

수치해석 HW#3

(Ch4)

경북대학교 전자공학부

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수치해석 HW#3

4.11 $\cos(\frac{\pi}{3}) = \frac{1}{2}$ (true value)

1) zero-order
 $\cos(\frac{\pi}{3}) \approx 1$
 True relative error
 $\left| \frac{1-1}{1} \right| \times 100 = 100\%$

2) Approximate relative error
 0.25 (approx)

3) First-order
 $\cos(\frac{\pi}{3}) \approx 1 - \frac{(\frac{\pi}{3})^2}{2} = 0.451687$
 True relative error
 $\left| \frac{1-0.451687}{1} \right| \times 100 = 54.831\%$

4) Approximate relative error
 $\left| \frac{1-0.451687}{0.451687} \right| \times 100 = 121.4\%$

5) Second order
 $\cos(\frac{\pi}{3}) \approx 1 - \frac{(\frac{\pi}{3})^2}{2} + \frac{(\frac{\pi}{3})^4}{24} = 0.501986$
 True relative error
 $\left| \frac{1-0.501986}{1} \right| \times 100 = 49.8\%$

6) Approximate relative error
 $\left| \frac{1-0.501986}{0.501986} \right| \times 100 = 99.6\%$

7) Third order
 $f(x) \approx f(1) + 2 \cdot f'(1) + \frac{2}{3!} f'''(1)$
 $= 354 + 150 \cdot \pi \cdot \frac{1}{2} = 554$
 $(\because f'''(1) = 150)$
 $\therefore \text{Error} = 20\%$

4.16
 $f(x) = 25x^2 - 6x + 79 - 88$
 $f(2) = 15 \cdot 2^2 - 12 \cdot 2 + 7 = 283$

1) Forward
 $f(2) = \frac{f(2.05) - f(2)}{0.05} = 320.56$

2) Backward
 $f(2) = \frac{f(2) - f(1.95)}{0.05} = 248.56$

3) Central
 $f(2) = \frac{f(2.05) - f(1.95)}{0.1} = 284.56$

Centered \Rightarrow 가장 True Value에 가까움

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4.13
 $f(x) = 25x^3 - 6x^2 + 7x - 88$
 true
 $f(2) = 88$
 2nd order
 $f(x) \approx f(1) - 6 \cdot 1^2 + 7 \cdot 1 - 88 = -86$
 $\therefore \text{Error} = 2.3\%$

4.14
 $f(x) = 25x^3 - 6x^2 + 7x - 88$
 $f(2) = 88$
 $f'(x) = 75x^2 - 12x + 7$
 $f'(2) = 283$
 $f''(x) = 150x - 12$
 $f''(2) = 288$
 $f'''(x) = 150$
 $f(2) \approx f(1) + f'(1) + \frac{f''(1)}{2} + \frac{f'''(1)}{6}$
 $= 88 + 283 + \frac{288}{2} + \frac{150}{6} = 554$
 $\therefore \text{Error} = 20\%$

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4.22 Matlab code

```
function diffex(func, dfunc, x, n)
    format long
    dftrue=dfunc(x);
    h=1;
    H(1)=h;
    D(1)=(func(x+h)-func(x-h))/(2*h);
    E(1)=abs(dftrue-D(1));

    for i=2:n
        h=h/10;
        H(i)=h;
        D(i)=(func(x+h)-func(x-h))/(2*h);
        E(i)=abs(dftrue-D(i));
    end
    L=[H' D' E]';
    fprintf('    step size    finite difference    true error\n');
    fprintf('%14.10f %16.14f %16.13f\n',L);
    loglog(H,E),xlabel('Step Size'),ylabel('Error')
    title('Plot of Error Versus Step Size')
    format short

    ff=@(x) cos(x);
    df=@(x) -sin(x);
    diffex(ff, df, (pi/6), 11)
```

```
>> diffex
```

입력 인수가 부족합니다.

오류 발생: **diffex** (line 3)

```
dftrue=dfunc(x);
```

책에 있는 그대로 코드를 쳤으나 인수가 부족하다는 오류가 발생했습니다.

4.25 Matlab code

시간이 부족하여 풀지 못했습니다. 죄송합니다.