

1. How many equilibrium states can be born at bifurcations of the following system?

$$\begin{cases} \dot{x} = y + x^2 - z^2, \\ \dot{y} = z + x^2 + y^2 + z^2, \\ \dot{z} = 2y - z + x^2 - 4yz. \end{cases}$$

2. Draw the bifurcation diagram on the plane of parameters  $(a, b)$  for the following system:

$$\begin{cases} \dot{x} = -y - x - b, \\ \dot{y} = -x - y^4 + y^2 + ay. \end{cases}$$

3. For each value of the (real) coefficient  $a$ , determine how many periodic orbits can be born at bifurcations of the zero equilibrium state of the following system:

$$\begin{cases} \dot{x} = -y, \\ \dot{y} = x - ax^2 + xy. \end{cases}$$

Are they stable or unstable?