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System Simulation
Midterm Problem 2

$$H_p(z) = \frac{T\left(\frac{14}{11}z - \frac{8}{11}\right)}{z^2 - \frac{16}{11}z + \frac{5}{11}} \qquad \alpha_2 = 1 \quad \alpha_1 = -\frac{16}{11} \quad \alpha_0 = \frac{5}{11}$$
$$\beta_2 = 0 \quad \beta_1 = \frac{14}{11} \quad \beta_0 = -\frac{8}{11}$$

A) 3rd order accuracy since it satisfies 3 Lambert equations

B) $pLTE_p[k] = C_p T^{(M+1)} x^{(M+1)} \approx \frac{C_p}{C_p - C_c}\left(X_c[k] - X_p[k]\right)$

$$= \frac{C_p}{C_p - C_c}\left(X_c - X_p\right)[k-1]$$

$$C_p = C_3 = \frac{8}{6} + \frac{1}{6}\alpha_1 - 2\beta_2 - \frac{1}{2}\beta_1$$
$$= \frac{8}{6} + \frac{1}{6}\left(-\frac{16}{11}\right) - 2(0) - \frac{1}{2}\left(\frac{14}{11}\right)$$
$$= \frac{5}{11}$$

$$C_c = C_4 = \frac{16}{24} + \frac{1}{24}\alpha_1 - \frac{8}{6}\beta_2 - \frac{1}{6}\beta_1$$
$$= \frac{16}{24} + \frac{1}{24}\left(-\frac{236}{151}\right) - \frac{8}{6}\left(\frac{70}{151}\right) - \frac{1}{6}\left(\frac{44}{151}\right)$$
$$= \frac{16}{24} - \frac{59}{906} - \frac{280}{453} - \frac{22}{453}$$
$$= \boxed{\frac{49}{302}}$$

$$pLTE_p = \frac{C_p}{C_p - C_c} \cdot T = \frac{\frac{5}{11}}{\frac{5}{11} - \frac{49}{302}} = \boxed{\frac{1510}{971} = 1.5551 \cdot T}$$

C) See matlab attached

D) secondary domain is not relatively easy to obtain with my transfer function

E) see secondary plot w/ shading