Ampère Meetings

Distributed Systems: A Scientific Outlook
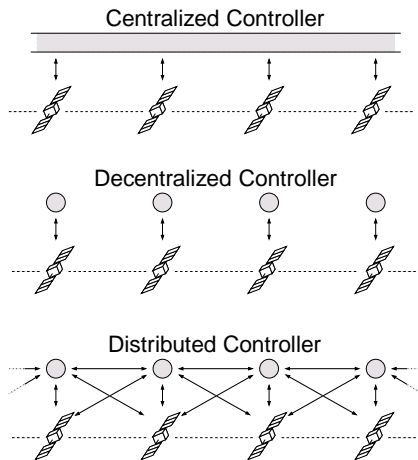
Paolo Massioni

Laboratoire Ampère, UMR CNRS 5005,
INSA de Lyon, Université de Lyon,
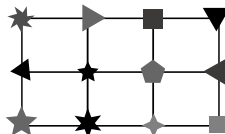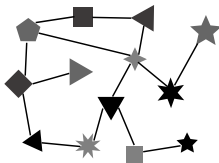69621 Villeurbanne CEDEX, France

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Centralized / Distributed / Decentralized

Centralized Controller

Decentralized Controller
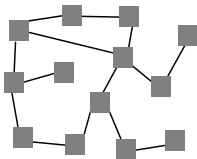
Distributed Controller

Lyon 1

INSA
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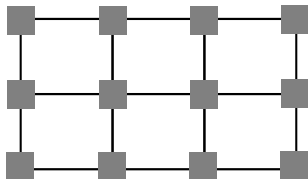UNIVERSITÉ DE LYON

A Classification of Distributed Systems
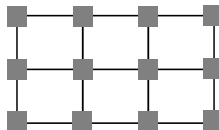

Arbitrary interconnections   Regular lattice

Homogeneous with Regular Lattice

- B. Bamieh, M. Jovanovic, P. Mitra and S. Patterson "Effect of topological dimension on rigidity of vehicle formations: Fundamental limitations of local feedback." CDC 2008.

- B. Bamieh, F. Paganini and M.A. Dahleh. "Distributed control of spatially invariant systems." IEEE Transactions on Automatic Control 47(7):1091-1107, 2002.

Homogeneous with Arbitrary Interconnections
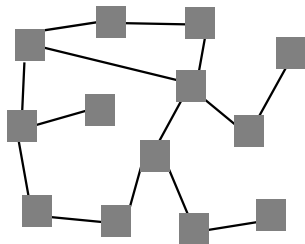
- A. Fax and R. Murray. "Information flow and cooperative control of vehicle formations." IEEE Transactions on Automatic Control 49(9):1465-1476, 2004.
- P. Massioni and M. Verhaegen. "Distributed control for identical dynamically coupled systems: A decomposition approach." IEEE Transactions on Automatic Control 54(1): 124-135, 2009.

Heterogeneous with Regular Lattice
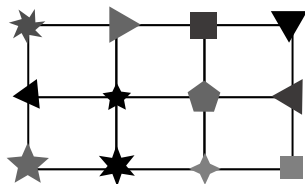
- G.E. Dullerud and R. D'Andrea. "Distributed control of heterogeneous systems." IEEE Transactions on Automatic Control, 49(12):2113-2128, 2004.

- J.K. Rice and M. Verhaegen. "Distributed control: A sequentially semi-separable approach for heterogeneous linear systems." IEEE Transactions on Automatic Control, 54(6):1270-1283, 2009.

Heterogeneous with Arbitrary Interconnections
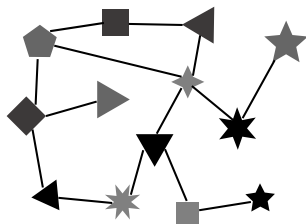
- C. Langbort, R.S. Chandra and R. D'Andrea. "Distributed control design for systems interconnected over an arbitrary graph." IEEE Transactions on Automatic Control, 49(9):1502-1519, 2004.

Application: Electric Grid

European high voltage transmission grid
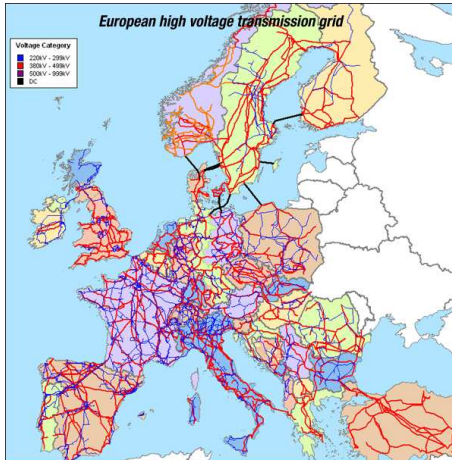
Applications: Adaptive Optics
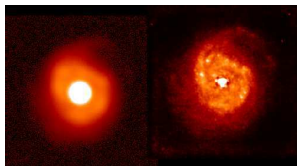

Image: Canada France Hawaii Telescope
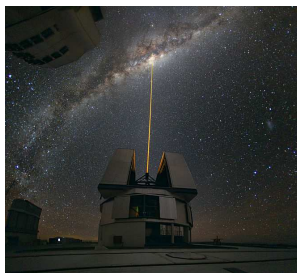
Image: Yuri Beletsky, Paranal Observatory, Chili

flat wavefront
turbulence
distorted wavefront
wavefront sensor
control system
deformable mirror
corrected wavefront
camera
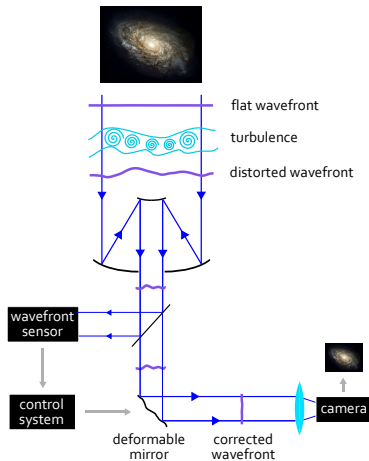
Application: Flow Control
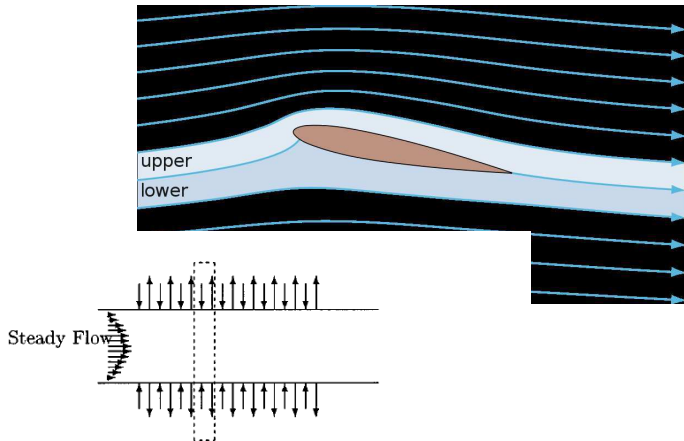

upper
lower

Steady Flow

Fig. 3. 2-D Poiseuille flow with active boundary control.

Applications: Multi-Agent Systems (?)