第二周作业

软件学院　17S4060　[illegible]

2.4 写出增量线性化方程

在(x_0, y_0)附近将非线性函数展开成泰勒级数

(这里省略高阶项)

$$y_0 + \Delta y = 2x_0 + 0.5x^3 + (2 + 1.5x^2)\Big|_{x=x_0}\Delta x$$

$$\Rightarrow \quad \Delta y = 3.5\Delta x$$

2.6 求象函数

(1) $\varphi(1-e^{-\frac{t}{T}}) = \varphi(1) - \varphi(e^{-\frac{t}{T}})$

$$= \frac{1}{s} - \frac{1}{s+\frac{1}{T}} = \frac{1}{s(Ts+1)}$$

(3) $\varphi(\sin(5t+\frac{\pi}{3})) = \varphi(\frac{1}{2}\sin 5t) + \varphi(\frac{\sqrt{3}}{2}\cos 5t)$

$$= \frac{1}{2}\cdot\frac{5}{s^2+25} + \frac{\sqrt{3}}{2}\frac{s}{s^2+25}$$

2.7 求解微分方程

(3) $\ddot{c}(t) + 2\dot{c} + c(t) = 1(t)$

两边取拉式变换

令 $C(s) = L(c(t))$

$$s^2C(s) - sc(0) - \dot{c}(0) + 2(sC(s) - c(0)) + C(s) = \frac{1}{s}$$

初始条件为0得

$$s^2C(s) + 3sC(s) = \frac{1}{s}$$

$$C(s) = \frac{1}{s^2(s+3)} = \frac{1}{9}\left(\frac{3}{s^2} - \frac{1}{s} + \frac{1}{s+3}\right)$$

$$c(t) = \frac{1}{3}t - \frac{1}{9} + \frac{1}{9}e^{-3t}$$