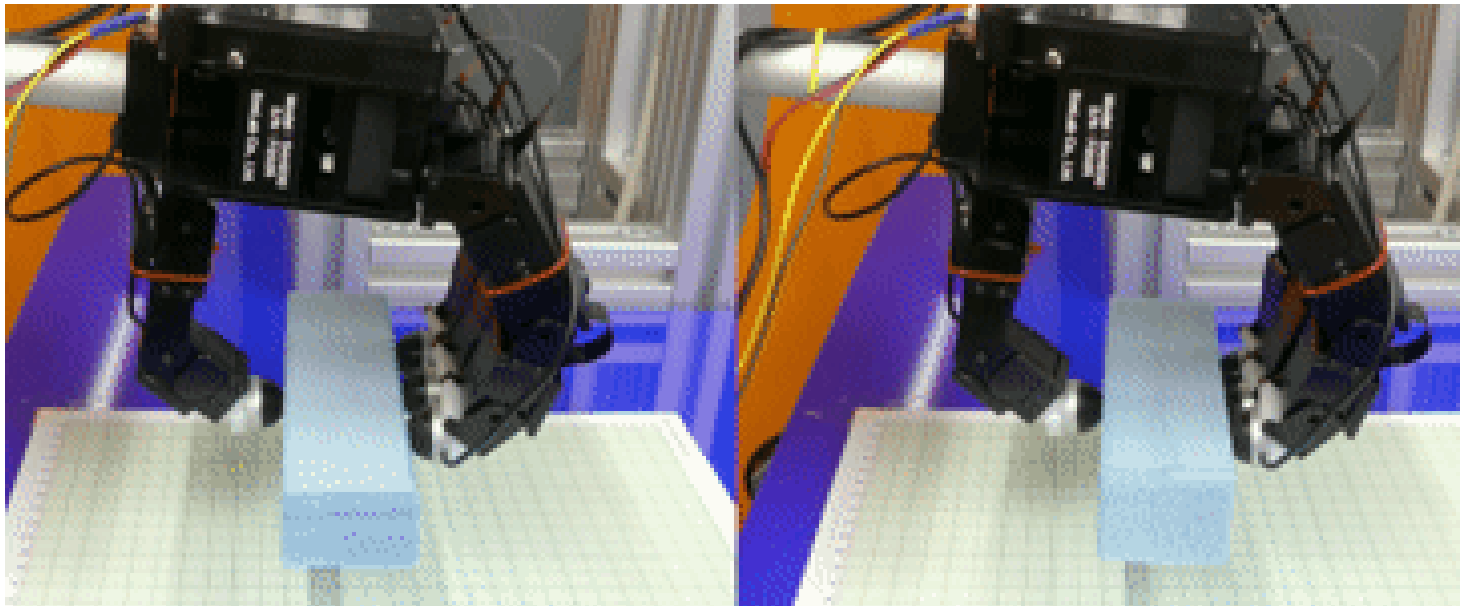# Learning object-centric trajectories of dexterous manipulation from demonstration

Gokhan Solak & Lorenzo Jamone
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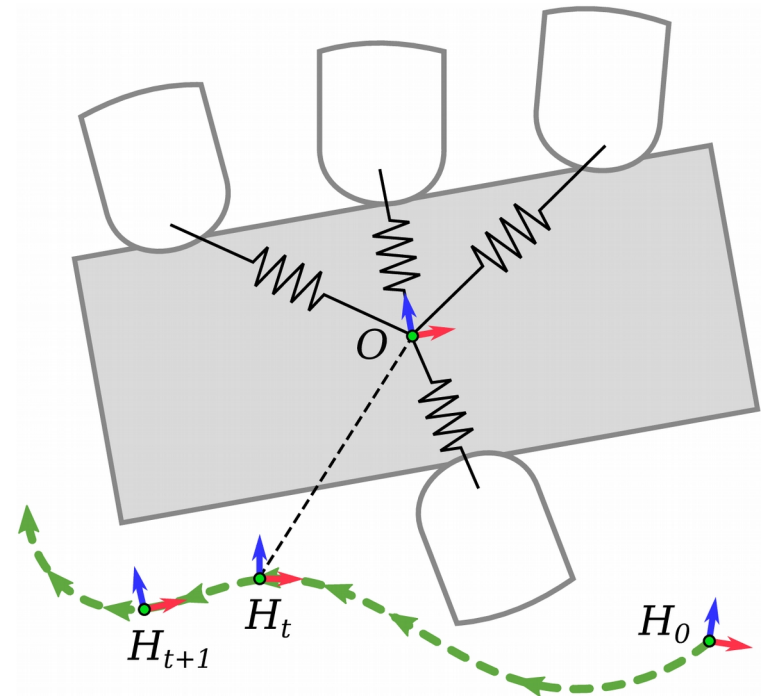
Advanced Robotics @ Queen Mary ARQ | Queen Mary University of London

