Model Documentation of the Winkler System

1 Nomenclature

1.1 Nomenclature for Model Equations

x	x-coordinate
y	y-coordinate

2 Model Equations

State Vector:

$$\underline{x} = (x\ y)^T \qquad\qquad = (x_1\ x_2)^T$$

System Equations:

$$\dot{x}_1 = 2x_2 \tag{1a}$$

$$\dot{x}_2 = (x_1 + x_2)(-(x_1 - x_2)^2 + 1) \tag{1b}$$

3 Derivation and Explanation

The Winkler System is nonlinear and unstable. It has three rest positions, one spiral source in (-1, 0), one spiral source in (1, 0) and one saddle point in (0, 0). You can recognize the symmetry to the point of origin.

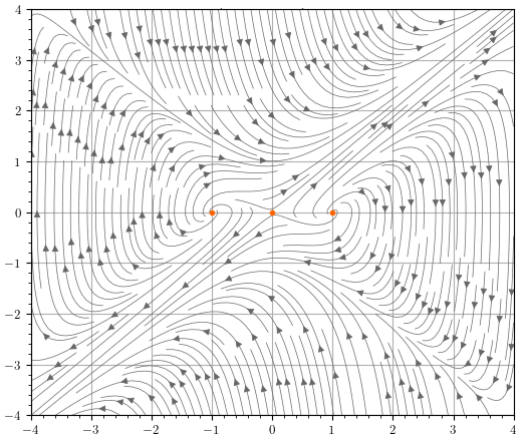

Figure 1: Phaseplane

4 Simulation

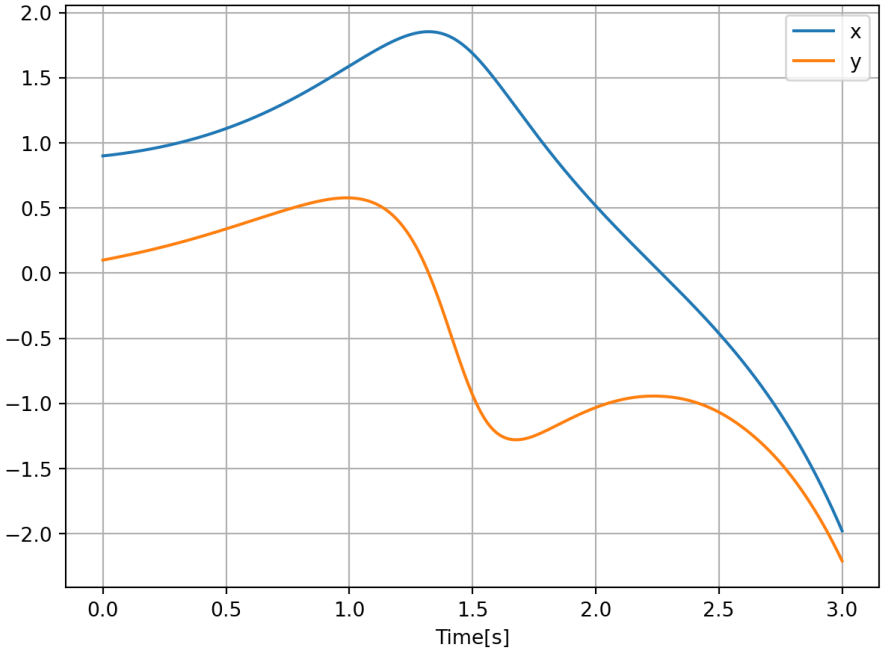

Figure 2: Simulation of the Winkler system.

References

[1] J. Winkler: *Lecture Notes "Nonlinear Control Systems 1", Institut of Control Theory, TU Dresden*, published 2022.