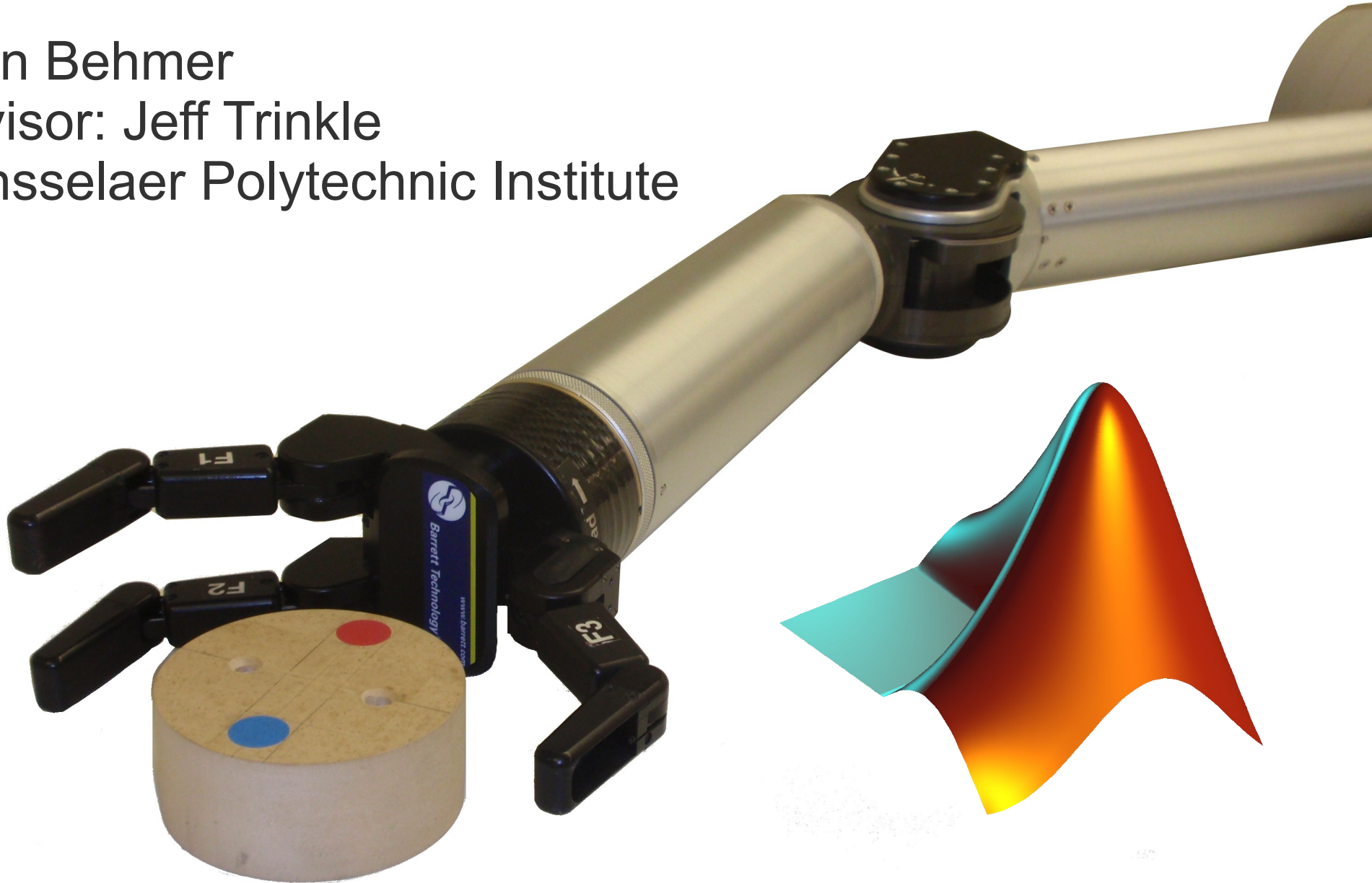


Matlab Controller for Barrett WAM

John Behmer

Advisor: Jeff Trinkle

Rensselaer Polytechnic Institute



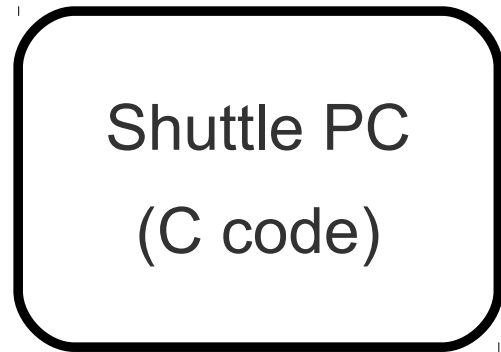
Some Background

- Barrett WAM
 - Human-Like, backdrivable, low friction
 - 4 DOF or 7 DOF models
- Matlab / Simulink / xPC Target
 - Many applications in Robotics
 - Easy to learn and use
 - Block diagrams with built-in functionality
 - xPC Target for Windows only