Problem

- Dexterous manipulation:
  - Coordination of multiple fingers
  - Point contacts with the object
  - Difficulty of sensing the grasped object
  - Maintaining the grasp
- Our solution:
  - Dynamical movement primitives
  - Virtual spring framework
 - Tactile sensing

Dynamical Movement Primitives

- Express motion with dynamical systems
- Converge to goal under perturbations
- Learn trajectories as weighted sum of basis functions
- Generalize the trajectories with task parameters
- *We learn the task-space trajectory of the object*
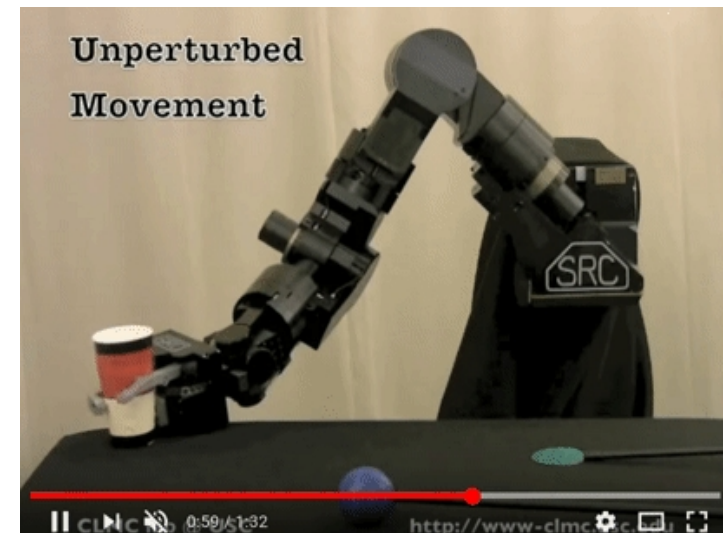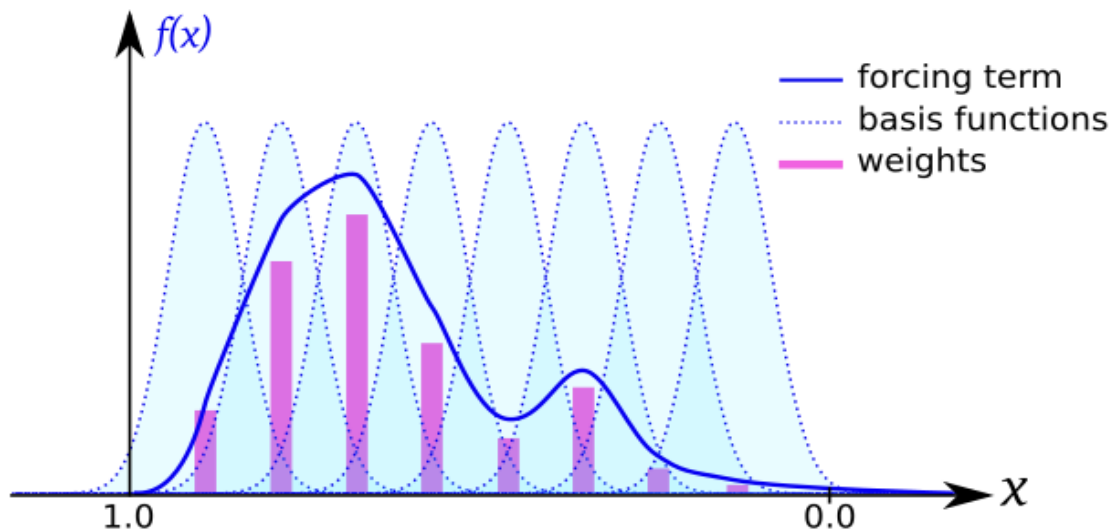
(Pastor et al, 2009)

