

# INLDS Practicum 13

Use the MATLAB bifurcation software `MatCont` to study the following systems and try to understand essential features of their phase portraits by relating your observations with the theory.

## Exercises

### Ex.1 Arneodo system with a saddle-focus homoclinic bifurcation

$$\begin{cases} \dot{x} &= y, \\ \dot{y} &= z, \\ \dot{z} &= cx - by - z - x^2. \end{cases} \quad (1)$$

Fix  $b = 0.5$  and simulate the system at  $c = 0.960$  and  $c = 0.965$ . Which Shilnikov bifurcation happens between these two parameter values? Approximate the bifurcation parameter value  $c_{HOM}$  numerically.

### Ex.2 “Blue-sky” bifurcation in Gavrilov-Shilnikov system

$$\begin{cases} \dot{x} &= x(2 + \mu - b(x^2 + y^2)) + z^2 + y^2 + 2y, \\ \dot{y} &= -z^3 - (y + 1)(z^2 + y^2 + 2y) - 4x + \mu y, \\ \dot{z} &= z^2(y + 1) + x^2 - \varepsilon. \end{cases} \quad (2)$$

Fix  $(b, \varepsilon) = (10, 0.02)$  and simulate the system at  $\mu = 0.4$  and  $\mu = 0.25$ . Which bifurcation happens between these two parameter values? Approximate the bifurcation parameter value  $\mu_{BS}$  numerically.

## Homework

There is no hand-in exercise.