

BIPOP

Modelling, Simulation, Control and Optimisation of Nonsmooth Systems

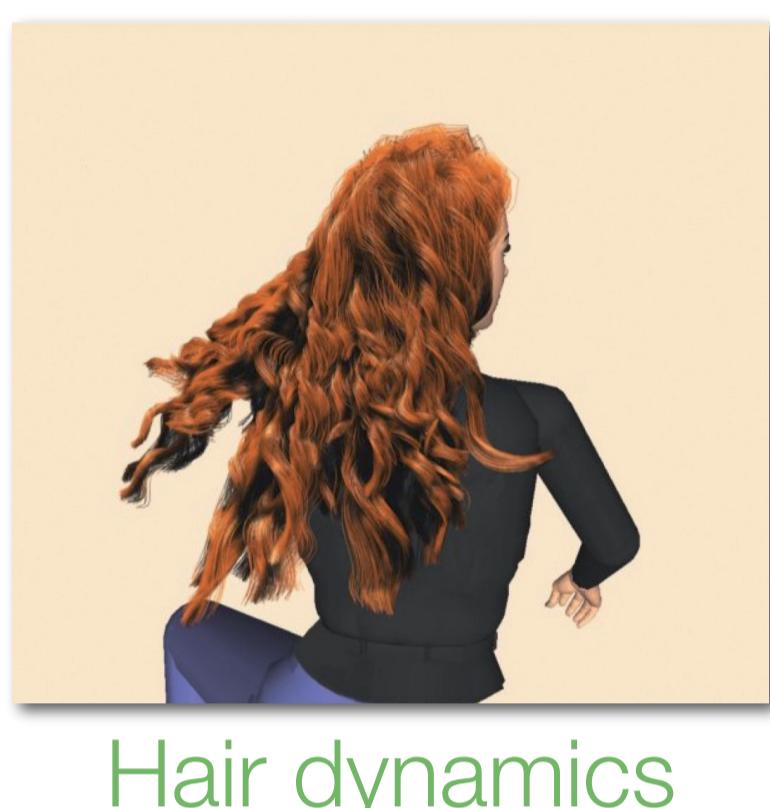
Nonsmooth Mechanics

$$\xi = -M(q)dv + F(q, v, t)dt$$

$$C = T_{\Phi}(q)$$

$$\zeta = \frac{v^+ + ev^-}{1+e}$$

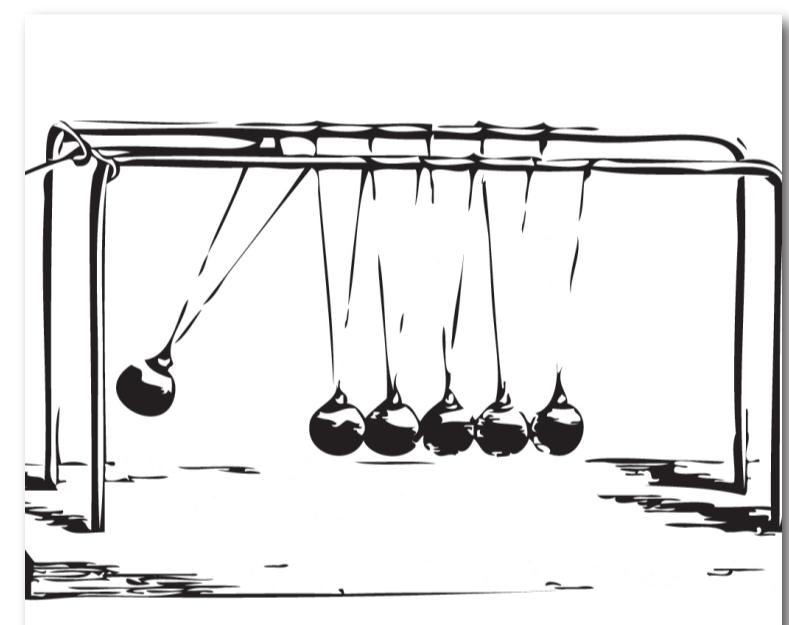
Contact mechanics
(impacts, friction)



