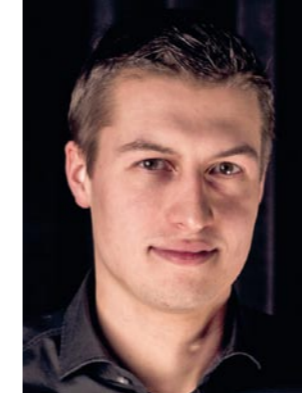


Advanced Feedforward and Learning Control for High Tech Motion Systems

High Tech Systems Center



Joost Bolder (1987) is a PhD candidate in the Control Systems Technology group, where he works on interactive learning control systems. His research is supported by Océ Technologies in Venlo, The Netherlands. Joost received the M.Sc. degree in Mechanical Engineering (cum laude) from the Eindhoven University of Technology, Eindhoven, The Netherlands in 2011. He conducted his graduation research on control of the sawtooth instability in tokamak fusion plasmas.



Frank Boeren (1987) is a PhD candidate in the Control Systems Technology group, where he works on modeling and control of high performance motion systems. His research is supported by Philips Innovation Services. Frank received his MSc degree in Mechanical Engineering (cum laude) from the Eindhoven University of Technology, in May 2012. His graduation research was conducted in cooperation with ASML Research Mechatronics. On May 27, 2013, he received the KVI-NIRIA graduation award for the best M.Sc. thesis in Mechanical Engineering 2011-2012.

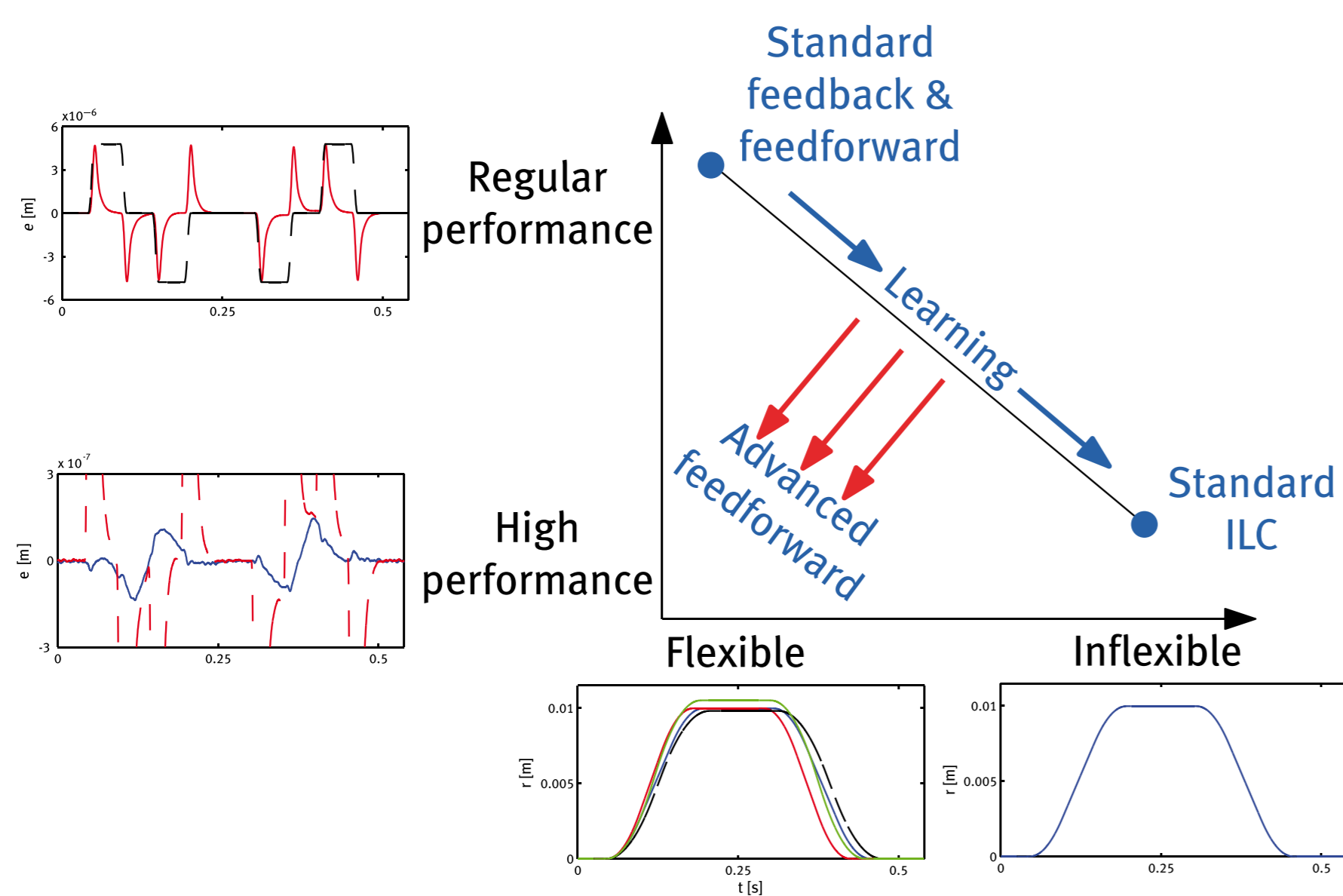
In cooperation with **océ** PHILIPS
A CANON COMPANY

