Spring Semester   Differential Equations   2017

Linear Stability Homework

For each of the systems in problems 1–4 below:

(i) Determine whether the equilibrium is hyperbolic or non-hyperbolic.

(ii) Sketch the phase plane.

(iii) Write down the stable, unstable, and center subspaces (using only real vectors).

(iv) Determine whether the system is linearly stable, asymptotically stable, both or neither.

1.

$$\dot{x} = 3x - y$$
$$\dot{y} = 2x$$

2.

$$\dot{x} = 2y$$
$$\dot{y} = -2x$$

3.

$$\dot{x} = x + 4y$$
$$\dot{y} = 2x + 3y$$

4.

$$\dot{x} = -x - y$$
$$\dot{y} = 2x - 3y$$