MODEL PREDICTIVE CONTROL

CONCLUSIONS

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COURSE STRUCTURE

- ✔ Linear model predictive control (MPC)
- ✔ Linear time-varying and nonlinear MPC
- ✔ MPC computations: quadratic programming (QP), explicit MPC
- ✔ Hybrid MPC
- ✔ Stochastic MPC
- ✔ Data-driven MPC

MATLAB Toolboxes:

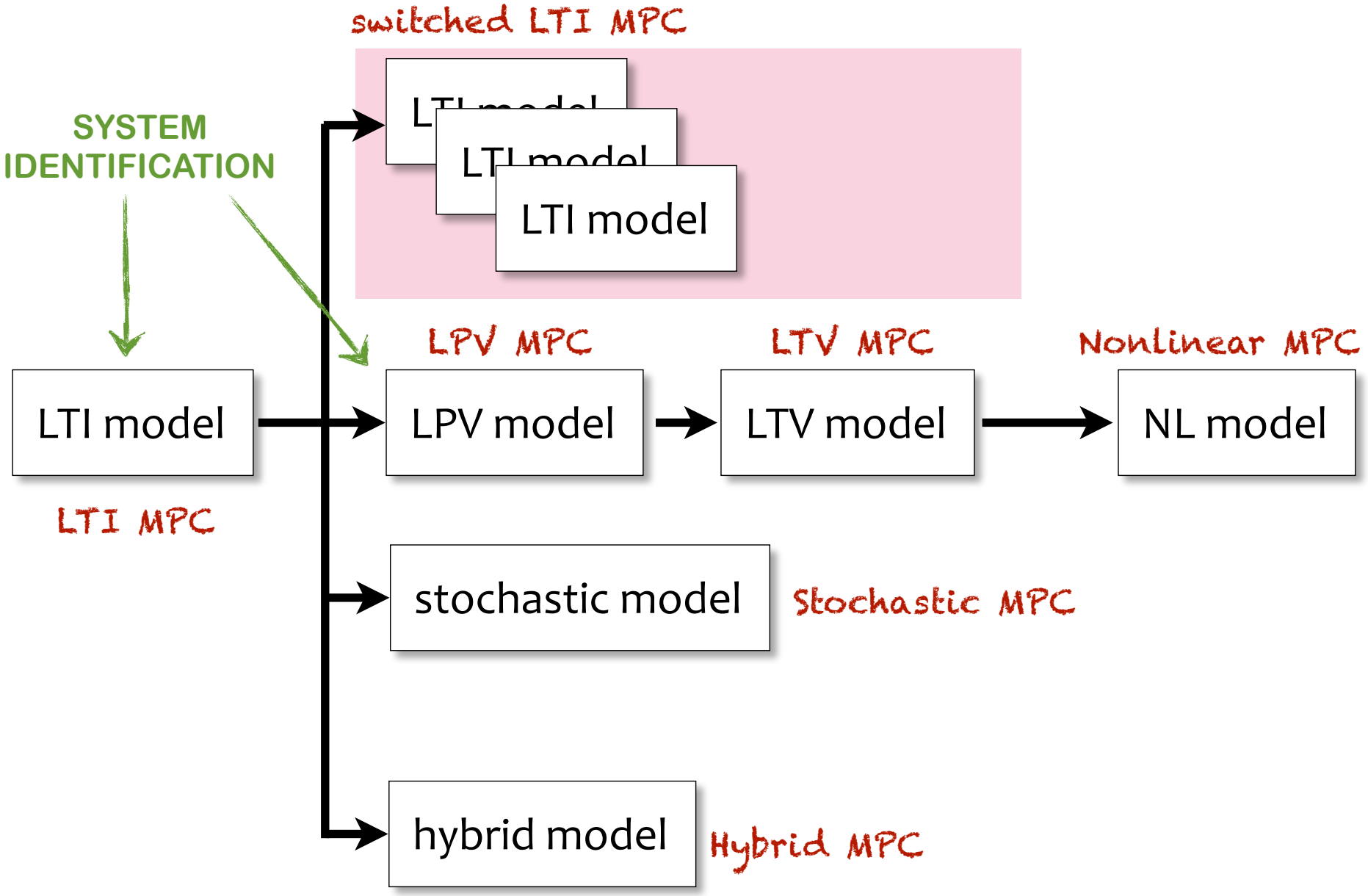
- **MPC Toolbox** (linear/explicit/parameter-varying MPC)
- **Hybrid Toolbox** (explicit MPC, hybrid systems)

