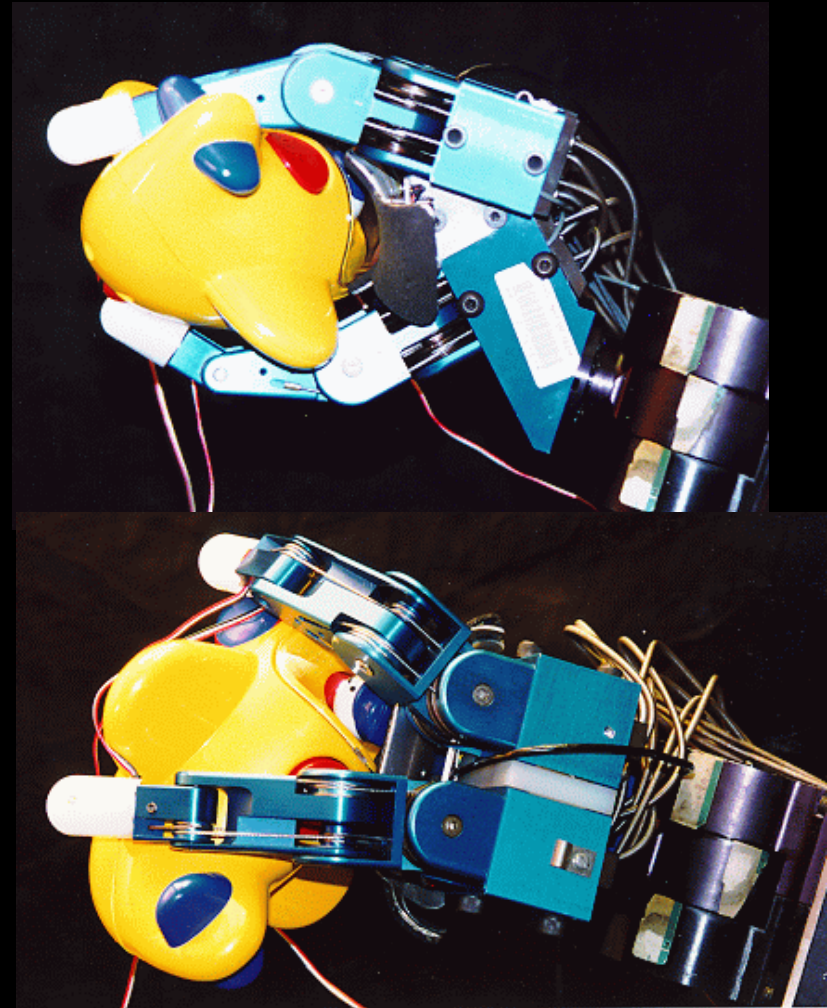
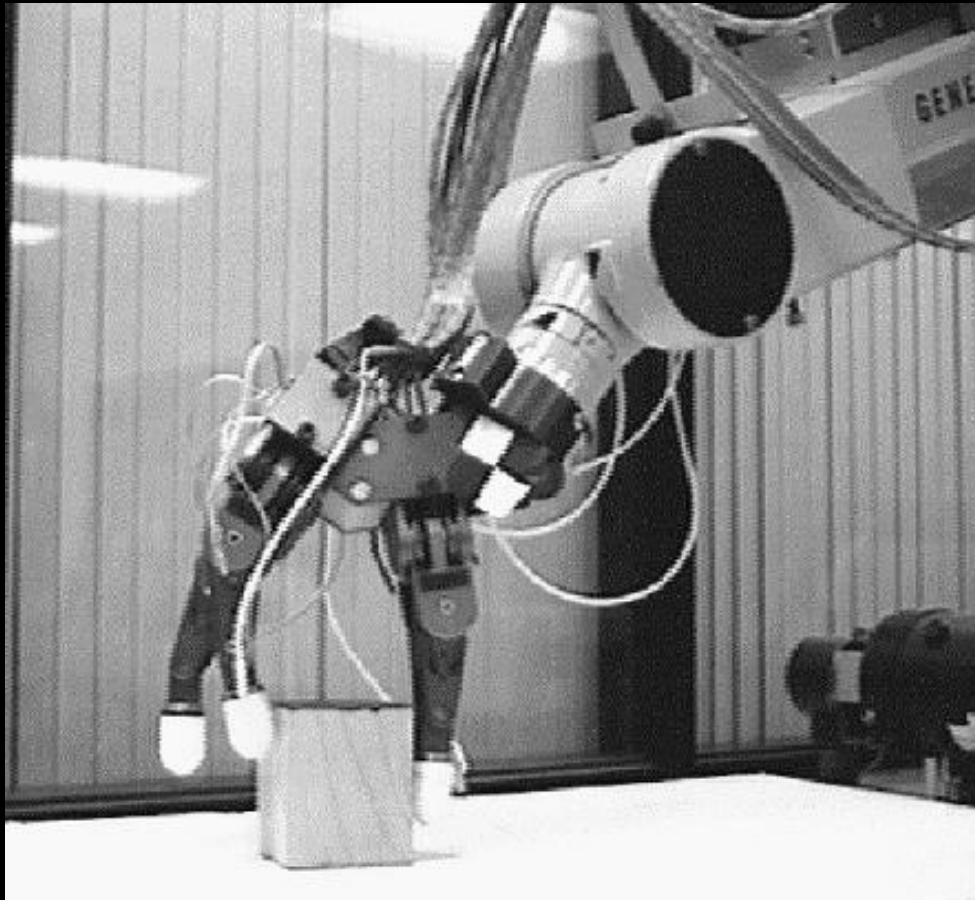


