

Industrial robots control with EICASLAB approach: industrial prototyping and experimentation results

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OVERVIEW

ACODUASI S introduction

Objectives

COMAU system

Motors control loop

Control architecture

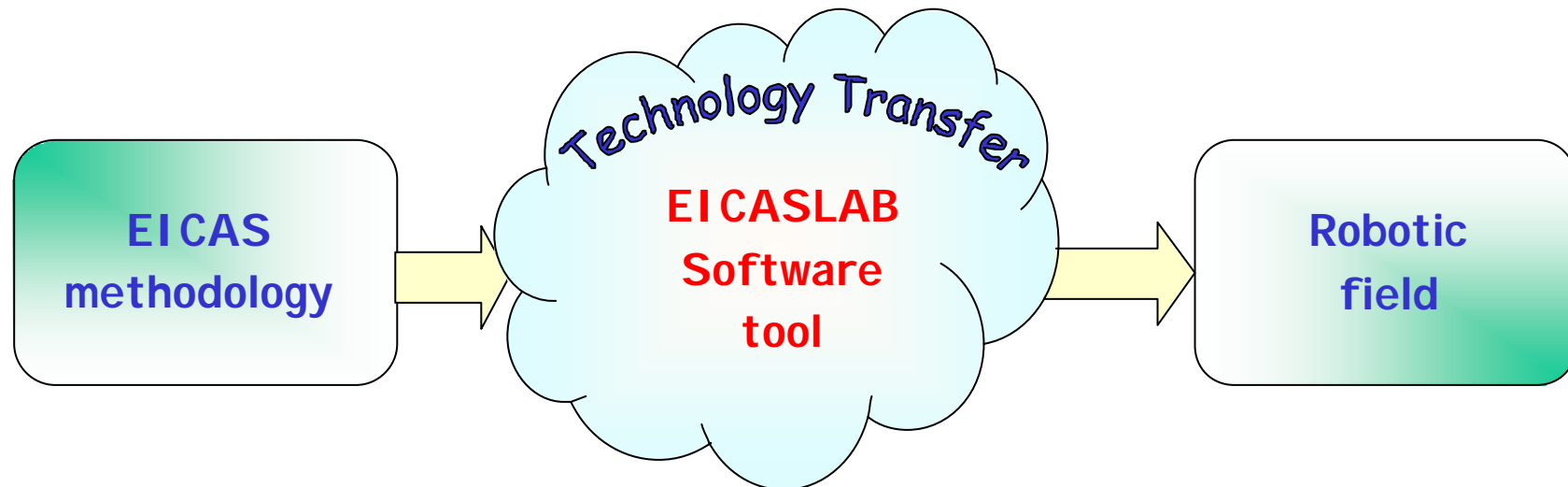
Development

Experimental results

INTRODUCTION

ACODUASIS

Automatic Control Design Using Advanced Simulation Software



OBJECTIVES

To demonstrate that, through the EICAS methodology it is possible to develop control algorithms:

designed just using plant project data, without requiring any additional experimental measures

robust and able to work properly since the first plant start-up without requiring any tuning in field of the control parameters

able to offer performance better than or equal to the ones obtained with control systems designed by means of classic methodology and setting-up through an expensive experimentation in field