Virtual Spring Framework

- Virtual springs connect fingertips to object frame
- Object pose approximation w.r.t. fingertips
- Impedance control with virtual springs
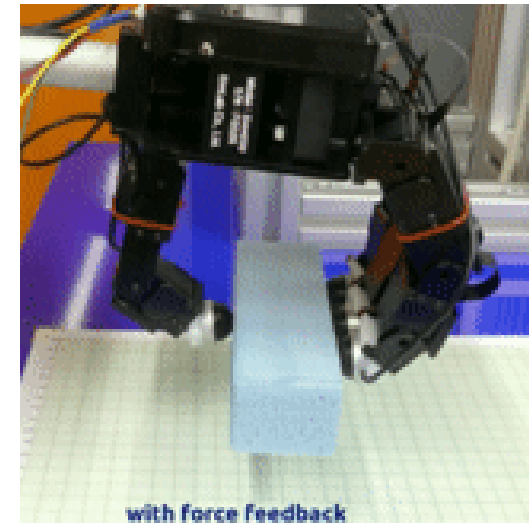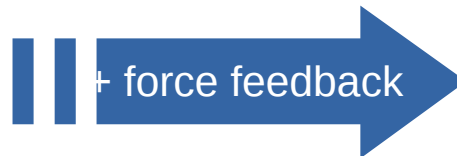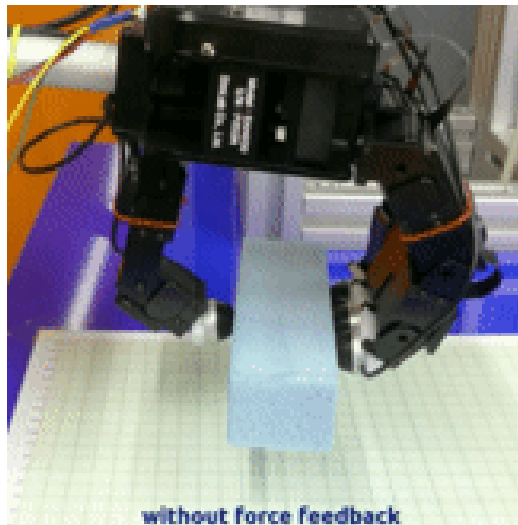- Apply the force to keep the object in grasp
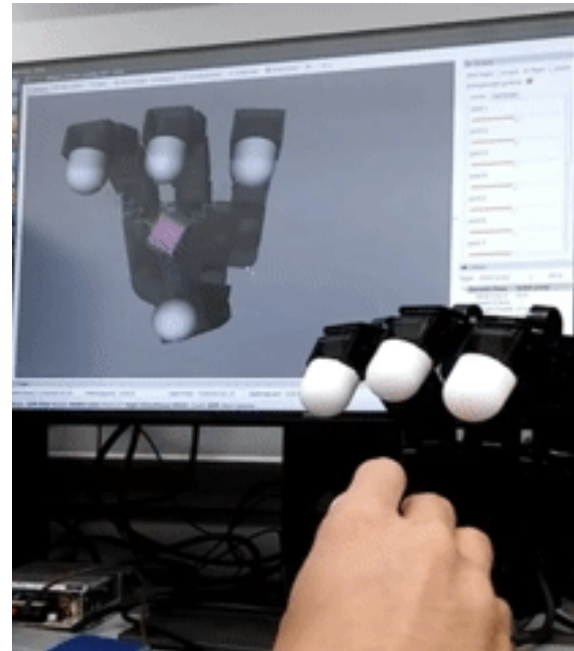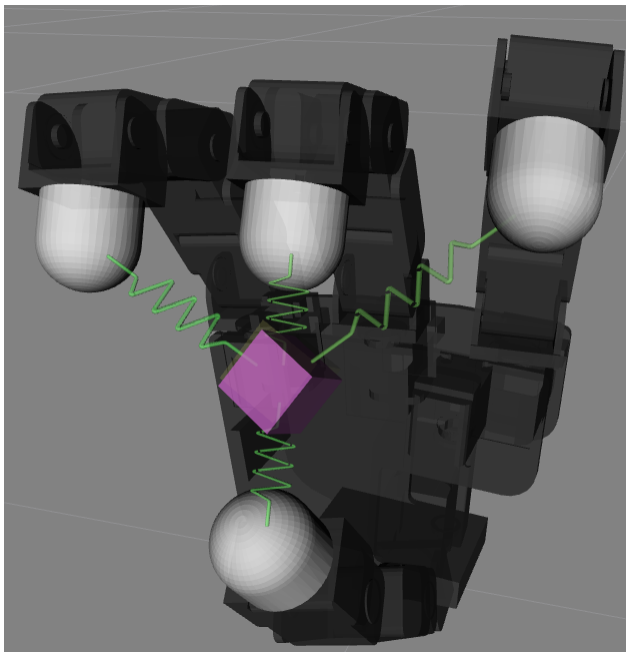
Force Feedback

