Nonsmooth

- nonsmooth = lack of differentiability ($\notin \mathcal{C}^1$),
- graphs with peaks, kinks, jumps.

Dynamics

- systems that evolves with time,
- branch of mechanics concerned with the motion of objects.

Where is nonsmoothness?

- nonsmooth solutions in time and space:
  - continuous, functions of bounded variations, measures and distributions.
- nonsmooth modeling of constitutive laws:
  - set–valued mapping, inequality constraints, complementarity, impact laws,
  - ODE with discontinuous r.h.s, differential inclusion, measure equation.

TRIPOP INRIA project team (LJK)

Research object:

Modeling, Simulation and Control of Nonsmooth Dynamics.

Main application:

Natural environmental risks in mountains.

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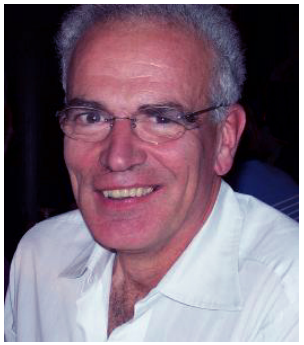

Scientific pairs: M. Jean, J.J. Moreau, M. Schatzman & C. Lemaréchal.

Our reference (bedside) books

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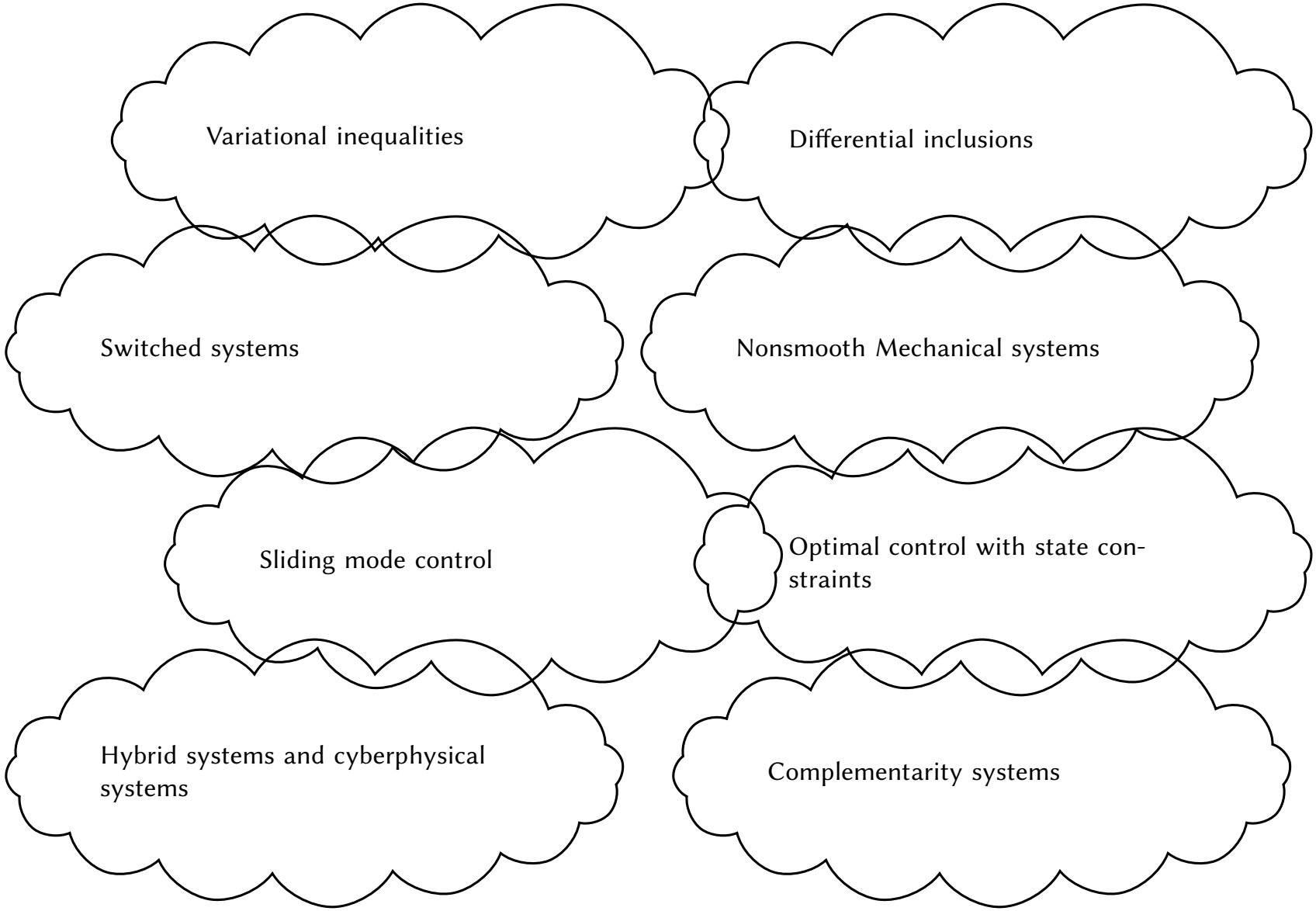
Variational inequalities
Differential inclusions
Switched systems
Nonsmooth Mechanical systems
Sliding mode control
Optimal control with state constraints
Hybrid systems and cyberphysical systems
Complementarity systems

Elasto-dynamics with plasticity, contact and impact.

A second order sweeping process

$$
\begin{cases}
v^+ = \dot{q}^+ & \text{(velocity of bounded variations)} \\
M(q)dv + F(q, v^+)dt + B^\top \sigma dt = \iota & \text{(differential measure)} \\
\dot{\sigma} = E\big(Bv - \dot{\varepsilon}^p\big) & \text{(elasticity)} \\
\dot{\varepsilon}^p \in N_C(\sigma) & \text{(plasticity)} \\
-\iota \in N_{T_M(q)}(v^+ + ev^-) & \text{(impact and contact)}
\end{cases}
$$