COMAU SYSTEM



COMAU NH4 200-2.7

- Six axes
- 200Kg of payload
- hollow wrist
- spot welding



COMAU C4G

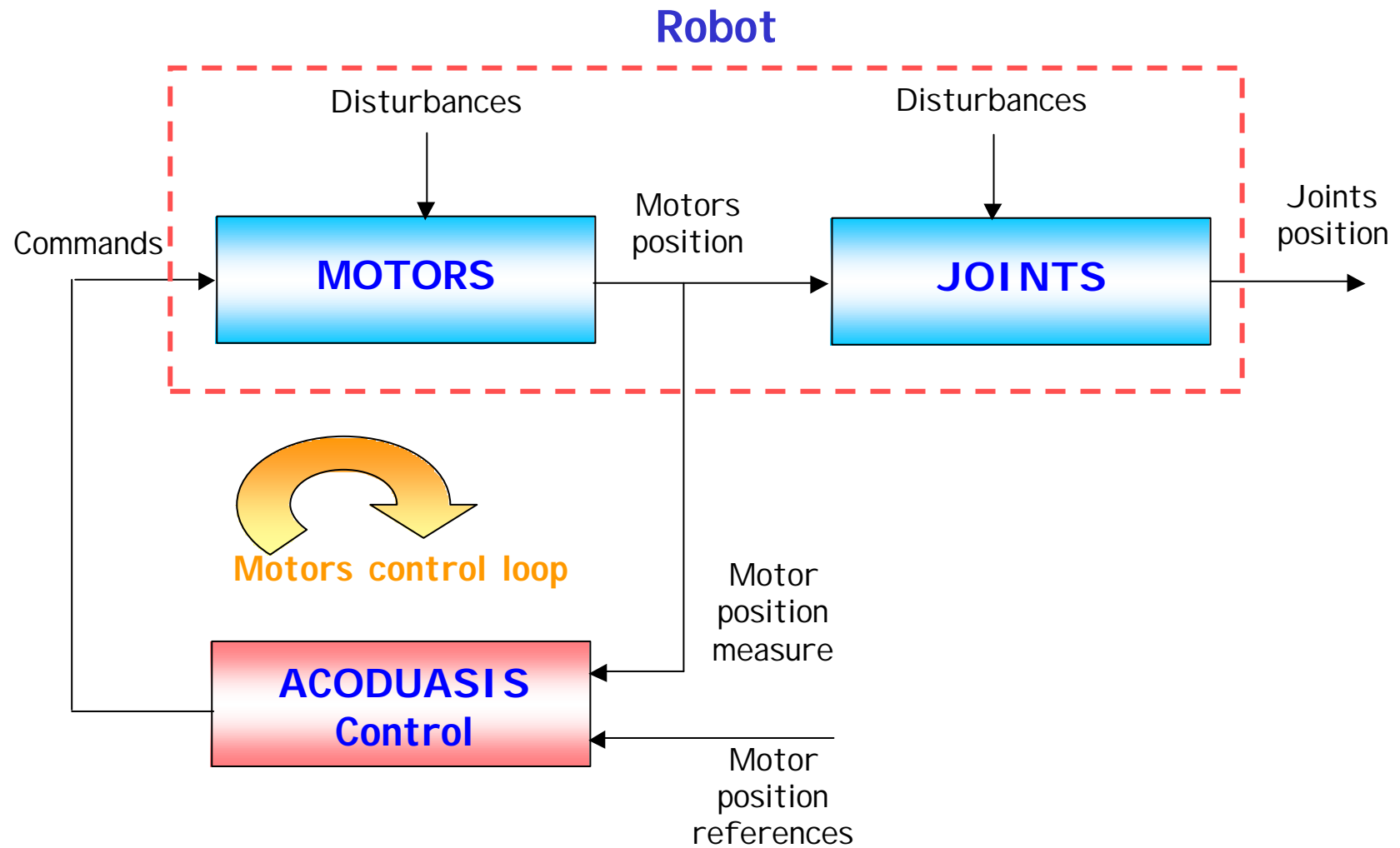
- PC Processing Unit
- 2 CPU boards
- Bus compact PCI
- up to 10 axes



