

Exercise 3 Imperfect bifurcations

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1 The equation

$$-\frac{1}{2}u^3 + r * u + h = 0. \quad (1)$$

2 Bifurcation analysis

Bifurcation analysis means looking at fixed point movement and the evolution of their stability. In this report equation 1 will be analyzed thoroughly. It contains the information of the fixed point location for the system:

$$\dot{u} = -\frac{1}{2}u^3 + r * u + h = 0. \quad (2)$$

`matcont` may be used to do this kind of analysis. However to put the results into perspective. A manual analysis has been performed beforehand ¹.

¹see pages 70-73 in strogatz' book

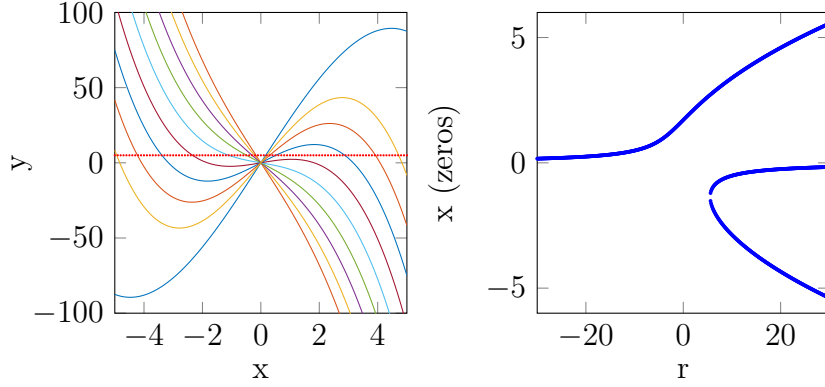


Figure 1: Solution branches with the function $-\frac{1}{2}u^3 + ru$ numerous colors for different $r \in [-30, 30]$ and the constant function $h = 5$ in red (left). Root locus plot for the same r values (right).

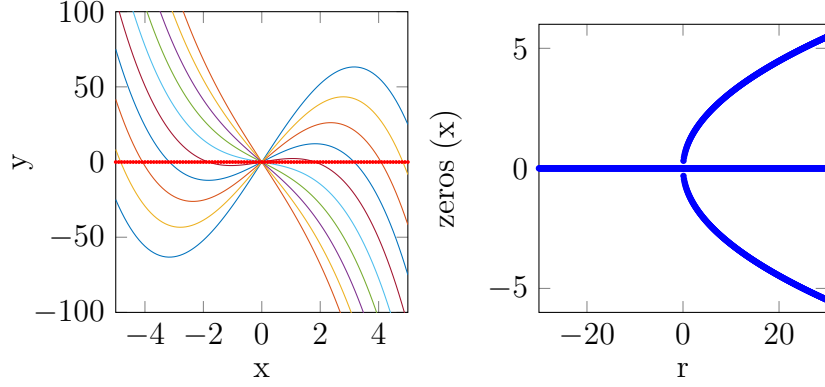


Figure 2: Solution branches with the function $-\frac{1}{2}u^3 + ru$ numerous colors for different $r \in [-30, 30]$ and the constant function $h = 0$ in red (left). Root locus plot for the same r values (right).

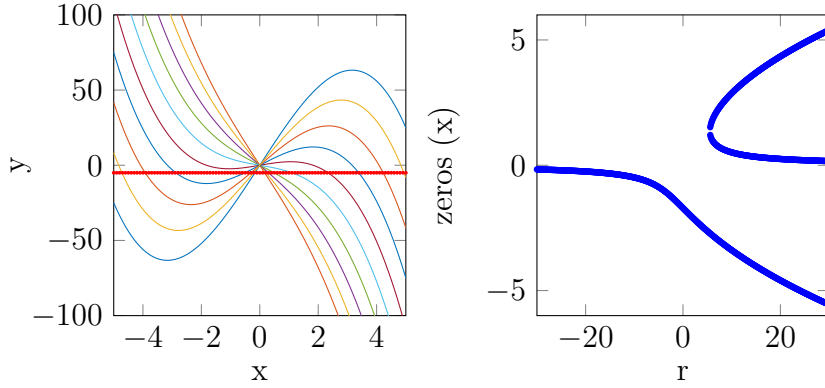


Figure 3: Solution branches with the function $-\frac{1}{2}u^3 + ru$ numerous colors for different $r \in [-30, 30]$ and the constant function $h = -5$ in red (left). Root locus plot for the same r values (right).