수치해석 5,6주차 과제

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$cd = 0.25$
$g = 9.81$
$V = 36$

$f(x) = sqrt(g*x/cd).*tanh(sqrt(g*cd/x)*t) - V$

0) $t = 4$
$x_l^1 = 50$
$x_u^1 = 200$
$x_r^1 = (x_l^1 + x_u^1)/2 = 125$
$f(x_l^1) = -4.580$
$f(x_u^1) = 0.860$
$f(x_r^1) = -0.409$

1) $f(x_u^1) \cdot f(x_r^1) < 0$ 이므로
$x_r^1 \rightarrow x_l^2$ 가 된다.
$x_l^2 = 125$
$x_u^2 = 200$
$x_r^2 = 162.5$
$f(x_l^2) = -0.409$
$f(x_u^2) = 0.860$
$f(x_r^2) = 0.359$
$\varepsilon_a = \left|\frac{(x_{r\_new} - x_{r\_old})}{x_{r\_new}}\right| \times 100 = 23.08\%$

2) 위 단순계산을 표로 정리하면,

| 회차 | $x_l$ | $x_u$ | $x_r$ | $f(x_l)$ | $f(x_u)$ | $f(x_r)$ | $\lvert\varepsilon_a\rvert$(%) | $\varepsilon_s$(%) |
|---|---|---|---|---|---|---|---|---|
| 0 | 50 | 200 | 125 | -4.580 | 0.860 | -0.409 | × | 0.5 |
| 1 | 125 | 200 | 162.5 | -0.409 | 0.860 | 0.359 | 23.08 > 0.5 | |
| 2 | 125 | 162.5 | 143.75 | -0.409 | 0.359 | 0.021 | 13.04 > 0.5 | |
| 3 | 125 | 143.75 | 134.375 | -0.409 | 0.021 | -0.181 | 6.977 > 0.5 | |
| 4 | 134.375 | 143.75 | 139.063 | -0.181 | 0.021 | -0.077 | 3.371 > 0.5 | |
| 5 | 139.063 | 143.75 | 141.406 | -0.077 | 0.021 | -0.027 | 1.657 > 0.5 | |
| 6 | 141.406 | 143.75 | 142.578 | -0.027 | 0.021 | -0.003 | 0.822 > 0.5 | |
| 7 | 142.578 | 143.75 | 143.164 | -0.003 | 0.021 | -0.009 | 0.409 < 0.5 | |

∴ 7회차까지 계산을 반복할 시 근사상대오차 $\varepsilon_a$ 가 $\varepsilon_s$(=0.5)보다 작아진다.

수치해석 6주차 과제

20150339 김진민

$f(x)=e^{-x}-x$, $f'(x)=-e^{-x}-1$, $x_0=0$

1) $x_0=0$

$f(x_0)=1$, $f'(x_0)=-1-1=-2$

$x_1=x_0-\frac{f(x_0)}{f'(x_0)}=0-\frac{1}{-2}=0.5$

2) $x_1=0.5$

$f(x_1)=e^{-0.5}-0.5=0.106530$, $f'(x_1)=-e^{-0.5}-1=-1.606530$

$x_2=x_1-\frac{f(x_1)}{f'(x_1)}=0.5-\frac{0.106530}{-1.606530}=0.566310$, $\varepsilon_a=\left|\frac{x_2-x_1}{x_2}\right|\times 100=\frac{0.5-0}{0.5}=100(\%)$

3) $x_2=0.566310$

$f(x_2)=e^{-0.566310}-0.566310=0.001306$, $f'(x_2)=-1.567616$

$x_3=x_2-\frac{f(x_2)}{f'(x_2)}=0.566310-\frac{0.001306}{-1.567616}=0.567143$, $\varepsilon_a=\left|\frac{0.566310-0.5}{0.566310}\right|\times 100=11.7091\%$

4) $x_3=0.567143$(106)

$f(x_3)=e^{-0.567143}-0.567143=0.00000045$, $f'(x_3)=-1.567143$

$x_4=x_3-\frac{f(x_3)}{f'(x_3)}=0.567143287$, $\varepsilon_a=\left|\frac{0.567143-0.566310}{0.567143}\right|\times 100=0.146876\%$

5) $x_4=0.567143287$

$\varepsilon_a=\left|\frac{0.567143287-0.567143106}{0.567143287}\right|\times 100=0.000319\%$ < $\varepsilon_s$ 이므로 추정완료

∴ $f(x)=e^{-x}-x$ 의 근은 $x=0.567143287$