**High-Frequency Nonlinear Model Predictive Control of a Robot Manipulator**

Sebastien Kleff, Avadesh Meduri, and others designed a MPC controller that can solve a path optimization problem over 1,000 times per second. They implemented this MPC controller on a 7 jointed robotic arm, to demonstrate the quality of their algorithm at pick-place task compared as open-loop controllers.

The optimizer in their MPC algorithm is Differential Dynamic Programming (DDP).

Show importance of preview horizon.

Def. Optimizer - program that solves these local optimization problems over predicted time frame

Ex. Find the best path and sequence of controls to bring arm toward end effector

Minimizing cost function J(p) = SSE(Ref) + SSE(acceleration)

Can we have an MCP so quick that it no longer acts as a planner? (i.e. it resolves optimization problem each time controls are sent to control system (motor drivers))

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Translated:

Find the sequence of control torques *u*,

And the sequence of states (positions and velocities) of robotic joints *x,*

That minimizes the cost of being in those states *x* or enacting controls *u* over Time Horizon T.

And each state *x*  and control *u* is within the constraints of the system.

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Reformulating:

Divide up the time interval into N subintervals.

Find sets of controls U, and states X, that minimize the net cost of those states and controls,

And law of evolution is represented (next state is completely determined by previous state and input controls)