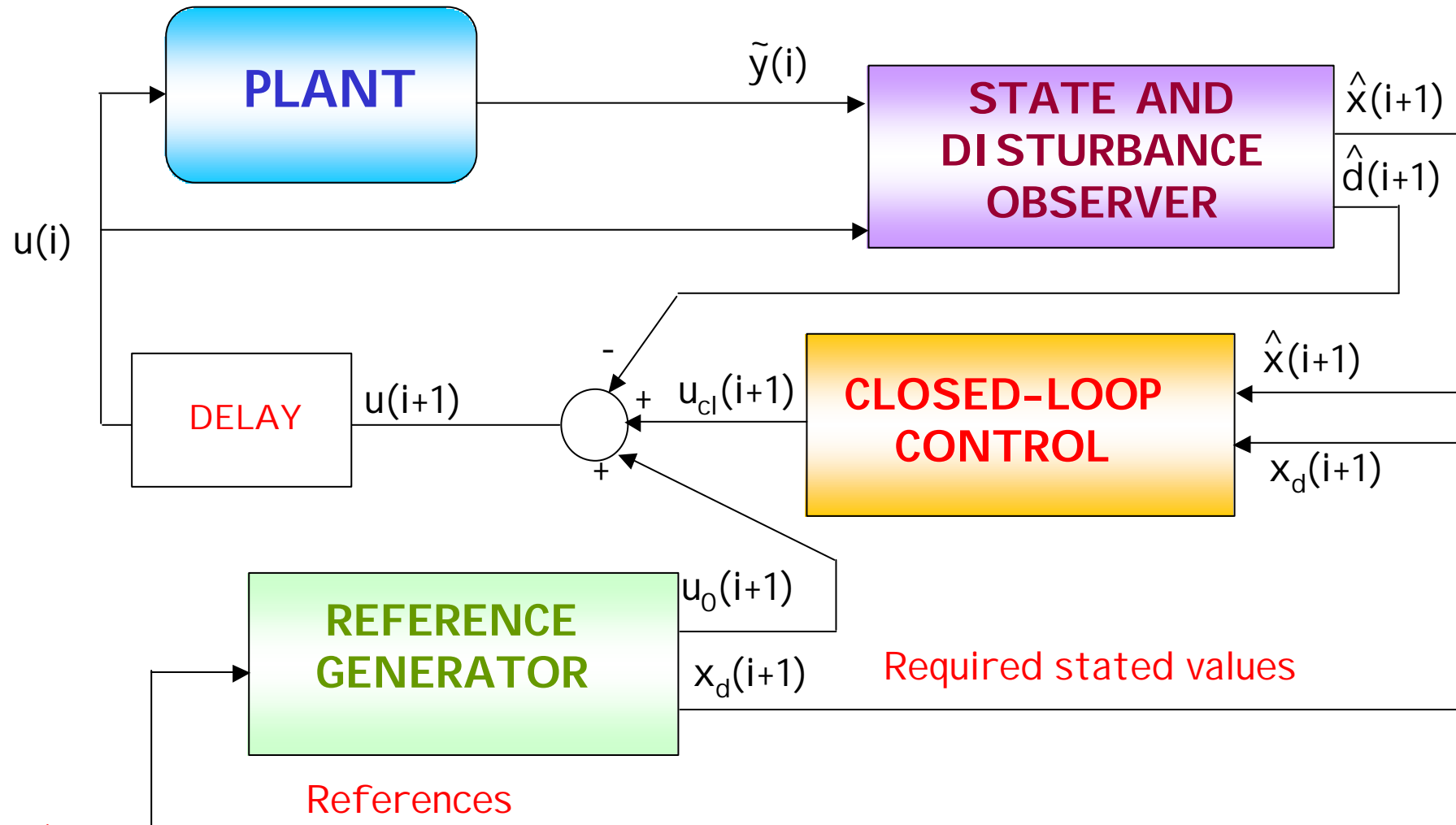
COMAU TP4i

- Human Machine Interface
- TCP-IP

MOTORS CONTROL LOOP



CONTROL ARCHITECTURE



DEVELOPMENT 1/2

Simulation phase

- analysis of the plant
- development of the fine model
- definition of the simplified model
- design of the control algorithm