Course page:

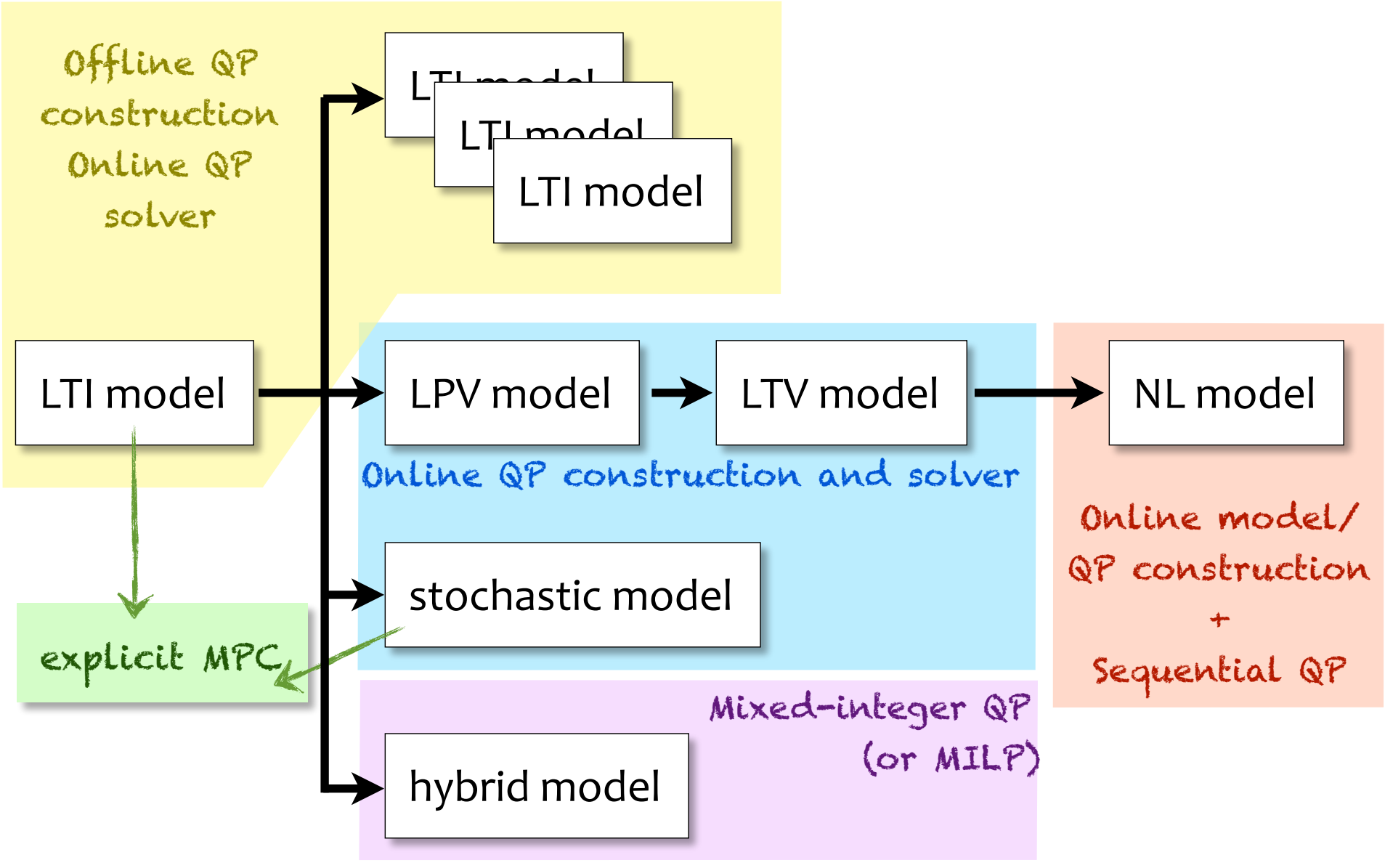
`http://cse.lab.imtlucca.it/~bemporad/mpc_course.html`

CONCLUSIONS

CHOICE OF PREDICTION MODEL



RESULTING OPTIMIZATION PROBLEM



CONCLUSIONS

- MPC is a **universal control methodology**:
  - different **models** (linear, nonlinear, hybrid, stochastic, …)
  - **optimize performance** index subject to **constraints**
  - **widely applicable** to many domains (process industries, automotive, aerospace, smart grids, ...)

