KU LEUVEN

Toolchain for Automated Control and Optimisation (TACO)

Filip Jorissen

Lieve Helsen

Summary of TACO

- MPC translator based on JModelica & CasADi & IPOPT
  - Non-linear, stationary equations are supported
  - But only linear dynamics
- Input: Modelica/Optimica model, output: MPC controller
- Automated translation and compilation
- Non-linear algebraic loops supported, but convergence problems
- Not supported: integer decision variables, algorithm sections

Implementation aspects

- Linear dynamics are pre-computed
- Boundary conditions are pre-computed using an FMU
  - CombiTimeTables are supported
  - Less computational overhead
- IPOPT: gradient-based non-linear solver
- Sparse and efficient evaluation of sensitivities using CasADi
- Variable MPC horizon: move blocking

Computation speed

- Demo application:
  - 32 zones: detailed IDEAS model with 1000 states
  - Pressure-driven hydronic and air flow networks (IBPSA)
  - Detailed air handling unit model
  - Simplified borefield and heat pump
  - 92 optimisation variables
  - Horizon of 3 days

- Average optimisation time: 5 seconds per run