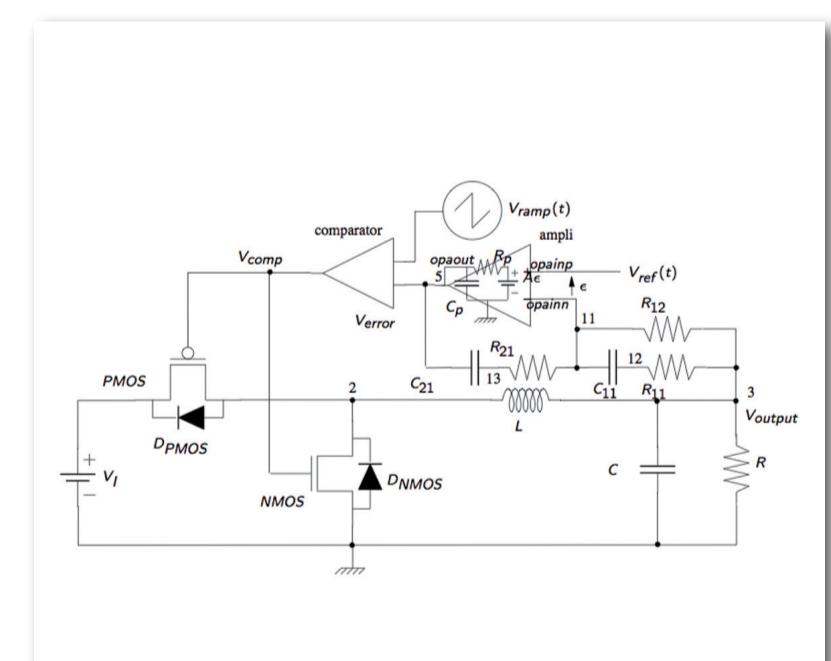
Hair dynamics



Optimization for
meteorology



Impact modelling



Switched electrical
circuits

Nonsmooth Electronics

$$\xi = -\dot{x} + Ax + Bu(t)$$

$$C = \{x \mid Cx + Eu(t) \geq 0\}$$

$$\zeta = x$$

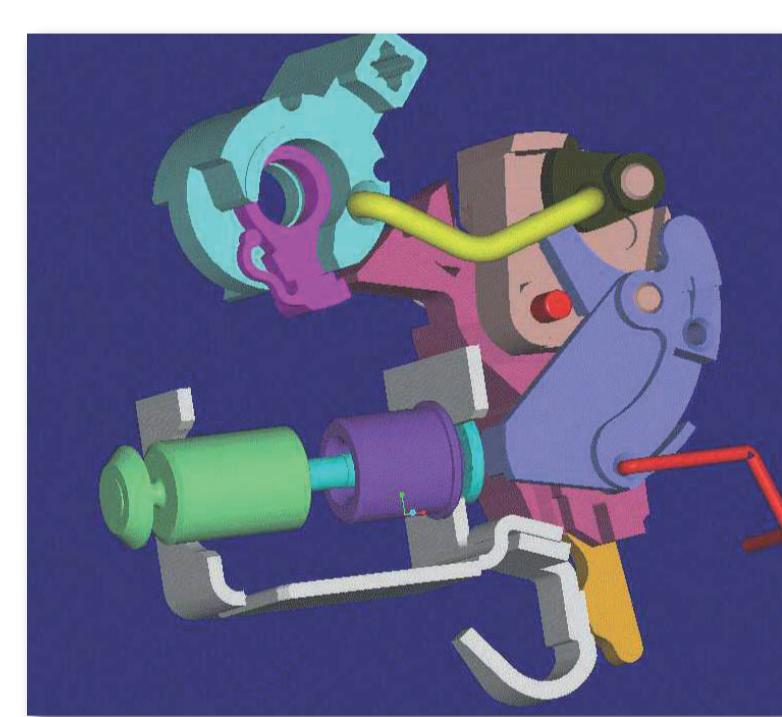
Ideal diodes and transistors,
piecewise linear systems

$$\xi \in N_C(\zeta)$$

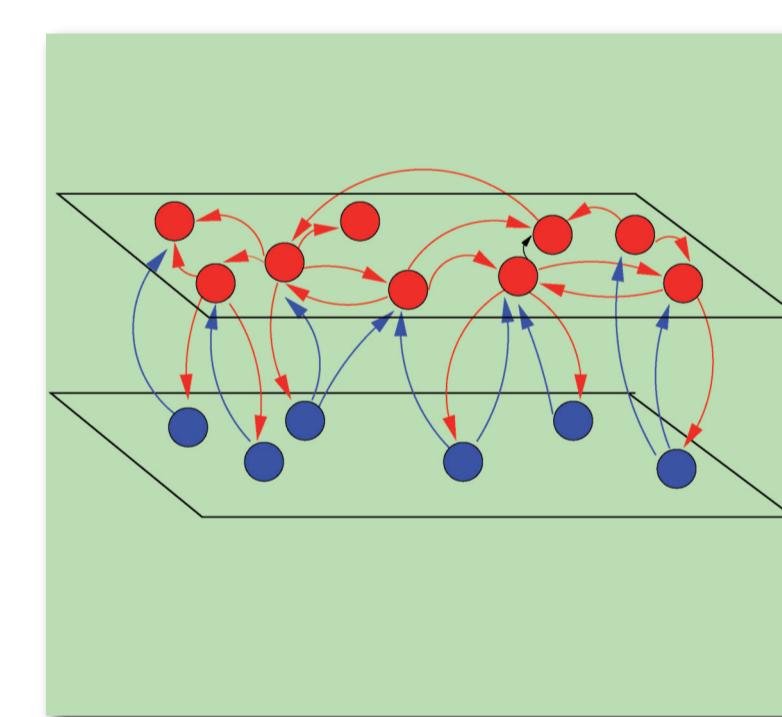
Inclusions in normal cones

Mathematical Foundations

Variational Inequalities, Differential Inclusions,
Complementarity Systems, Convex and Nonsmooth analysis
Piecewise smooth systems



