

Faculty of Mathematics and Natural Sciences, University of Groningen Engineering and Technology Institute Groningen (ENTEG)

Profile report: Optimization and Control (Optimalisatie en Regeltechniek)

Discipline: Control Engineering

Level: Assistant Professor (tenure track)

Fte: 1.0

1. Scientific discipline

Control engineering; systems and control; optimization; optimal control.

Systems and control theory deals with the analysis of dynamical systems and the synthesis of feedback laws that regulate the systems behavior to a desired one. Optimization studies the methods for finding the best value of an objective function within a domain. Optimal control refers to the methods for finding the control input that optimizes a cost functional subject to differential constraints.

2. Vacancy

This position is opened by the board of the Faculty of Mathematics and Natural Sciences (letter with reference EMK/gl/16/00262). The candidate will be embedded in the SMS-Cyberphysical Systems group within the Engineering and Technology Institute Groningen (ENTEG) of the Faculty of Mathematics and Natural Sciences (FMNS) of the University of Groningen (UG).

3. Selection Committee

Prof. J.M.A. Scherpen (Discrete Technology and Production Automation, Director ENTÉG, Chair)

Prof. C. De Persis (SMS-CPS, ENTÉG)

Prof. F. Picchioni (Product Technology, ENTÉG)

Prof. M. Cao (Discrete Technology and Production Automation, ENTÉG)

Prof. A.J. van der Schaft (Systems, Control and Applied Analysis group, JBI)

Prof. N. van de Wouw (Dynamics and Control, TU Eindhoven)

To be announced (Student member)

Prof. H.L. Trentelman (Systems, Control and Applied Analysis group, JBI) is an advisory member of the Selection Committee.

HR-advisor

H. Haagsma (HR advice)

4. Research area

The successful candidate is expected to conduct research in areas at the intersection of optimization and dynamical control systems. These areas include but are not limited to differential games, distributed optimization, optimization and control of network systems, optimal control. Other areas might be considered as well in cases of applications by exceptional applicants. The research area of interest focuses on the development of novel methods and algorithms for large scale optimization problems and differential games in connection with dynamical systems and networks, and the formal investigation of their properties, namely stability, convergence and robustness. These techniques are important in application areas such as smart cities, transportation systems, flow networks, energy systems, supply chain networks, optimal actuator/sensor placement, cyber security and epidemic networks.

5. Research group and Institute

ENTEG at the FMNS has a strong track record of research in Systems and Control. This position will expand the current expertise to cover the area of optimization for dynamical control systems. The candidate will be embedded in the SMS-Cyberphysical Systems group where research in cyber-physical systems, dynamical networks, nonlinear systems, hybrid and switched control is conducted, with applications ranging from power networks, to data centers, water and heat networks, as well as adaptive optics.

Other related research groups corresponding to the more Mechanical Engineering oriented part of ENTEG are DTPA-Systems and Control Engineering and Advanced Production Engineering (tribology and surface engineering, high-power laser processing, 3D printing). Collaboration with these groups for teaching and research projects is foreseen. The (bio-)chemical engineering part of ENTEG consists of 4 groups focussing on products and production technology for (bio-)chemical based products. The SMS-Cyberphysical System group promotes interdisciplinary research in collaboration with other ENTEG groups.

6. Local and national position.

The research activities in Systems and Control at UG are part of the Jan C. Willems Center for Systems and Control, which fosters collaboration among its members both at ENTEG and at the Johann Bernoulli Institute for Mathematics and Computer Science (JBI). Researchers in Systems and Control have a prominent role in the recently established cross-disciplinary research theme on Data Science and Systems Complexity (DSSC) within the Faculty of Mathematics and Natural Sciences. This involves scholars from diverse disciplines such as mathematics, computer science, artificial intelligence, systems and control, engineering, astronomy. Scholars in Systems and Control aim at establishing a system-theoretic perspective on data science and complex systems. At the national level, research activities are part of the Dutch Institute of Systems and Control (DISC). Worldwide, current leading research in systems and control focuses on complex dynamical systems, possibly distributed over large-scale networks, combining physical components with cyber elements modeling computational and communication devices. The large-scale nature and complexity of these systems requires advanced analytical tools for optimal decisions and control. This tenure track position strengthens the existing expertise at UG towards this research direction.

7. Expected contribution to research

The successful candidate is expected to consolidate his/her own research line of high quality, so that within five years the candidate has sufficient visibility and an outstanding reputation in the international research field. It is very important that the research leads to publications in top-tier scientific journals. Furthermore, in second instance, publications at well-known, high quality, scientific conferences are important.

An essential part of the research activities comprises the supervision of Ph.D. students and post-doctoral researchers. The candidate is also expected to be successful in obtaining external funding for the research and to contribute to the development of the research group.

8. Expected contribution to teaching

The candidate for the vacancy is expected to teach and develop courses in the area of Optimization and Optimal Control, develop and supervise B.Sc. and M.Sc. thesis projects which fall in the area of interest of the SMS-CPS group. In collaboration with the group permanent staff the candidate initiates the development of new courses and thesis subjects, and plays an active role in the development of the educational program. The educational activities are mostly related to the Industrial Engineering & Management program.

9. Expected contribution to the organization

The successful candidate is expected to contribute to the general organization of research on the national and international scale and within the faculty and institute. Also contributions to the organization of existing and new teaching programs are expected.