11

ON HIS SIMULATION,

	RMS ERRORS	MAX ERRORS
PD CONTROL	2.4°, 1.0°	6°, 2°
FEEDBACK COMP	1.6°, 0.9°	4°, 2.4°
	WE HAVENT INCLUDED INERTIA	
FEED FORWARD COMP	0.36°, 0.2°	1°, 0.6°
	WE NOW HAVE COMPENSATED FOR INERTIA	
INVERSE DYNAMICS	0.05°, 0.05°	0.2°, 0.2°
	VERY DIFFERENT. INERTIA IS IN LINE W/ PD CONTROLLER	
	- DECOUPLES EFFORT OF ROBOT	
	- WE'LL NEED DIFFERENT PD GAINS (EVERYTHING IS SEEN AS $\frac{1}{s^2}$ ⇝ WE'RE SEEING DIFFERENT GAINS FROM THE SYSTEM)	
	DECOUPLING PD GAINS	
INVERSE DYNAMICS W/ HALF-SAMPLE RATE	0.020°, 0.020°	0.1°, 0.1°

SENSORS

POTENTIOMETERS

- ANALOG
- TYPICALLY RESOLUTION IS UNLIMITED (LIMITED BY DAQ)
- DEAD ZONES
  - ↳ RANGE LIMITED TO ~355°
  - ↳ DEAD ZONE ONCE PER REVOLUTION
- NOISY
- SIMPLE TO INTERFACE W/ DAQ
  - ↳ ALL YOU NEED IS ANALOG INPUT
- LOTS OF FRICTION
  - ↳ LEADS TO MECHANICAL WEAR
- GIVE US AN ABSOLUTE POSITION MEASUREMENT

ENCODERS

- DIGITAL
- LIMITED RESOLUTION
- RELATIVE POSITION MEASUREMENT
  - ROBOT START POSITION = 0
  - REQUIRE A HOMING PROCEDURE
- CAN ROTATE INDEFINITELY (NO DISCONTINUITY)
- NO NOISE (ADVANTAGE OF DIGITAL)
  - SOFTWARE COUNTING IS RISKY
  - BETTER TO HAVE DEDICATED HARDWARE CHIP
    - EX. LS7184 CHIP
- INTERFACE W/ DAQ IS MORE COMPLICATED

ENCODERS

A COUNT PULSES

B COUNT PULSES

- B WILL BE ± 90° OUT OF PHASE DEPENDING ON DIRECTION OF ROTATION

$\text{RESOLUTION} = \frac{360°}{\#\text{ OF STRIPES}}$

POT EXAMPLE

12-BIT DAQ

∴ 2^{12} VOLTAGE LEVELS

$\text{RESOLUTION} = \frac{360°}{2^{12}} = 0.1°$

OR $\frac{360}{N}$ N = # OF COILS IN POT

LS84 CHIP

QUADRATURE DECODER CHIP LS7184