

Engineering Trips Part IIB
2014

Paper 4F2 : Robust and Nonlinear Systems and Control
Answers

1. (a) $\| (I - G_0K)^{-1}G_0K \|_\infty < \frac{1}{\epsilon}$
(b) (i)

$$T(s) = \frac{1}{s+1} \begin{bmatrix} 1 & a \\ -a & 1 \end{bmatrix}$$

(iii) $\epsilon_{max} = \frac{1}{\sqrt{1+a^2}}$

2.

3. (b) (ii) For instance an eight-loop: $\omega(x)$ union of equilibrium and homoclinic orbits.
(d) For instance a damped pendulum, Lyapunov function = energy, derivative is non negative but zero when velocity is zero.

4. (b) (i) $H(s) = \frac{Cs}{LCs^2 - Cs + 1}$, $\phi(y) = y^3$.
(ii) $\frac{3a^2}{4\pi}$
(iii) $\omega = \frac{1}{\sqrt{LC}}$