Experimental phase

- analysis of the COMAU controller C4G
- creation of a new control modality in the controller
- implementation of the control algorithm code
- verification of the performance in field

DEVELOPMENT 2/2

EICASLAB in
simulation and experimentation



Simulation of the whole system
robot COMAU NH4, sensors,
actuators and controller COMAU C4G

Debug of the control algorithm C code



The same source code
downloaded in the controller

Import and analysis of the data
acquired on field

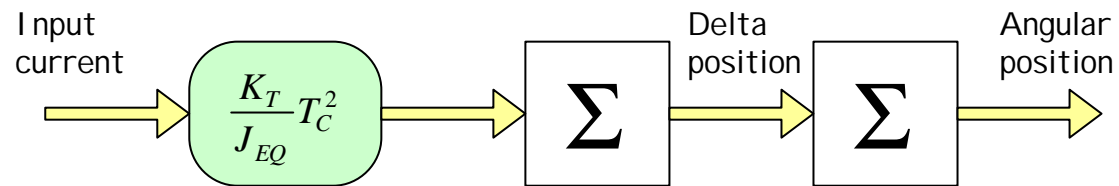


Simulation of the actual
reference trajectories



Comparison between
simulation/experimentation
performance

EXPERIMENTAL RESULTS - control based on a simplified model



Control based on rigid robot model

Only 2 parameters requested

No identification phase

No additional real-time information

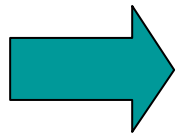
EXPERIMENTAL RESULTS - system start-up

Robot worked properly and in a safe way

The same parameters used in simulation

No tuning in field

Advantage of the E I C A S methodology



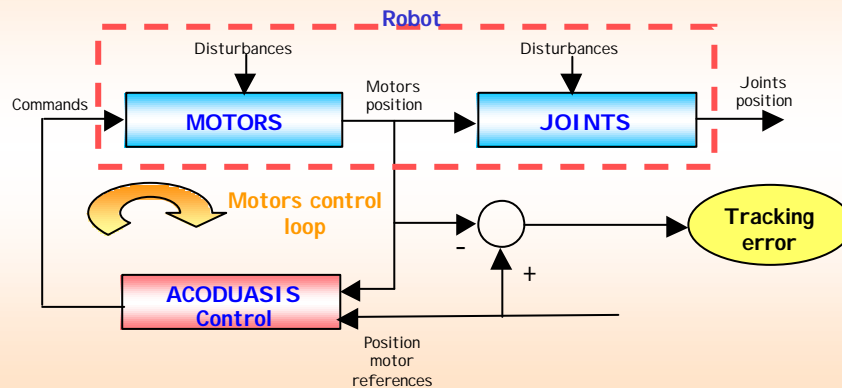
Minimisation of the time needed to obtain the final version of the control algorithm application, completely tested and working with the requested performance

