HUMBOLDT-UNIVERSITÄT ZU BERLIN
INSTITUTE FOR THEORETICAL BIOLOGY

Theoretical Biology Modeling

Prof. Hanspeter Herzel
Dr. Pål Westermark
Adrián E. Granada

Lecture: Thursday 08:15, H12
Exercise: Thursday 12:00, ITB

itb.biologie.hu-berlin.de/~granada/teaching/tbm

2. Exercise **Hand out: 29.10.09, Hand in: 05.11.09, in the lecture**

---

1. **Growth law**

Consider the following general growth law:

$$\frac{dx(t)}{dt} = ax(t)^b \tag{1}$$

1. Solve the differential equation!

   (a) Sketch the solution with $x(o) = 1$ for $b = 2$, $b = \frac{1}{2}$ and compare with the growth for $b = 1$!

2. **Steady states:**

$$\frac{dx}{dt} = 1 - 2\cos(x) \tag{2}$$

   (a) Calculate the steady state/s and determine their stability

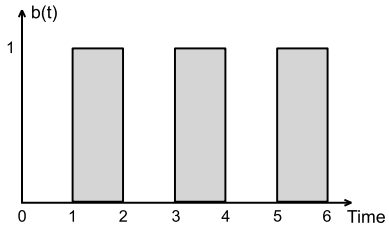
3. **Drug dynamics.**

   The kinetics of drug metabolism is given by:

$$\frac{dx}{dt} = -ax + b(t) \tag{3}$$

   with

$$b(t) = \begin{cases} 0 & 2n \leq t < 2n+1 \\ 1 & 2n+1 \leq t \leq 2n+2 \end{cases} \; n\varepsilon N \tag{4}$$



   (a) Solve the equation for tε[0,1] and for tε[1,2].
   (b) Sketch $x(2)$ as a function of $x(0)$.
   (c) What might be the asymptotic dynamics of $x(t)$?