Learn the rules...then break them: Fusion 360 for Industrial Robot Arms

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About the speaker
Equipment used:

- ABB IRB 1200 (5 kg/0.9 m reach) with IRC5 controller
- Dewalt hand router with custom mount
- End mill
- Polyurethane foam
LEARNING OBJECTIVES

1. Quick introduction to Industrial Robots
2. Set-up manufacturing space in Fusion 360 to post-process native robot code for the application of milling
3. Test and validate posted robot code from Fusion 360 in a virtual robot simulator
4. Identify various coordinate systems of the industrial robot arm and calibrate tool data and work object data
5. Share customer case study – *Odico Construction Robotics*
6. Introduce the Autodesk Technology Centers and how anyone may access Industrial Robot Arms
INDUSTRIAL ROBOTS

For sake of this training, ‘robot’ refers to a 6-axis robotic arm. External devices, when used, create a 7th axis (such as linear rails, positioners, or rotaries). We will not be covering external devices in this presentation.
ROBOT SAFETY

Follow the standard! ANSI/RIA R15.06-2012 American National Standards Institute Safety Requirements for Industrial Robots and Robot Systems

Get informed on general safety hazards surrounding the use of industrial robots and prevent injuries by controlling associated risks.

This hands-on lab does not substitute in-person equipment training.
• Hard guarding
• Interlocked doors
• Spindle automatically turns off if anyone enters the cell

DO NOT mill without the appropriate safety systems in place.
An industrial robot has no awareness of its position in space.
To establish spatial relationships, relative positioning must be established.

**TOOL CENTER POINT (TCP)**
Defines the relationship of the tool and the robot

**WORK OBJECT (WOBJ)**
Defines the relationship of the robot and the work piece

**BASE**
Origin of the individual robot - the center of Joint 1 at the bottom of the robot. WOBJ typically references this position. In multi-robot work environments more than one base coordinate may be present (that situation will not be covered in this presentation.)

**WORLD**
In situations where multiple robots are present, the word coordinate system is used to determine the relationship of multiple base systems.
Before we begin:

1. Download the *Data Set*

2. Measure your stock

3. Measure your tool
Post Library for Autodesk Fusion 360

This is the place to find post processors for common CNC machines and controls.
Make sure to read this **important safety information** before using any posts.

![ABB Robotics - Rapid](https://cam.autodesk.com/hsmposts)

**Download / Share / RSS / Guide**

**ABB**
- Purpose: M16ng
- Version: 40890
- Changed: 61 days ago
- Extension: pgf
- Downloads: 408


**Recent changes**

https://cam.autodesk.com/hsmposts
Identify various coordinate systems of the industrial robot arm and calibrate tool data and work object data.
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[Link to YouTube Video](https://youtu.be/CrTIBxqGwM?t=22)
The load of the tool:
- The mass (weight) of the tool in kg
- The center of gravity of the tool load ($x$, $y$, and $z$) in mm, expressed in the wrist coordinate system
Odico is a pioneer in robotics and digital manufacturing. Our mission is to transform the global construction industry. Using technology, we increase efficiency and unleash the industry's innovative potential.

https://odico.dk/en/

All images in this slide deck are courtesy of Odico.
Robot cell CAD + part
Designed in Inventor
Workflow:
- Hole recognition to generate drilling toolpath (or create manually)
- Open post-processing form
- Select ABB postprocessor
- Define relevant post properties
- Post-process to get robot native language programs
ABB robot native language output
(including option to define the rotation angle of the robot head around tool axis)
Drilling is completed using the robot end effector motion.
Fusion 360 toolpath loaded in ABB RobotStudio for validation.
Fusion 360 toolpath simulated in ABB RobotStudio
Robot cell being assembled...

Fusion 360 toolpath being run on actual robot cell
Drill Mate

Drilling the same patterns over and over again in huge objects calls for extreme precision and stamina. It is something better left for machines than for humans. Based on this, we've created a beast of a robot that does this one thing masterfully.
How Drill Mate Will Help You

Drill Mate helps you in the production of complex aluminum profiles by offering an easy file-to-factory workflow. With its onboard robotic precision drilling capability, it enables rapid prototyping on the go. Its large work envelope of $2 \times 4.3$M allows for the processing of the typical dimensions in façade construction.
Why We Created Drill Mate

Precision drilling of curved aluminum profiles is typically a demanding process that requires time-consuming calibration and fitting. We created Drill Mate to automate this process by coupling a robotic drilling process with a conventional CAM-programming workflow.
What Is Drill Mate

Drill Mate is a mobile robotic platform for precision drilling of advanced aluminum façade profiles. Its sturdy steel base and modular architecture allows for quick, in-factory installation. The system comes with a heavy-duty 6-axis robot manipulator equipped with a multi-phase drilling head that has 4 variable bit-sizes and an inbuilt cooling system. Drill Mate is compatible with Autodesk Fusion 360 for an easy CAM-programming work.
The Future of Making Starts Here

The Autodesk Technology Centers Outsight Network brings together pioneers innovating in design, architecture, engineering, construction, manufacturing, and emerging technologies.

Through this network, Autodesk helps bring solutions to life that enable people to do more and make better things with less negative impact on the world.
The Autodesk Technology Centers Outsight Network is a global community with resident teams from industry, academic, and entrepreneurial sectors coming together to create a shared vision of the future of making.

The program provides our residents access to a diverse and innovative community, subject matter expertise, and tools at no charge.