Case Study: Stanford/JPL Hand



Outline

Salisbury and Craig, Articulated Hands: Force Control and Kinematic Issues, IJRR 1(1) 1982.

Motivation: Design a hand capable of both rigid grasping and in-hand manipulation

Approach:

- Investigated kinematic designs through DoF counting

- Chose hand DoF based on geometric contact and force analysis

 - 3 fingered hand, 3 joints per finger

- Selected finger and joint placement to set fingertips at isotropic points when the hand grasps a 1 inch sphere

- Used minimal 4 tendon per finger transmission design

- Developed algorithms for force and stiffness control of object, as well as for sensing forces and object shape

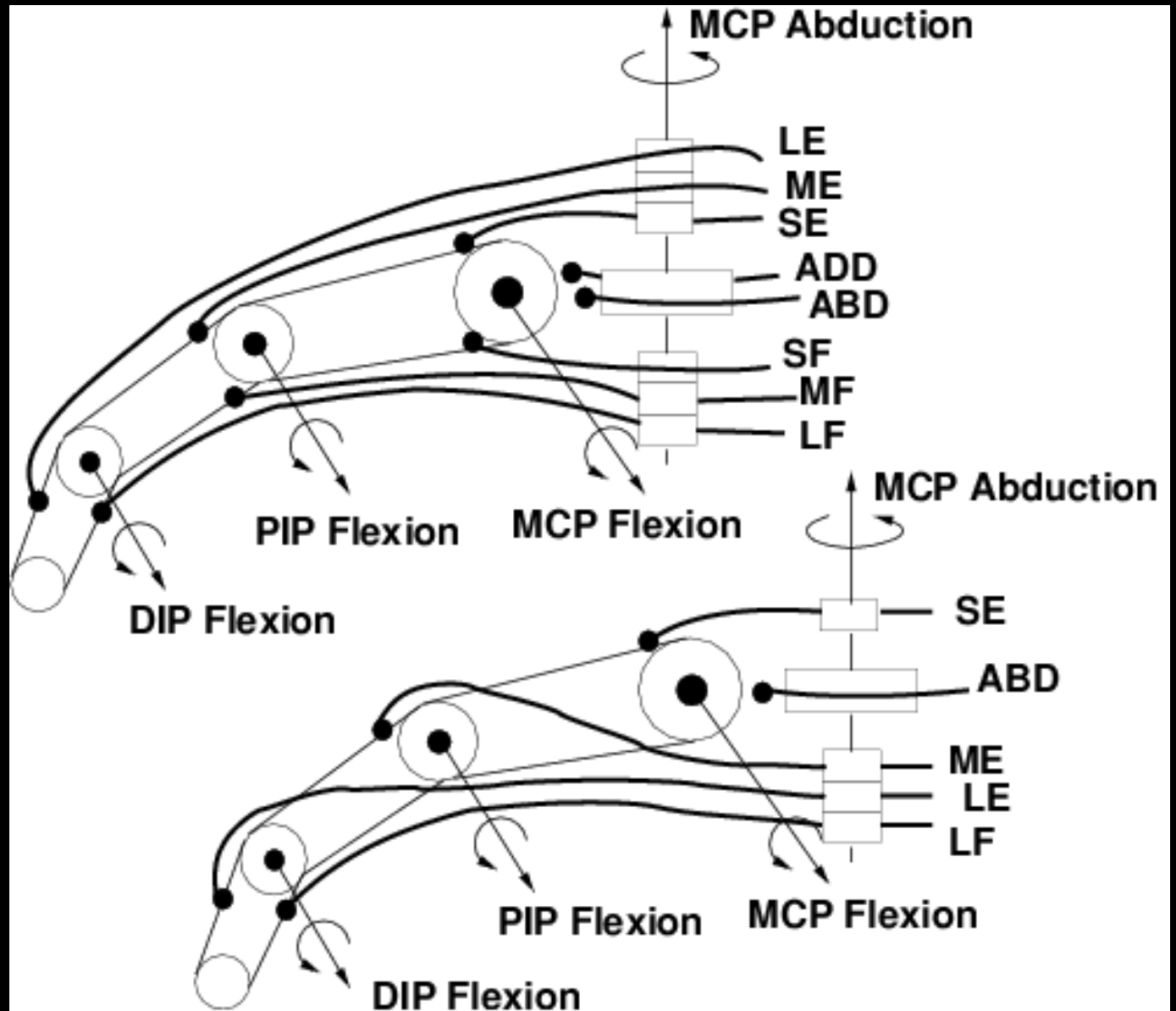
Implications of N+1 tendon design?



