

# Direct Torque Control

`direct_torque (torques=[0,0,0,0,0,0], friction_comp=<True|False>)`

`get_mass_matrix (q=<joint angles>], include_rotors_inertia=<True|False>)`

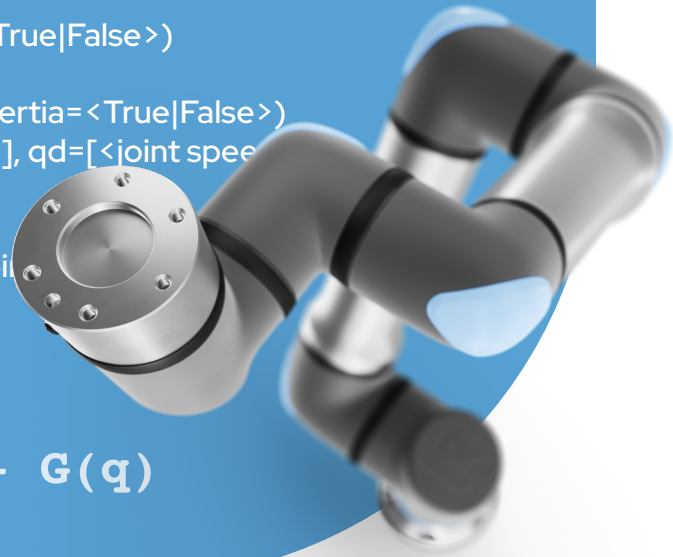
`get_coriolis_and_centrifugal_torques (q=<joint angles>], qd=<joint speed>]`

`get_actual_joint_accelerations()`

`get_jacobian(q=<joint angles>, tcp=<tcp offset>)`

`get_jacobian_time_derivative(q=<joint angles>, qd=<joint speed>], tcp_offset=<tcp offset>)`

$$M(q)\ddot{q} + C(q, \dot{q})\dot{q} + F(\dot{q}) = \tau - G(q)$$



**Direct Torque Control supports researchers in building custom control algorithms for compliant contact-rich and force-critical interaction.**

## Is your research limited by traditional position and velocity motion control?

Researchers and developers can face limitations when using traditional position or velocity control for tasks that require precise force regulation and compliance—such as assembly, insertion, or human-robot interaction. These methods lack the adaptability for effective performance in dynamic environments.

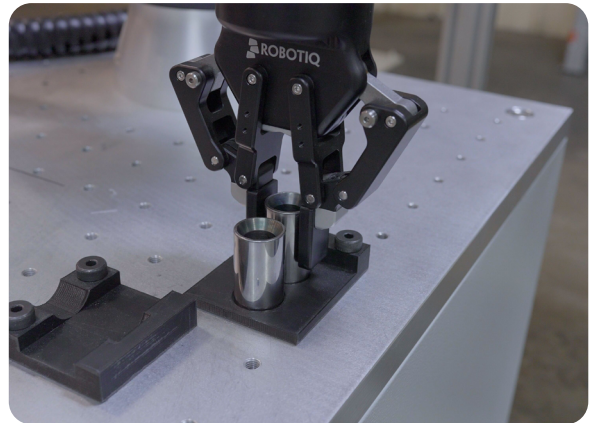
## Direct Torque Control for Universal Robots: Empowering Research with Advanced Force Control

Universal Robots Direct Torque Control provides low-level access to joint-level torque commands via UR Script, required to implement advanced strategies like impedance and force-based controls. This enables advanced control, flexible research, and sim-to-real deployment on robust, industrial-grade collaborative robots.



## Key benefits for researchers and developers:

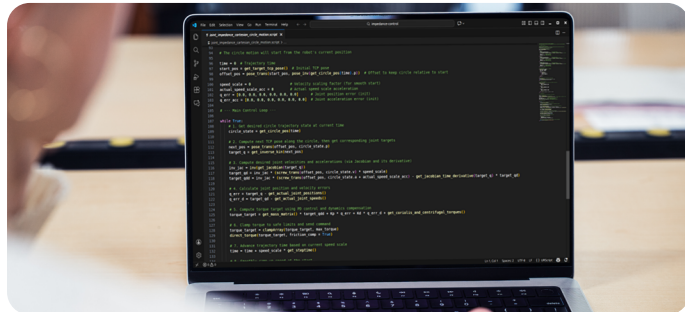
- ✓ **Custom Control Algorithms:** Impedance, force, and other custom strategies.
- ✓ **Advanced Dynamics Access:** Retrieve Mass Matrix, Coriolis, Centrifugal forces, Jacobians and more.
- ✓ **Gravity Compensation:** Built in gravity force and TCP payload compensation.
- ✓ **Sim-to-Real Made Efficient:** Bridge the gap between simulation and hardware.
- ✓ **Open Development Platform:** Integrate with UR's ROS 2 driver.
- ✓ **Reliable Hardware for Research & Industrial Deployments:** Develop on equipment designed for industrial deployment, ensuring your innovations are ready to scale.



## How to get Direct Torque Control?

Direct Torque Control is standard feature in PolyScope and can be accessed through UR Script, as documented in the UR Script Directory.

As an advanced low-level control function, Direct Torque Control bypasses several compliance features and should be used with care. Users are responsible for keeping the robot within safety limits.



## Product Technical Specification & Computability Guide

Feature	Compatible Robots	Compatible Software	UR Script Directory Links
Direct Torque Control	UR Series e-Series	PolyScope X 10.10+	<a href="#">Direct_Torque command PolyScope X 10.11</a>
		PolyScope 5.23+	<a href="#">Direct_Torque command PolyScope 5.24</a>