- Contact slippage is a problem
- Including simple tactile info* improves stability
- Adapting spring stiffness

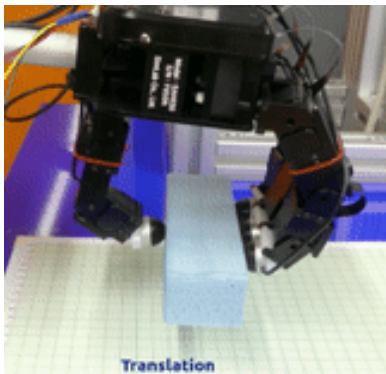*Proportional control of the desired force*

+ force feedback

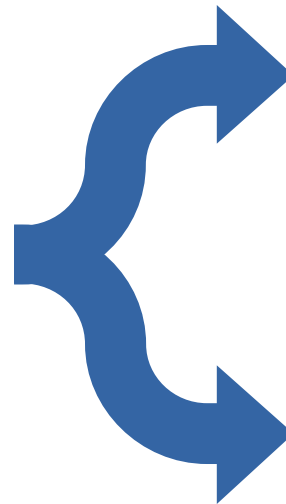without force feedback

with force feedback

Experimental results

- Teaching trajectories kinaesthetically
- Reproducing complex trajectories stably
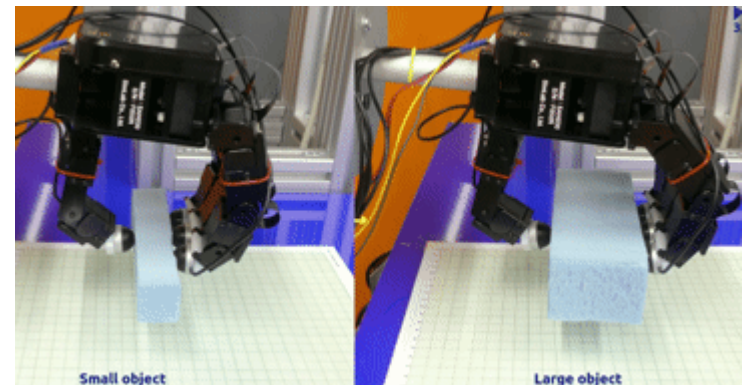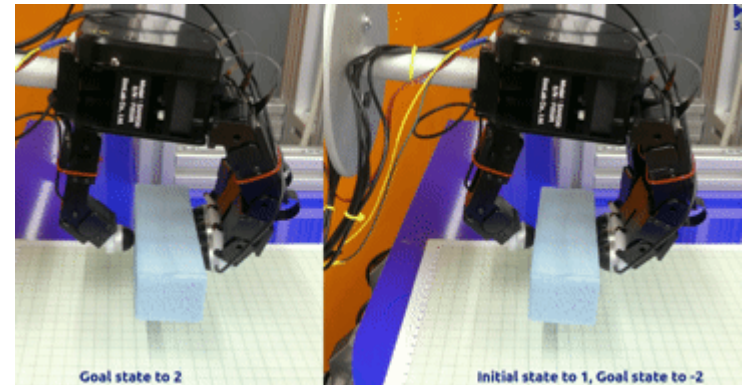- Possible to generalize to different conditions

Thank you

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