Circuit breaker



Neural networks



Modelling and
simulation bipeds

Nonsmooth Optimization

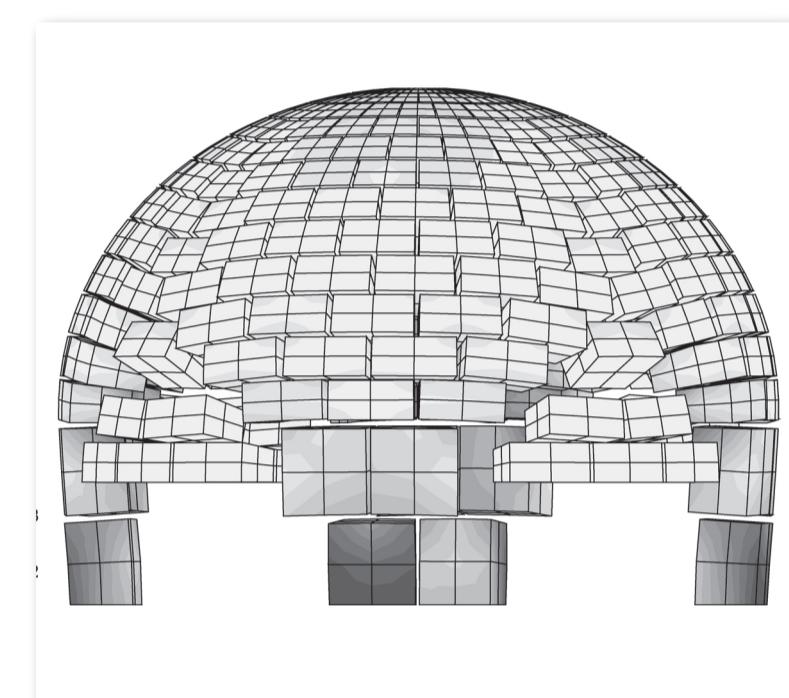
$$\xi = \begin{pmatrix} 0 \\ -1 \end{pmatrix}$$

$$C = \text{epi}(f)$$

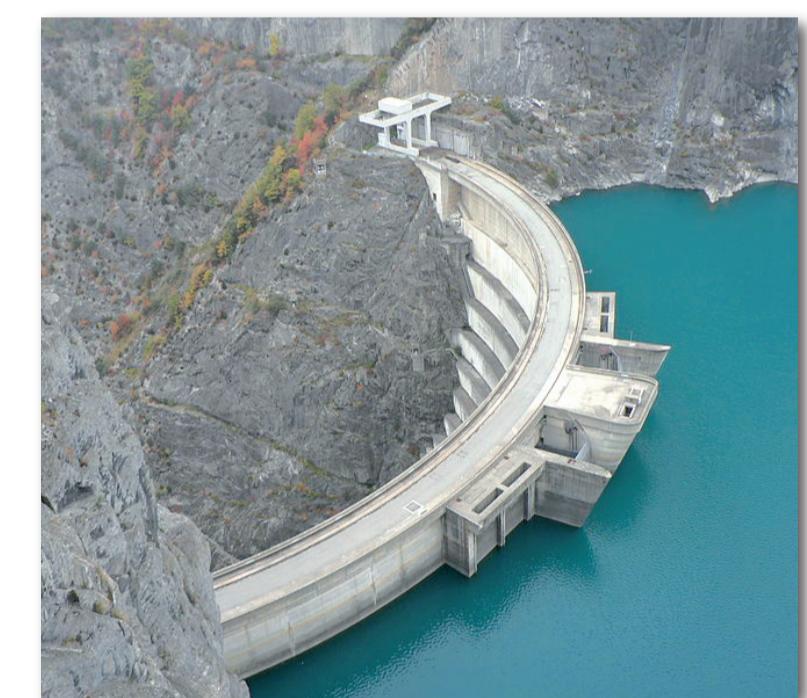
$f(\cdot)$ convex function of x

$$\zeta = \begin{pmatrix} x \\ f(x) \end{pmatrix}$$

Problems with nonsmooth constraints,
Complementarity problems



Masonry structures



Optimization of
energy production



Analysis

- Numerics
- Well posedness
- Relationship between formulations
- Optimization algorithms

Scientific leader and contact

bernard.brogliato@inrialpes.fr

Modelling

- Impact mechanics
- Hair dynamics
- Spiking neural networks

Control

- Stability
- Passivity
- Optimal Control
- Observers
- Tracking Control

Simulation Software

- Siconos
- Humans
- Modulopt



INRIA Grenoble - Rhône-Alpes and Laboratoire Jean Kuntzmann