \frac{1}{dx^2}\left\{\begin{array}{l} \cancel{f(x)} + \cancel{f'(x)dx} + \frac{dx^2}{2} f''(x) + \cancel{\frac{dx^3}{6} f'''(x)} + \frac{dx^4}{24} f''''(x) + \dots \\ \cancel{-2f(x)} \\ \cancel{f(x)} - \cancel{f'(x)dx} + \frac{dx^2}{2} f''(x) - \cancel{\frac{dx^3}{6} f'''(x)} + \frac{dx^4}{24} f''''(x) + \dots \end{array}\right.$$

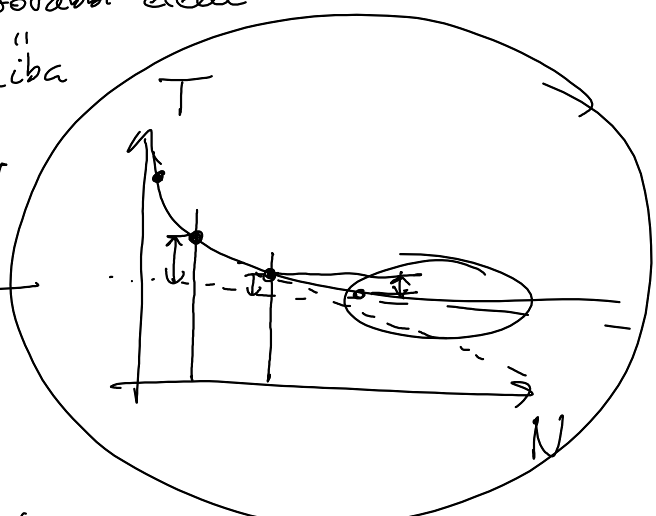
$$= \frac{1}{dx^2}\left(dx^2 f''(x) + \frac{dx^4}{12} f''''(x) + \dots \right) =$$

$$f''(x) \cong \underbrace{f''(x)}_{\text{pontos}} + \underbrace{\frac{dx^2}{12} f''''(x) + \dots}_{\text{további elem hiba}}$$

valamekkora

$\sim dx^2$

$$\rightarrow \boxed{f''(x) + O(dx^2)}$$



$$f'(x) \cong \frac{f(x+dx) - f(x)}{dx} \quad \dots \quad O(dx^{n?})$$

$$f'(x) \cong \frac{f(x+dx) - f(x-dx)}{2dx} \quad \dots \quad O(dx^{n?})$$

THERM

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15:49

Felületi állagvédelmi ellenőrzés

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$$f = \frac{\overbrace{\overline{T_s} - \overline{T_e}}^{\Delta T_{kimu-s}}}{\underbrace{\overline{T_i} - \overline{T_e}}_{\Delta T}} =$$

$$= \frac{14.7 - 0}{20 - 0} = [0 \ldots 1] \; [-]$$

$$\times \quad T_e \qquad\qquad T_s \qquad\qquad T_i$$

≥ 0.6 lélektani érték

$\Theta = f \geq 0.65$ régi MSZ

≥ 0.7 DIN 4108-2

$$f = \frac{T_s - T_e}{T_i - T_e}$$

$$\rightarrow \underline{\underline{T_s}} = T_e + f\,(T_i - T_e)$$

↳ f -értéken