EXPERIMENTAL RESULTS - performance

Evaluation criteria

Analysis considering the class of COMAU reference signals

Variable to be analysed: *tracking error*



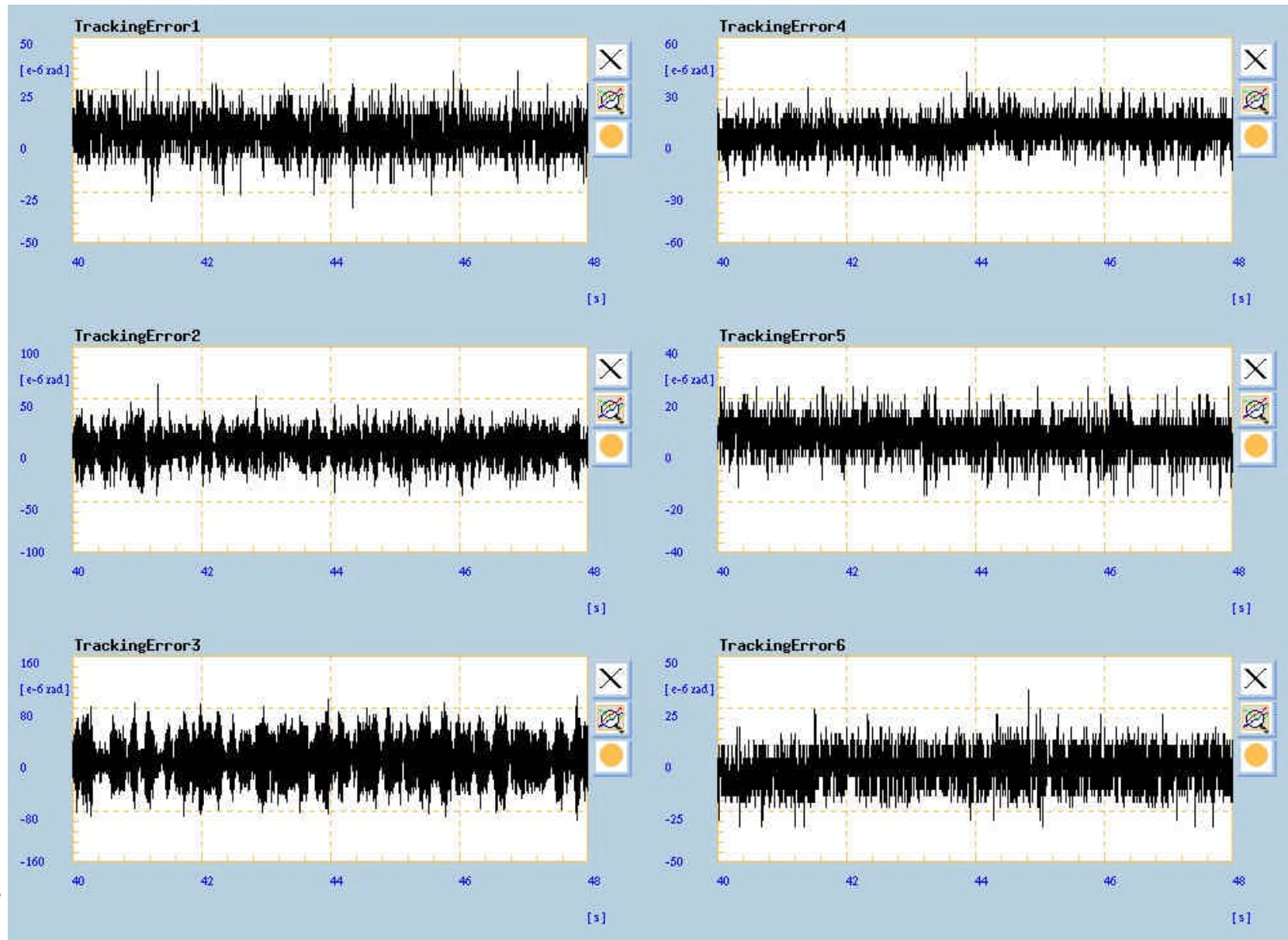
2 indexes:

