A ROS 2 Package for Online Cobots Impedance Modulation

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Flexibility  Adaptability
At this purpose:

we propose a **ROS2 package** aimed to unlock **flexibility** and **adaptability** of robot behaviors and interactions by exploiting a **variable impedance modulation** targeting **human-robot applications**.
Principle behind
Drilling Task

Robot impedance is **online** modulated based on
- task trajectory
- task force
- task precision
Task to Execute

- Drilling
- Pushing
- Assistance

- Task trajectory
- Task force
- Task precision
Task to Execute

ROS2 Package Inputs
- Task trajectory
- Task force
- Task precision

ROS2 Package Outputs
- stiffness
- damping

Variable Impedance Modulation

Robot Control

assistance

drilling

pushing
How to use the package
By using ROS2 topics!
0. Configuration

Variable Impedance Modulation

Node_Settings.yaml

stiffness_preset
stiffness_constant
stiffness_maximum
damping_preset
damping_maximum
robot_initial_config
wrench_initial
precision_initial
transition_time
robot_urdf_model_path
robot_base_frame_name
robot_tip_frame_name
topic_subscriber_name
topic_publisher_name
rate
log_path
verbose
0. Configuration

Variable Impedance Modulation

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Params
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0. Configuration

Variable Impedance Modulation

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Variable

Impedance Modulation

Node_Settings.yaml

```yaml
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```

Params

ROS2
Node_Settings.yaml

- stiffness_preset
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- rate
- log_path
- verbose
1. Publish inputs

bool cartesian_space
float64[] joints_position
float64[] joints_position_reference
float64[] task_pose_reference
float64[] task_wrench
float64[] task_precision

Variable Impedance Modulation

2. Subscribe outputs

float64[] robot_stiffness
float64[] robot_damping
float64[] robot_feedforward_torque

Every Iteration!
How the package works
Pushing task: 3kg object, demanded force equal to 30N and demanded precision equal to 1cm.

Ros2 node: task planner

Ros2 node: variable impedance modulation
Centauro

pushing
Inail 2 arm assistance
• Source code
https://github.com/ADVRHumanoids/RobotImpedanceModulation

• Documentation/Instructions
https://github.com/ADVRHumanoids/RobotImpedanceModulation

• Projects
CONCERT: https://concertproject.eu/
HARIA: http://haria-project.eu/

• Publications

“An Assistive Human-Robot Bi-Manual Co-Manipulation System for Subjects with Upper Limb Motion Deficiencies” (ICRA submitted)
THANK YOU FOR YOUR ATTENTION!

ANY QUESTIONS?

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