Next-generation motion systems

Key requirements:

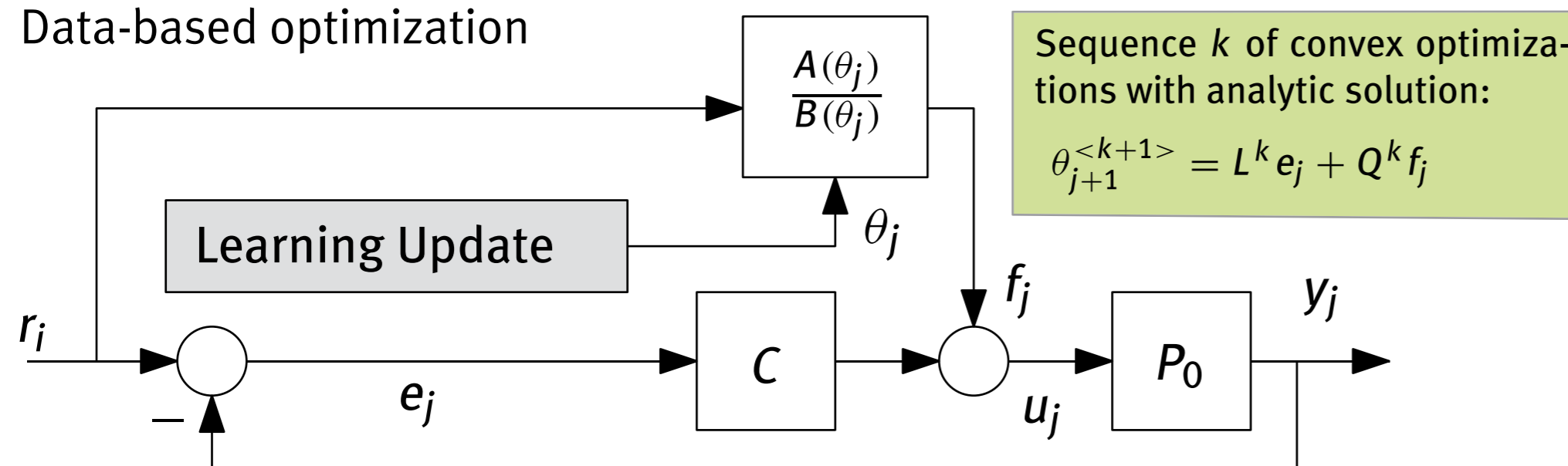
- Performance: accuracy and throughput
- Flexibility: variability of tasks

Man on the moon objectives for feedforward:



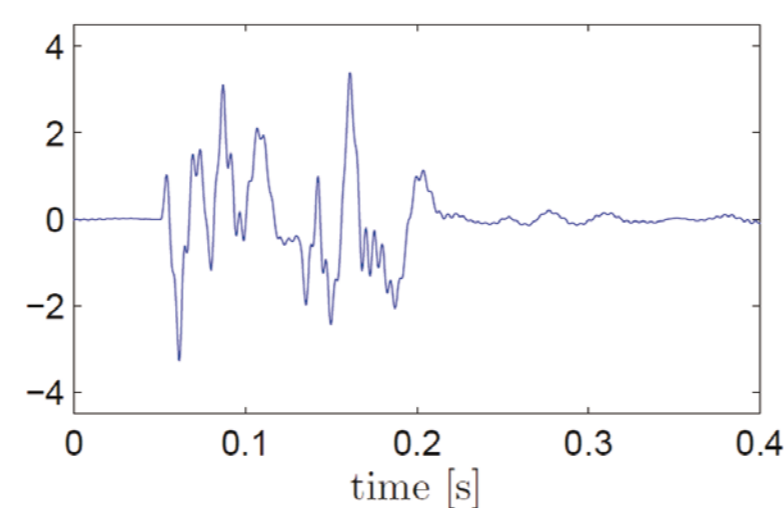
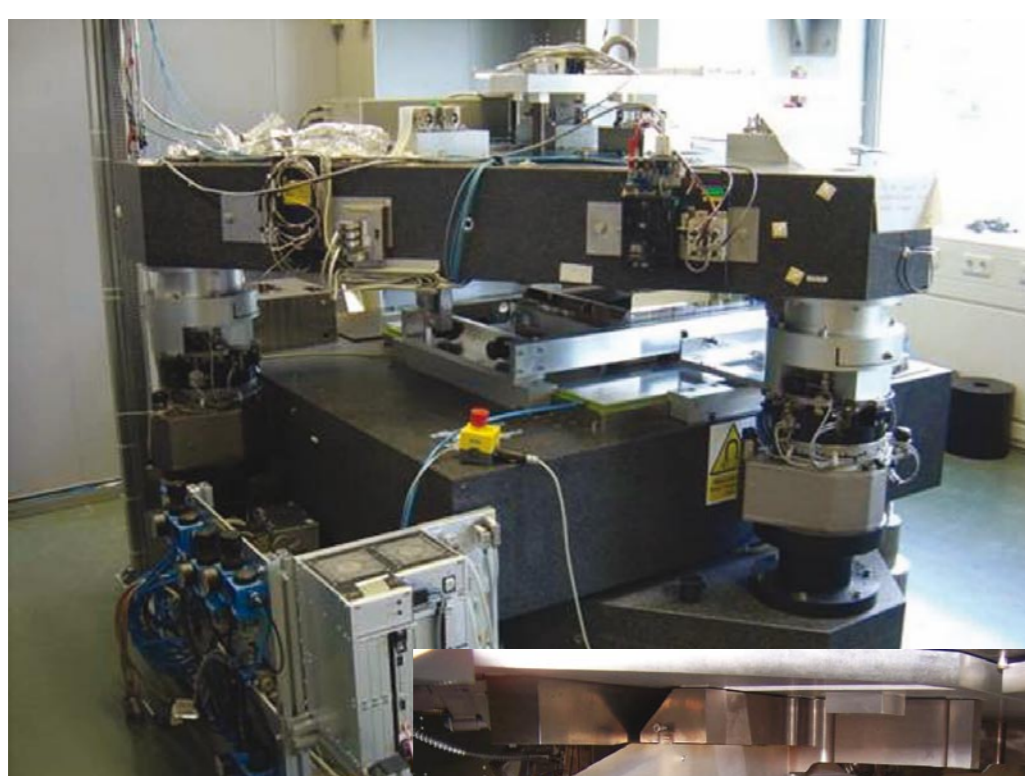
Our Advanced Feedforward Approach

Data-based optimization



Wafer positioning (Philips)

Exceptional accuracy (nanometer)