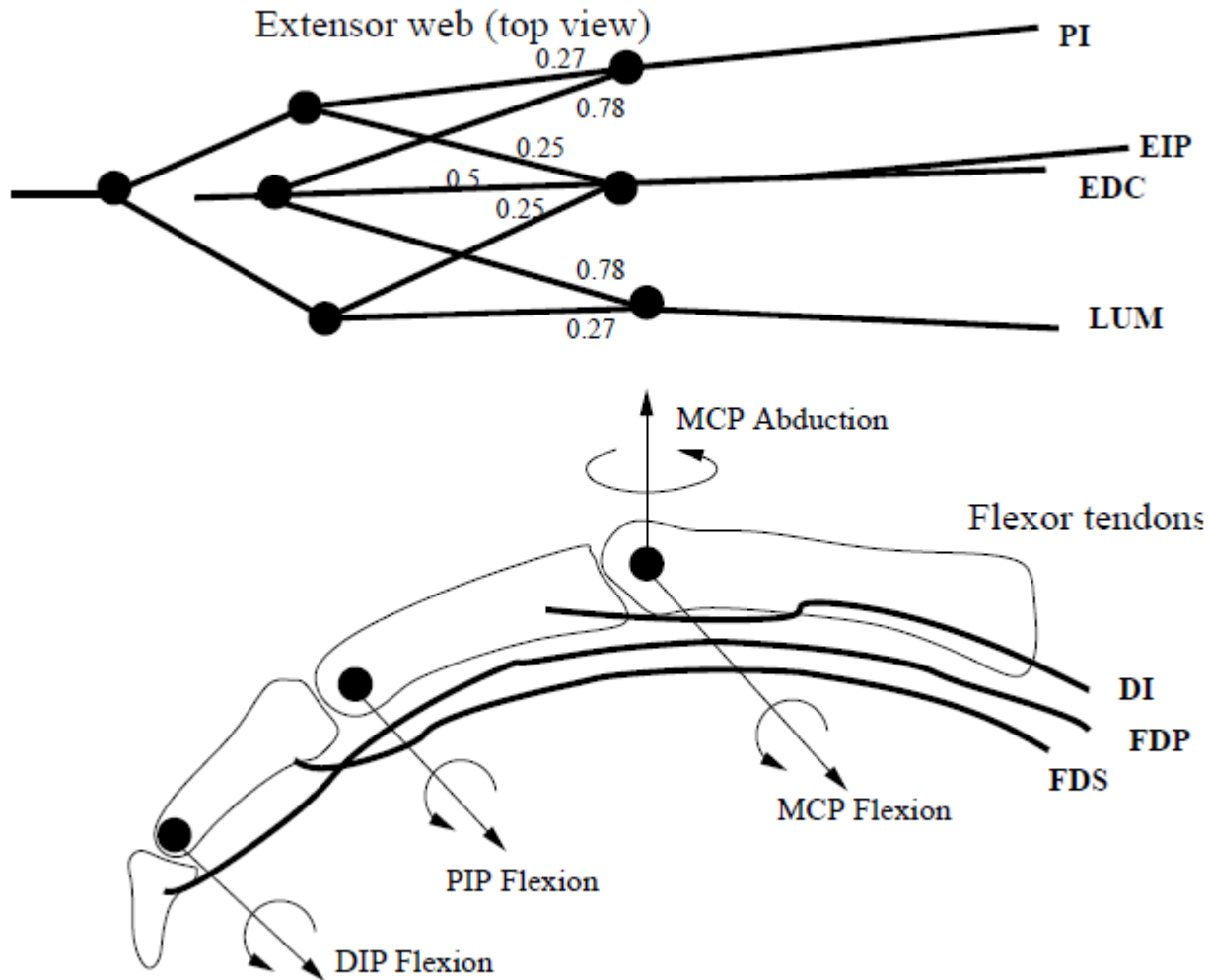
2N design



N+1 design



Human Finger Design



Features and Flaws

Can show minimalistic design for 6DoF manipulation and rigid grasping

It would be nice to think about designs for power grasps as well (e.g., “negative space” inside fingers and palm)

Position sensing would be a big help!

Minimal cable drive is nice for minimizing motors, etc.. but there are some side effects stiffness control, errors can accumulate on all joints from tendon slip ...

Design optimization (e.g., where to place thumb)

