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Training in Embedded Predictive Control and Optimization

Results in Brief

Training a new generation of European scientists in embedded predictive control

European industry and academia needs to forge closer links to keep pace with the latest developments in embedded control technology. An EU initiative brought together young researchers across Europe to build the foundations for more collaboration.
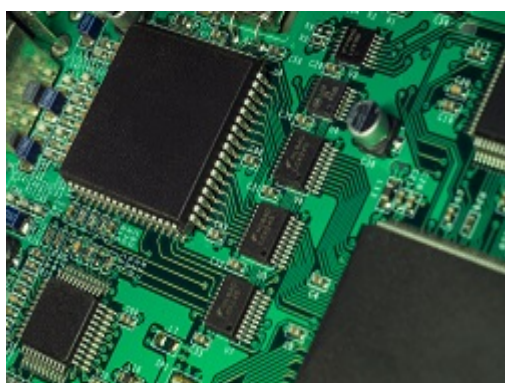
💬 **DIGITAL ECONOMY**	⚙ **INDUSTRIAL TECHNOLOGIES**	⚛ **FUNDAMENTAL RESEARCH**

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European companies and society use embedded control technology in a broad range of applications, from cranes to planes. Monitoring, control and regulation are realised by means of embedded systems, based on putting the predictive capabilities of humans on a chip and improving on them.

The EU-funded TEMPO ↗ project aimed to meet the growing needs of the rapidly emerging interdisciplinary field of embedded predictive control and optimisation by mentoring a group of young European scientists. "The European Commission wants to make research careers more attractive to young people," says project coordinator Prof. Tor Arne Johansen. "These researchers were offered a PhD programme which gives them the opportunity to improve their research skills, join established research teams and enhance their career prospects in the area of embedded predictive control and

optimisation."

Technology of choice

"The knowledge platform of TEMPO was driven by cutting-edge research that aims to firmly establish the rapidly emerging field of embedded model predictive control (MPC) and optimisation as the technology of choice in advanced embedded control systems in European industry," he explains. The project also focused on making significant contributions to enabling technology for innovative and challenging industrial application in sectors where MPC is usually not used today.

TEMPO hired 14 early-stage researchers (ESRs) involved in embedded MPC and optimisation. They participated in a joint academic/industrial programme of leading-edge training-by-research, high-quality supervision, complementary and transferable skills training, inter-network secondments and workshops.

The aim was to create a closely-connected group of leading scientists that are highly sought after by European industry. Another goal was to get them ready to incorporate embedded MPC and optimisation into new innovative products, industries and services. This will help to build a solid foundation for long-term European excellence in this domain by disseminating the research and training and best practice into the project partners' doctoral schools. Ultimately, TEMPO will foster long-term partnerships and collaboration mechanisms that outlast the programme.

Technical breakthroughs

The ESRs achieved several technical and scientific breakthroughs. These include: increased reliability and scalability of optimisation-based and explicit MPC targeting fast embedded control systems and reduced cost; reductions in computation times; reductions in software footprint for low-cost industrial embedded controllers; theories and tools for theoretical verifiable performance; and a technology platform available through robust plug-and-play software tools to support automated design, implementation and validation.

All doctoral fellows were able to travel to distinguished schools and universities around the world to train with leading academics. They established their own collaborations, such as the creation of the Operator Splitting Quadratic Program, an open source C package for solving convex quadratic programmes based on operator splitting methods.

TEMPO helped bridge the gap between theoretical and practical applications with partner businesses like Renault-Nissan Group, present in 118 countries. The fellows became not only predictive control specialists, but also aware of industrial constraints such as cost and safety.

One of the main benefits of TEMPO, the participants noted in a project video ⬈, was being able to receive guidance and training on things like presentation skills, thus receiving "a full package of knowledge" that will help them communicate with industry and academia.
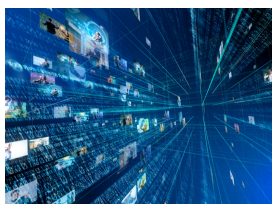
Keywords

TEMPO, embedded predictive control, embedded model predictive control and optimisation

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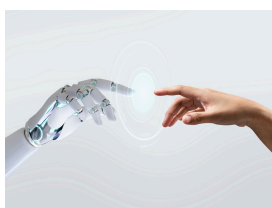
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Project Information

TEMPO

Grant agreement ID: 607957

Project closed

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