

Network Analysis SS 17

Continuous Modeling

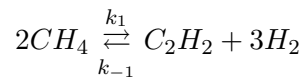
Alexander Bockmayr
Annika Röhl

28 April 2017

Deadline: Thursday, 4 May, 10:00 am

1 Exercise

1. Consider the chemical reaction systems



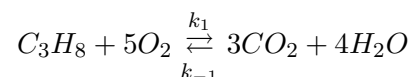
- (a) Give the differential equation models for the system assuming mass action kinetics.
- (b) Implement the model in Copasi. Use the standard values for the concentrations and $k_1 = 0.1$ and $k_{-1} = 0.01$ for the rate laws. Choose reasonable parameters for the time course and plot the concentrations against time.

2. Consider the differential equation $\dot{x} = Ax$ with $A = \begin{pmatrix} 2 & -1 \\ -1 & 2 \end{pmatrix}$

- (a) Compute the eigenvalues of A
- (b) What do the eigenvalues imply for the type of the critical points?
- (c) Draw the phase portraits (including nullclines, direction field and flow) using Xpp. Keep track of what you did.

2 Exercise

1. Consider the chemical reaction systems



- (a) Give the differential equation models for the system assuming mass action kinetics.

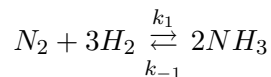
- (b) Implement the model in Copasi. Use the standard values for the concentrations and $k_1 = 0.1$ and $k_{-1} = 0.01$ for the rate laws. Choose reasonable parameters for the time course and plot the concentrations against time.

2. Consider the differential equation $\dot{x} = Ax$ with $A = \begin{pmatrix} 2 & -1 \\ 1 & 1 \end{pmatrix}$

- (a) Compute the eigenvalues of A
 (b) What do the eigenvalues imply for the type of the critical points?
 (c) Draw the phase portraits (including nullclines, direction field and flow) using Xpp. Keep track of what you did.

3 Exercise

1. Consider the chemical reaction systems



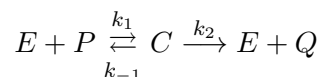
- (a) Give the differential equation models for the system assuming mass action kinetics.
 (b) Implement the model in Copasi. Use the standard values for the concentrations and $k_1 = 0.1$ and $k_{-1} = 0.01$ for the rate laws. Choose reasonable parameters for the time course and plot the concentrations against time.

2. Consider the differential equation $\dot{x} = Ax$ with $A = \begin{pmatrix} 2 & 0 \\ 0 & 2 \end{pmatrix}$

- (a) Compute the eigenvalues of A
 (b) What do the eigenvalues imply for the type of the critical points?
 (c) Draw the phase portraits (including nullclines, direction field and flow) using Xpp. Keep track of what you did.

4 Exercise

1. Consider the chemical reaction systems



- (a) Give the differential equation models for the system assuming mass action kinetics.

- (b) Implement the model in Copasi. Use the standard values for the concentrations and $k_i = i \cdot 0.1$ and $k_{-1} = 0.01$ for the rate laws. Choose reasonable parameters for the time course and plot the concentrations against time.
2. Consider the differential equation $\dot{x} = Ax$ with $A = \begin{pmatrix} 0 & -1 \\ -1 & 0 \end{pmatrix}$
- (a) Compute the eigenvalues of A
 - (b) What do the eigenvalues imply for the type of the critical points?
 - (c) Draw the phase portraits (including nullclines, direction field and flow) using Xpp. Keep track of what you did.

Send the solutions for exercise 3 and 4 of your homework until Thursday 4. May, 10:00 am to Annika.Roehl@fu-berlin.de