- Mean value
- Standard deviation

Trials: static and dynamic

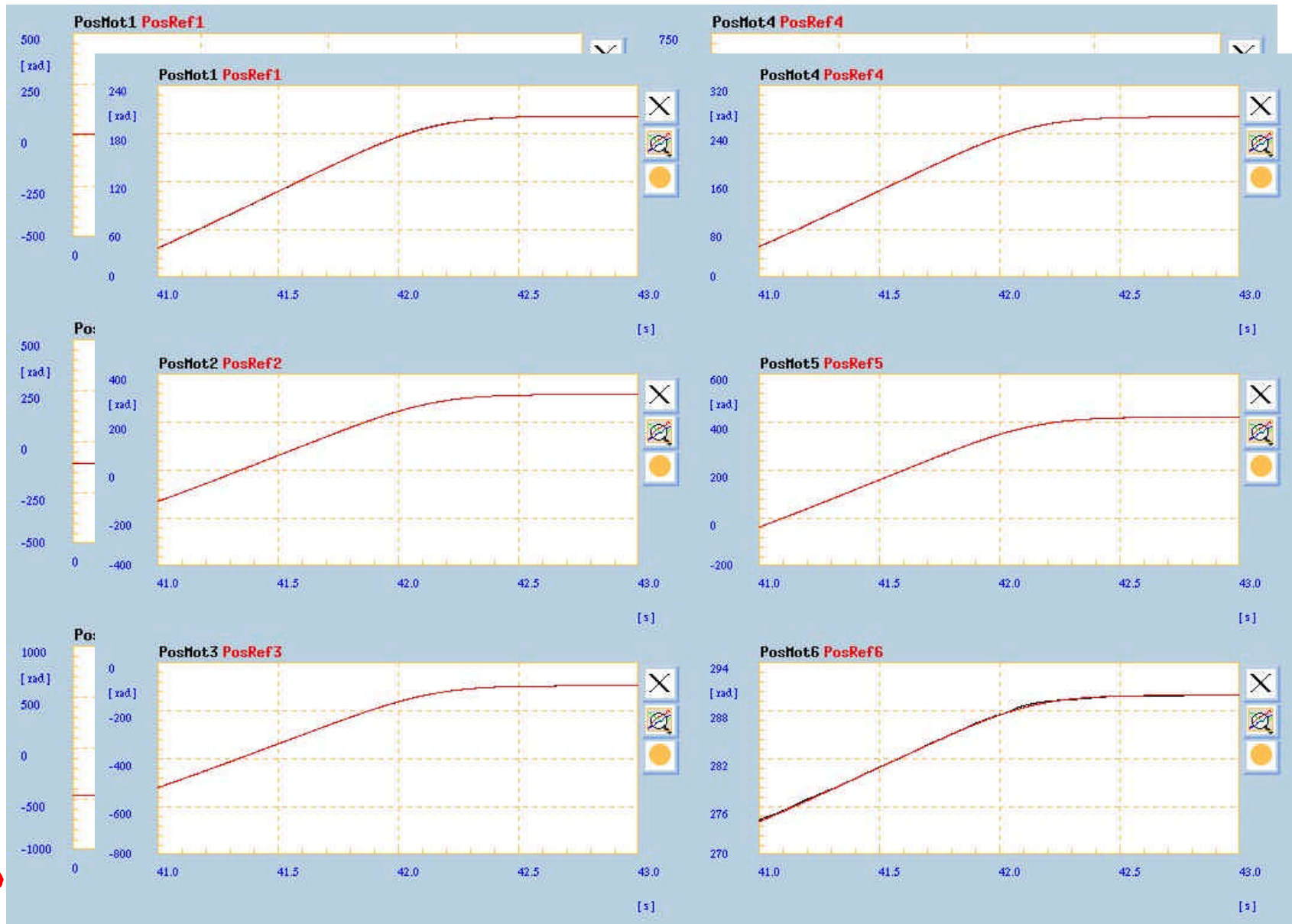
EXPERIMENTAL RESULTS - performance static trials