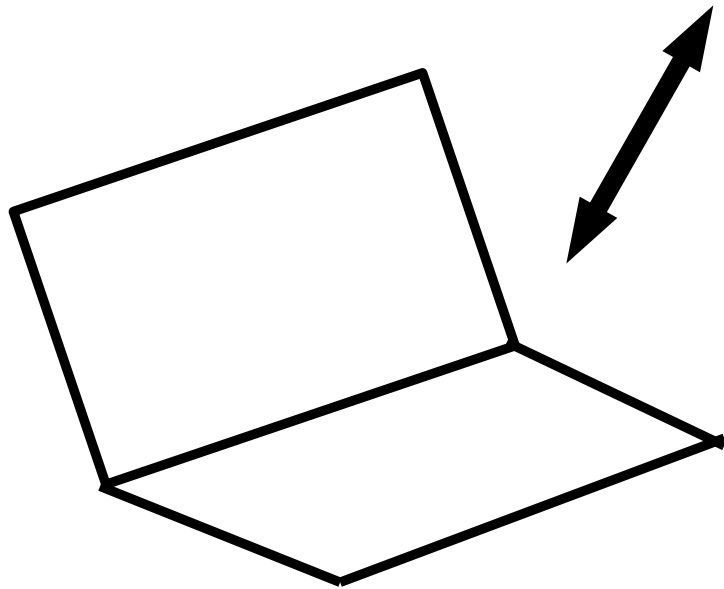
An Overview

- Wanted an easy way to hook in with Matlab
- Barrett control software (C code) difficult to write and understand
- Matlab/Simulink (block diagrams) is a good alternative
- University of New Mexico got it started
 - Professor Greg Starr
 - Matt Courtney

The "Old" Way



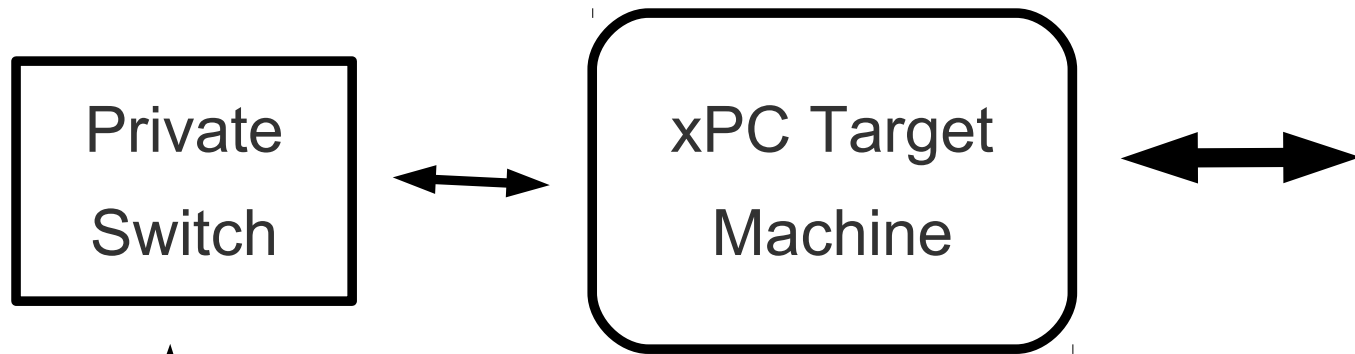
<http://www.barrett.com/robot/index.htm>