Measured error signal

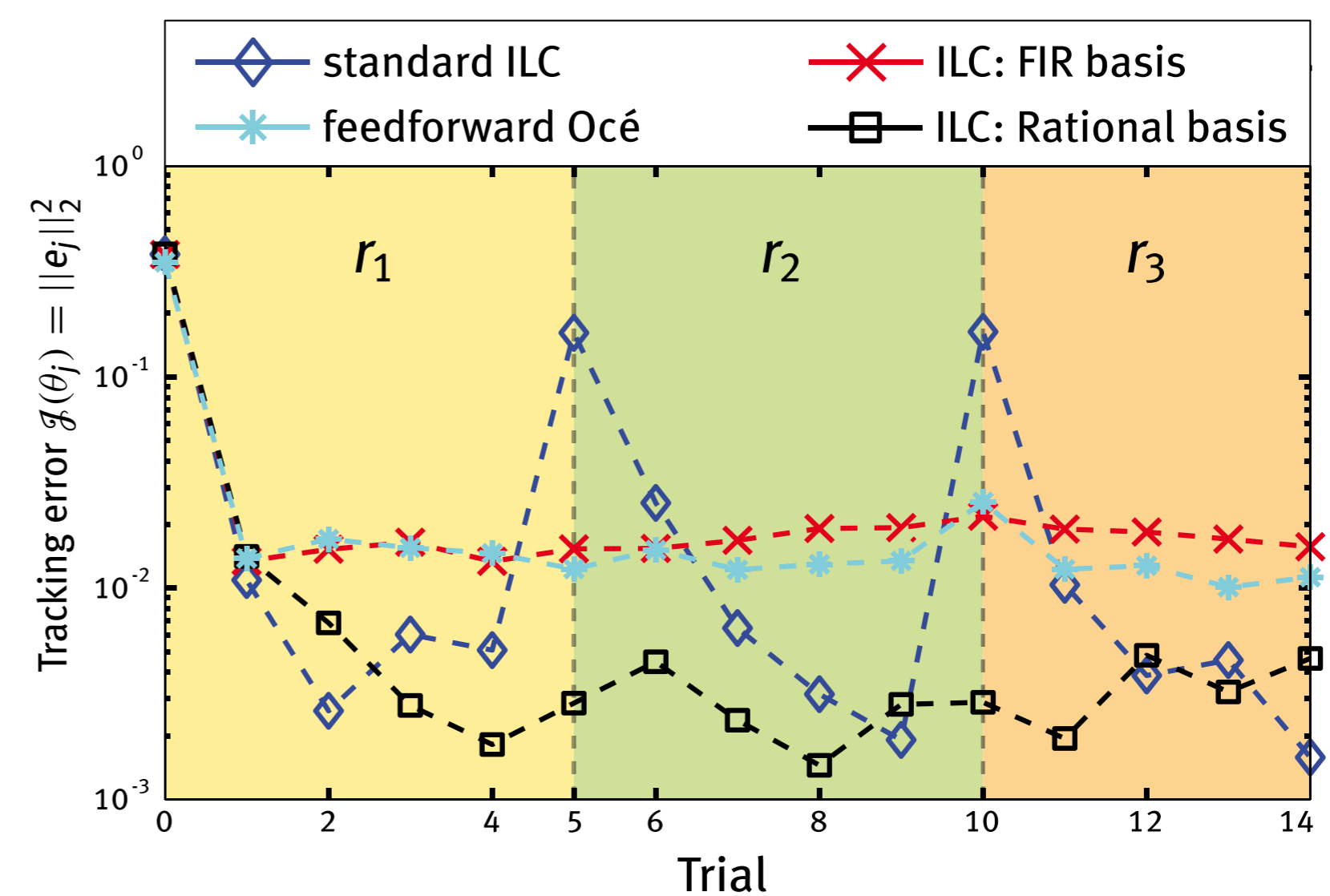
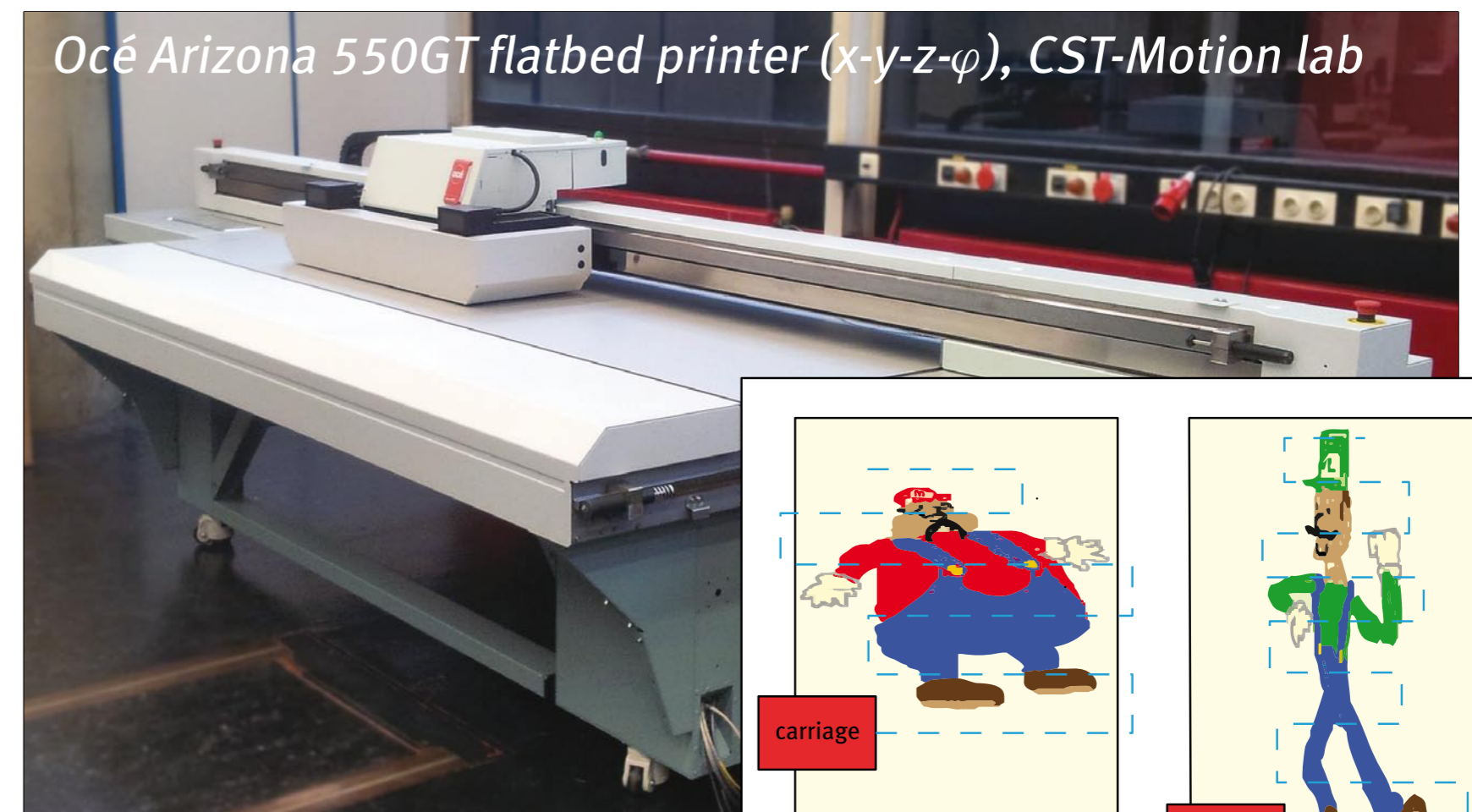


