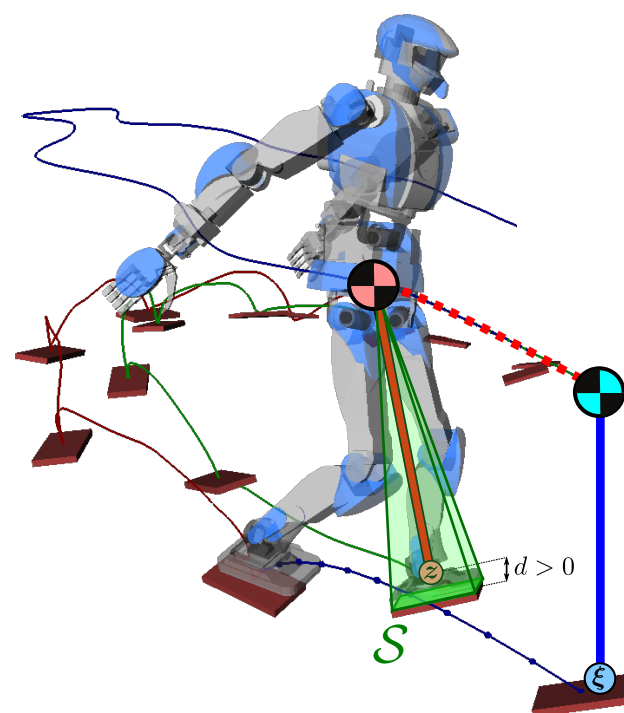
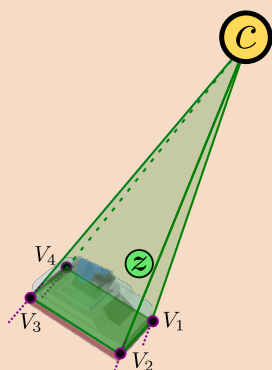


3 — Nonlinear MPC for Dynamic Walking

Caron & Kheddar — IROS 2017

Contact stability

Polyhedral projection
of the Contact Wrench Cone
yields an **Analytical formula**



Predictive

Linear equation of motion using the eCMP: $\ddot{c} = \omega^2(c - z) + g$

Advantage of this choice: forward integration becomes **analytical** (no integrator)

Contact stability constraints are **bilinear**: $cAz + Bc + Cz + d \leq 0$

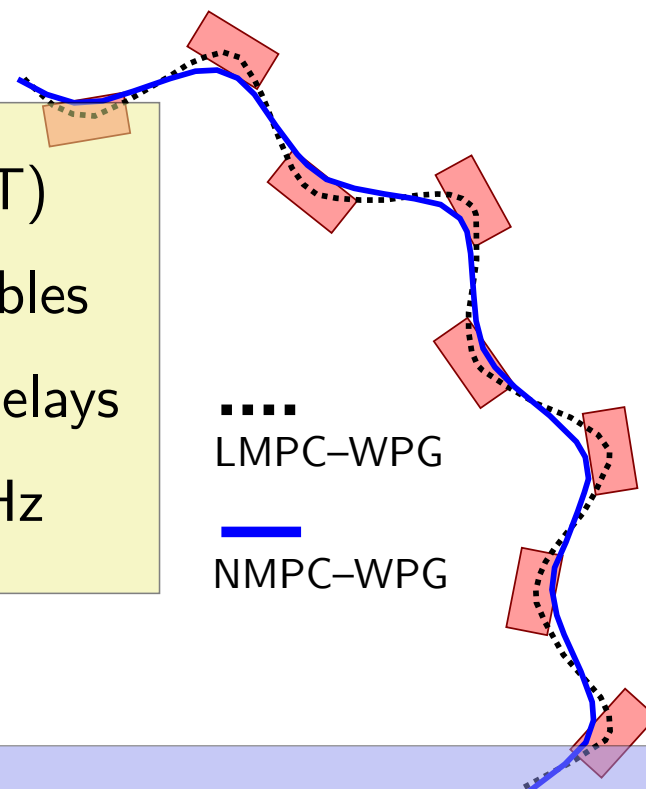
Optimal control

Resolution by Direct Multiple Shooting (IPOPT)

Adaptive step timings: durations as prob. variables

Runs at 30 Hz, but fails under control errors/delays

Recovery by constrained LQR running at 300 Hz



Limitation

Sensitivity to jumps in problem-optimum map, LQR recovery only local