Laptop

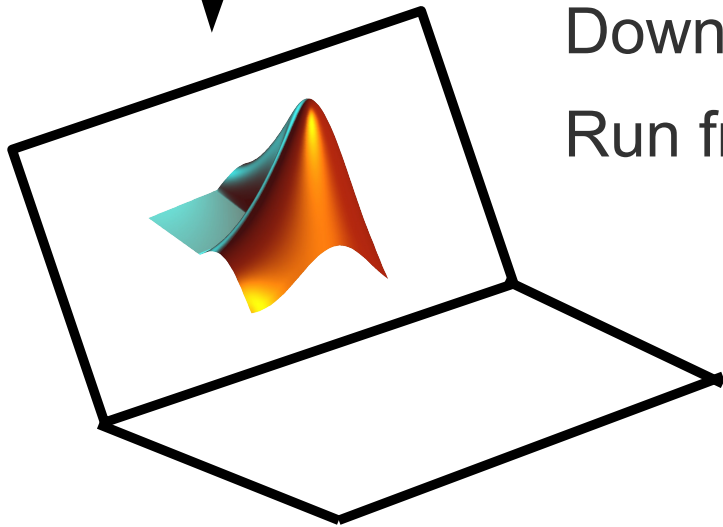
`ssh shuttlepc`
`./gravityCompensation`

The Matlab Way



<http://www.barrett.com/robot/index.htm>

Download Matlab Code
Run from Matlab / Collect Data



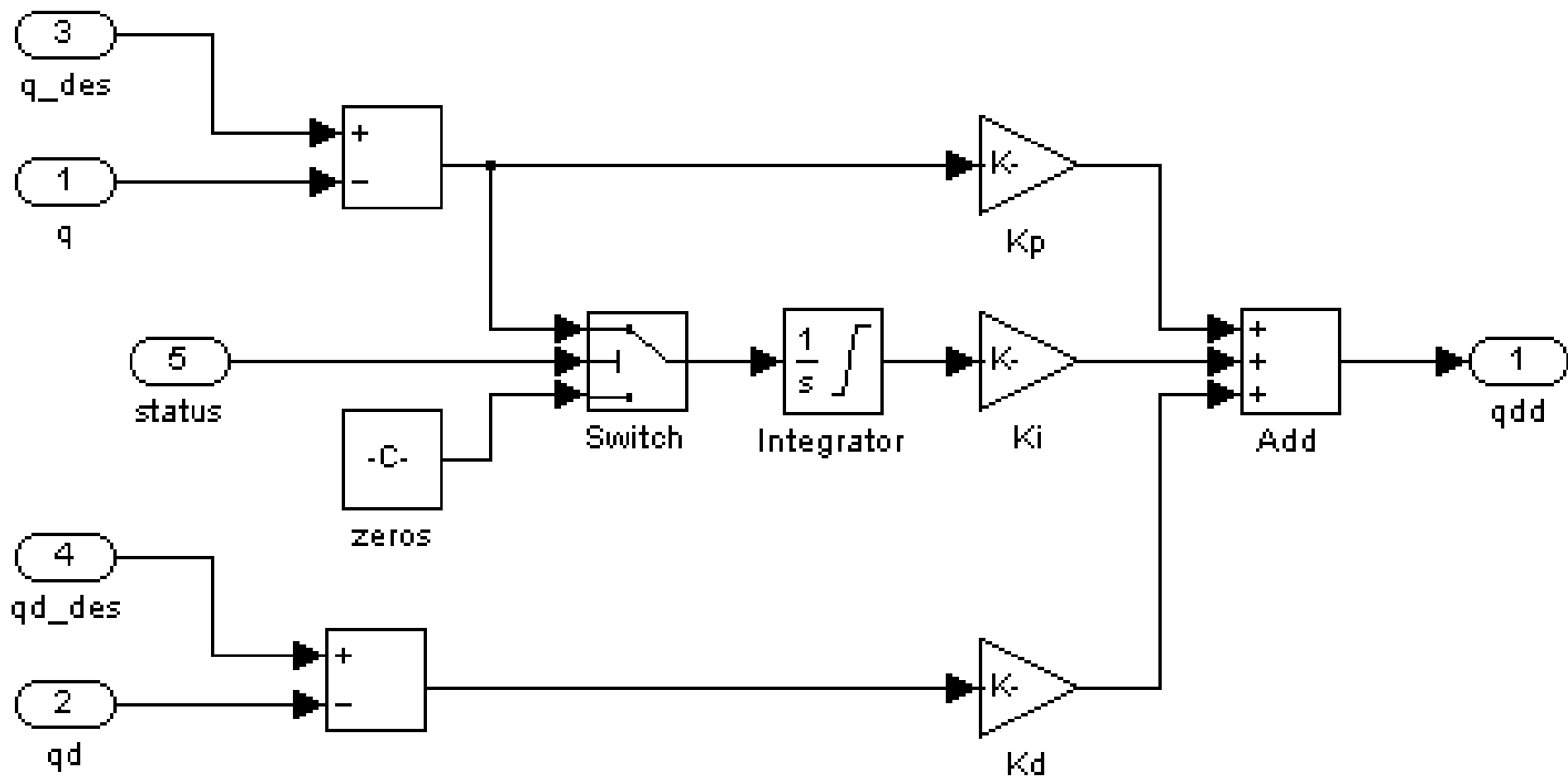
Laptop (block diagrams)

xPC Target Machine

- Boots a small Matlab kernel off a CD
- Requires specific hardware
 - Softing CAN cards
 - Some specific ethernet cards
- http://www.mathworks.com/support/product/XP/productnews/interactive_guide/xPC_Target_Interactive_Guide.html

The Controller

- Gravity Compensation
 - UNM passed off this code to us
 - Required some tweaking to make it work with our firmware version and 4 DOF vs 7 DOF
- PID position control, Friction Compensation
- Picking the gains
 - Parallel Axis Theorem
 - Rotation Matrices
 - Mass Inertia Matrices