Acknowledgments

We thank our advisors Tom Oomen and Maarten Steinbuch. Furthermore we acknowledge the contributions of Jurgen van Zundert, many MSc. students and our colleagues from industry.

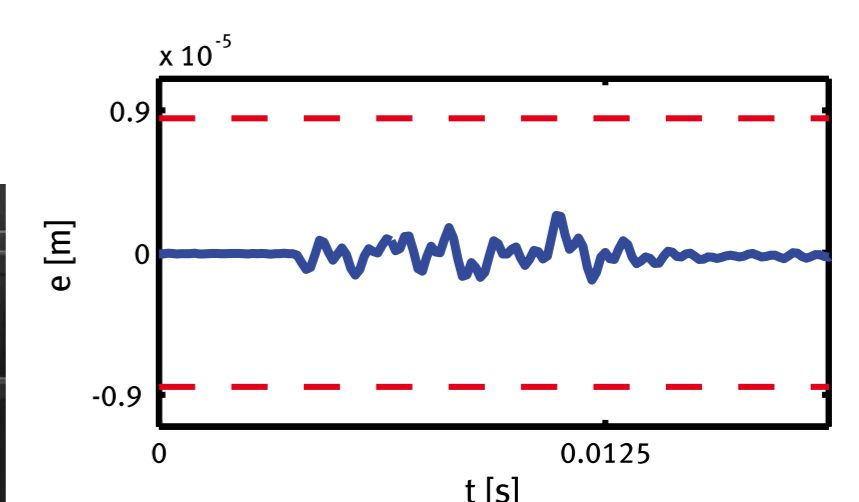
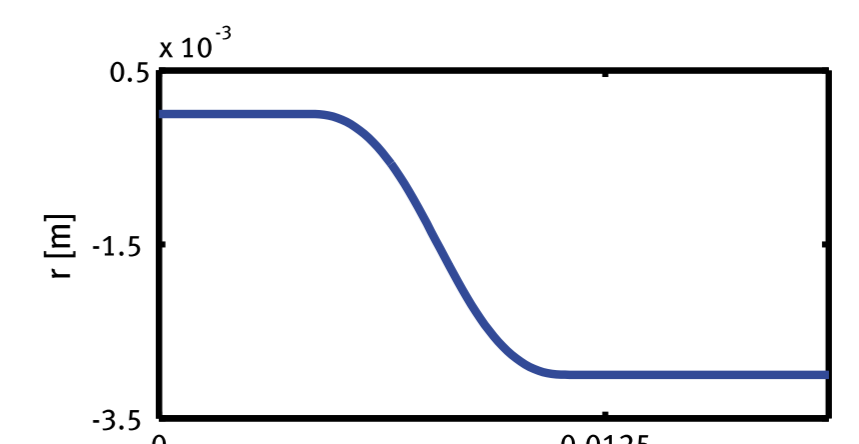
Printing (Océ)

Exceptional variation in tasks



Diebonding (NXP ITEC)

Exceptional throughput (> 90.000 lots/hour)



Measured servo performance for an aggressive setpoint.

Conclusion

Combined high performance and flexibility for a range of industrial high tech systems.