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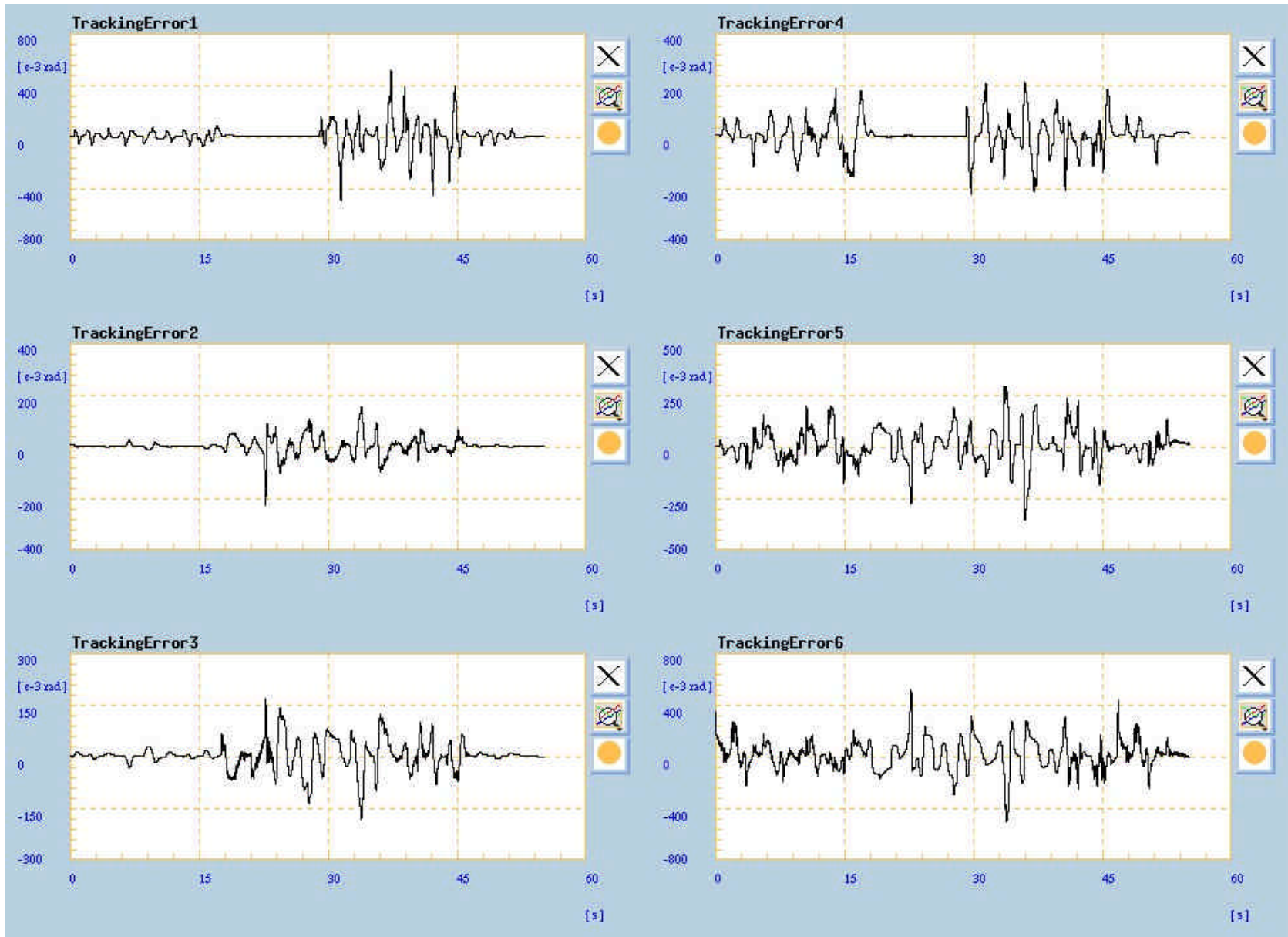
EXPERIMENTAL RESULTS - performance dynamic trials 1/2

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EXPERIMENTAL RESULTS - performance dynamic trials 2/2

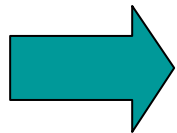
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EXPERIMENTAL RESULTS - performance

	Mean value [radians]	Standard Deviation [radians]
Static trials	1.13e-6	1.70e-5
Dynamic trials	3.83e-4	3.70e-2

Conclusion



Considering the operative requirements of the COMAU robots, it is possible to conclude that, in the context of the class of references used for such robots, the ACODUASIS control system error can be considered negligible both as mean value and as standard deviation.