بنام آنکه جان را فکرت آموخت

کنترل غیرخطی

آزمون پایانی – کتاب و کامپیوتر آزاد

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زمان آزمون: ۲/۳۰ ساعت +
۱۵ دقیقه برای بارگذاری

PROBLEM 1: (25%)

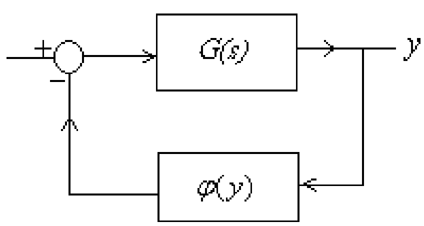
Using Chetaev's theorem prove that the following system has an unstable equilibrium point at the origin.

$$\dot{x}_1 = x_1^3 + 2x_2^3$$

$$\dot{x}_2 = x_1 x_2^2 + x_2^3$$

PROBLEM 2: (15%)

Study the absolute stability of the following system. Using the circle criterion, find the largest possible stability sector for the following scalar transfer function.



$$G(s) = \frac{2(-s+1)}{s(s+1)(s+2)}$$

PROBLEM 3: (25%)

Show that following system:

$$\dot{x}_1 = a(x_2 - x_1)$$

$$\dot{x}_2 = bx_1 - x_2 - x_1 x_3 + u$$

$$\dot{x}_3 = x_1 + x_1 x_2 - 2a x_3$$

in which, a, b are positive constants, is input-state feedback linearizable and design a state feedback control to globally stabilize the origin.

PROBLEM 4: (35%)

Consider the following system

$$\dot{x}_1 = 5x_1 - 6x_2 + \frac{x_2^2}{x_1}$$

$$\dot{x}_2 = \gamma_1 x_1 \cos(x_2) + \gamma_2 x_2^2 + u$$

Where parametric uncertainties are $|\gamma_1| < 4$ and $|\gamma_2| < 2$. Consider the sliding manifold $S = x_2 - \alpha x_1 = 0$ with $\alpha \in \mathbb{R}$ (a constant).

a) Determine the acceptable values of α in order for $\|x\|$ to be finite on the sliding manifold S.

b) Design a sliding mode controller so that the sliding manifold S is globally asymptotically stable for the α obtained in Part a. Determine the necessary conditions for the stability of the system in the presence of worst uncertainty.

c) Use continuous controller to reduce the chattering, what would be the final value of steady-state errors in this case.

Good Luck