MAE 281A Prof. M. Krstic

NONLINEAR SYSTEMS Winter 2000

FINAL EXAM

Take home. Open books and notes.

Total points: 50

Due Tuesday, March 21, 2000, at 2:00 pm in Professor Krstic's office.

Late submissions will not be accepted. Collaboration not allowed.

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1. (12 pts) Show that the following system is ISS

$$\begin{aligned}\dot{x}_1 &= -x_1^3 + x_1^2 x_2 \\ \dot{x}_2 &= -x_2^5 + x_2^2 u\end{aligned}$$

2. (12 pts) Using the center manifold theorem, determine whether the origin of the following systems is asymptotically stable:

(a) Khalil, Problem 4.7, Part (1)

(b) Khalil, Problem 4.9, only for $a = 0$

3. (14 pts) Using averaging theory, solve the following problems:

(a) Khalil, Problem 8.11, Part (2)

(b) Khalil, Problem 8.15, Part (6)

4. (12 pts) Using singular perturbation theory, study stability of the origin of the systems from the following problems:

(a) Khalil, Problem 9.17

(b) Khalil, Problem 9.19

Note: Ignore the questions asked in those problems but answer the question asked here!