

# Bifurcation in parameter dependent systems

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# Overview

## ① Introduction: Fixed Point Analysis

## ② Bifurcation

Example: Logistig growth with harvesting

# Introduction: Fixed Point Analysis

Given the system of differential equations:

$$y' = f(y)$$

## Definition

A *fixed point*  $y^*$  is defined by  $f(y^*) = 0$ .

- Solve the equation  $f(y) = 0$
- Analyse eigenvalues of the Jacobian at fixed points.

Now: System with *control parameter*  $\mu$ .

$$y' = f(y, \mu)$$

$\Rightarrow$  How does  $\mu$  influence the number, location and stability of fixed points?

# Bifurcation

## Definition

*Bifurcation* is the changing of the character of an equilibrium point and/or the creation of extra ones by alteration of a control parameter.

Example: Logistig growth with harvesting:

$$y' = \frac{1}{10}y(10 - y) - \mu$$

Solving  $f(y, \mu) = 0$  for any parameter  $\mu$ . E.g. for  $\mu = 0$  fixed points at  $y = 0$  and  $y = 10$ .