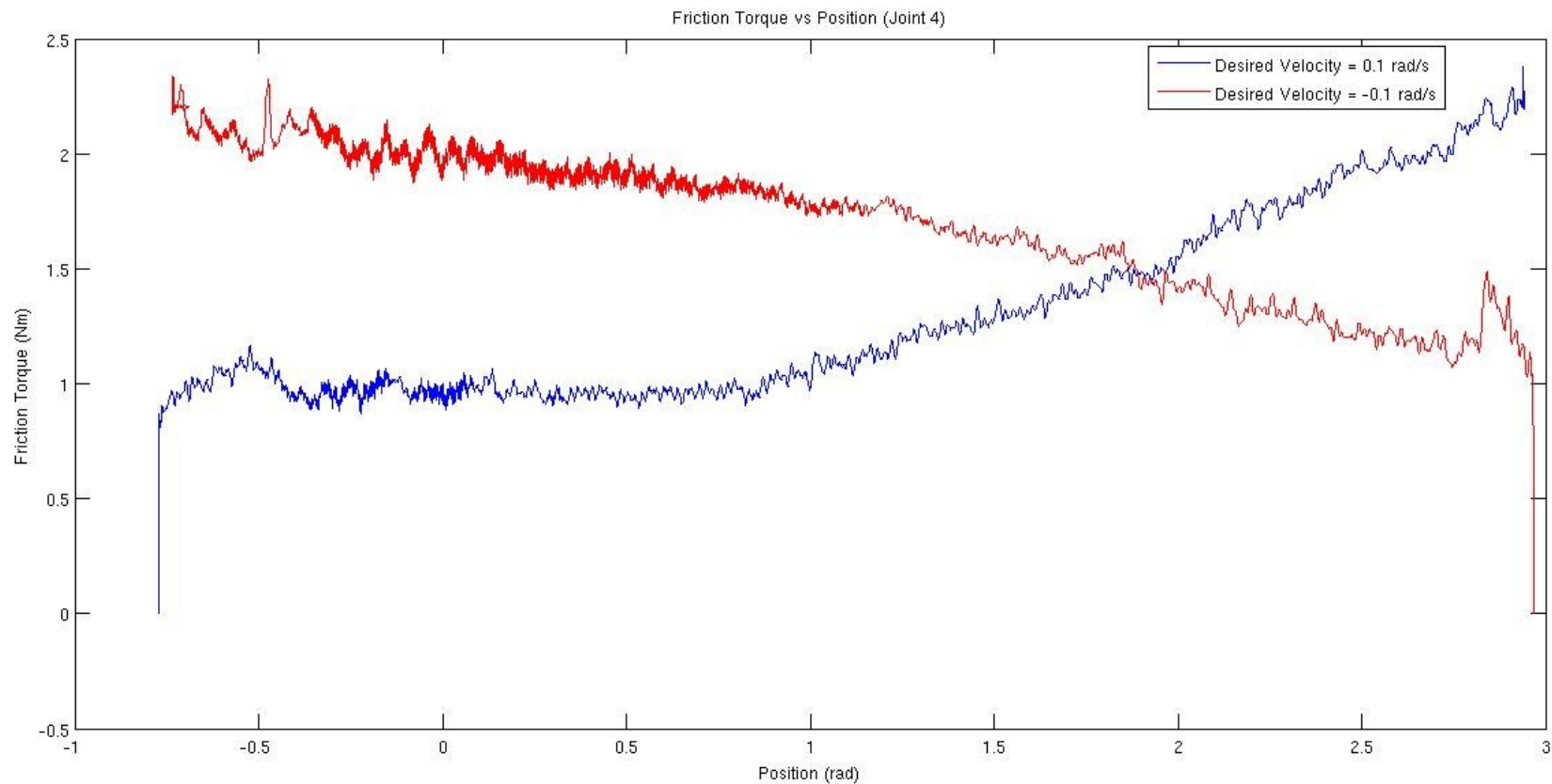


Where We Are Now

- Gravity Compensation
- Position Control will work once we have the proper gains and friction compensation
- Friction compensation giving some trouble

Challenges

- WAM Velocity Feedback
 - Differentiate position then use a moving average
- Friction Compensation



Where We're Going

- Barrett Hand Controller
- UDP Trajectory Control
 - With blending at trajectory points
 - Will hook in nicely with Matlab's image processing
- Arm and Hand coordination
- Grasping experiments

Thanks!

- These slides will be up on my homepage

<http://www.cs.rpi.edu/~behmej/>

- For more information...

RPI Robotics Wiki

<http://www.cs.rpi.edu/twiki/view/RoboticsWeb/WebHome>

RPI Matlab/WAM Setup Guide

<http://www.cs.rpi.edu/twiki/view/RoboticsWeb/MatlabxPC>

UNM Matlab/WAM Site (email starr@unm.edu for the password)

<http://www-mep.unm.edu:16080/wam/>