- **MPC research**:
  1. Linear, uncertain, explicit, hybrid, nonlinear MPC: **mature theory**
  2. Stochastic MPC, economic MPC, data-driven MPC: **many open issues**
  3. Embedded optimization methods for MPC: **many open issues**
  4. Systems identification for MPC: **a lot to "learn"** from machine learning

- **MPC technology**: already mature for industry

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Explicit MPC

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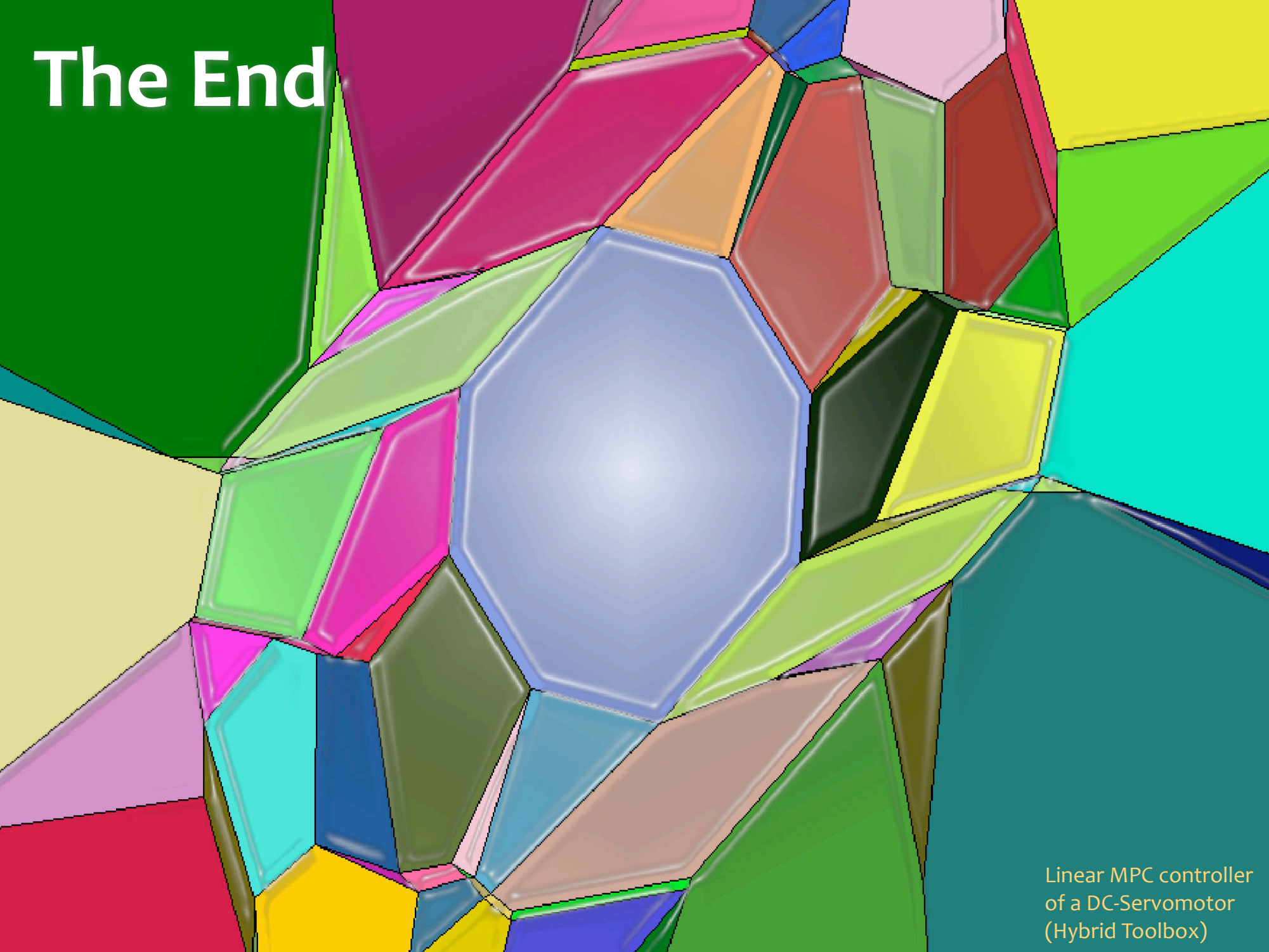

Linear MPC controller
of a DC-Servomotor
(Hybrid Toolbox)