

## Faculty of Science and Engineering

### Profile report: Dynamics and Vibration/Dynamica en vibratie

- Discipline: *Dynamics; Vibration; Mechanical Engineering;*
- Level: Assistant Professor (tenure track)
- Fte: Full time (1,0)

#### 1. Scientific discipline

Dynamics and vibration are subdisciplines of Mechanical Engineering. They are integral parts of understanding physical systems and technologies. The research, in general, includes experimental, computational, and/or theoretical research components and is directed at the many challenging dynamics and vibration problems associated with the design of modern engineering structures and transportation systems. The research aims to provide better predictability of the dynamic behaviour of engineering structures to ensure better performance, safer operations and lower maintenance costs for existing and future designs.

#### 2. Vacancy

This position is opened by the Board of the Faculty of Science and Engineering (letter with reference JK/gl/15/00712) and will be embedded in the institute Engineering and Technology Institute (ENTEG), Dynamics and Vibration Group. The position falls within the framework of 'Career Paths in Science 4' ('Bèta's in Banen 4'). Please see link for [criteria and conditions](#).

#### 3. Selection Committee

- Prof. dr. ir. H.J. Heeres (chair), director ENTEG, professor of Green Chemical Reaction Engineering (ENTEG);
- Prof. dr. F. Picchioni, teaching director ENTEG, professor of Product Technology (ENTEG);
- Prof. dr. M.M. Ghandchi Tehrani, professor of Dynamics and Vibration (ENTEG);
- Prof. dr. ir. B. Jayawardhana, director of Mechanical Engineering master programme; professor of Mechatronics and Control of Nonlinear Systems (ENTEG);
- Prof. dr. ir. J.M.A. Scherpen, professor of Discrete Technology and Production Automation (ENTEG);
- Prof. dr. J. Mottershead (University of Liverpool)
- Student member (w.n.b.)

#### Advisors

- Prof. dr. Antonis Vakis, director of Industrial Engineering and Management master programme, associate professor in Mechanics and Tribology of Engineering Systems (ENTEG);
- Mr. F. Salverda, HR advisor;
- Dr. K.E. Voskamp, scientific coordinator ENTEG.

#### 4. Research area

Dynamics and vibration occur in many physical systems and technologies, ranging from small-scale structures, such as sensors, to large-scale space structures. The research of the tenure-track position will deal with dynamics and vibration problems associated to the design of modern engineering structures, high-tech systems, advanced instrumentations and transportation systems. The analytical, numerical and experimental study of complex mechanical systems, such as those experiencing nonlinear phenomena as well as those with a large number of degrees of freedom, are key activities. The strength of the research area lies in combining theoretical techniques and numerical tools for analysis with dedicated experimental studies, which jointly provide insight into the dynamic behaviour of engineering structures.

The main research topics of the recently established research unit Dynamics and Vibration are structural modification, active vibration control, energy harvesting, nonlinear dynamics and control, time-varying systems, and health monitoring. The candidate is expected to complement the group's research activities in this field by focusing on dynamic analysis and testing for vibration control and predictive maintenance with particular applications in smart factories.

### **5. Embedding: institute (and basic unit)**

The candidate will be embedded in the research institute ENTEG ([www.rug.nl/enteg](http://www.rug.nl/enteg)). ENTEG is the engineering science and technology institute of the Faculty of Science and Engineering (FSE) of the University of Groningen. ENTEG's research is highly multidisciplinary in nature and focuses on fundamental and engineering research on the development of new and innovative processes and products for a wide range of product sectors. ENTEG has a strong track record in (industrial) research projects in the field of systems and control, green chemical product and process engineering and smart advanced production engineering. ENTEG staff strongly links to various educational programmes, including the Mechanical Engineering, Industrial Engineering and Management, and Chemical Engineering degree programmes.

The candidate is expected to set up their research line within the new basic unit Dynamics and Vibration. This new unit currently is setting up research and teaching links to the other Mechanical Engineering oriented units of ENTEG - the basic units Advanced Production Engineering (APE), Computational Mechanical and Materials Engineering (CMME), Discrete Technology and Production Automation (DTPA), Optimization and Decision Systems (ODS), and Smart Manufacturing Systems (SMS). APE focuses on mechanical precision engineering and material science. CMME focuses on predicting and optimization of the performance of materials, components and systems. Research within DTPA and SMS, on the other hand, focuses on the dynamical modeling, analysis, control and systems engineering of complex systems with applications to electro-mechanical systems. ODS complements the latter two groups and focuses on optimization and decision systems.

### **6. Local and (inter)national position**

Mechanical Engineering in Groningen is unique in the Dutch academic landscape because it is embedded in a broad, comprehensive university environment. This enables a multidisciplinary approach and collaborative research across disciplines; on many topics, research at FSE covers the entire innovation cycle, from fundamental science to the scientific design of processes and products. This provides opportunities for a new research line like Dynamics and Vibration to seek collaboration with strong existing groups to strengthen the research profile either in the area of Mechanical Engineering or in other areas. Examples of such groups at the University of Groningen are embedded in ENTEG (see section 5), the Zernike Institute for Advanced Materials (focused on materials), the Kapteyn Astronomical Institute (creating innovative instruments for telescopes both earthbound and in space), the Energy and Sustainability Research Institute Groningen (for example on energy systems) and at the University Medical Center Groningen (UMCG; on medical instrumentation). There also lay opportunities in the already existing close collaborations between ENTEG and SRON (Netherlands space institute) and the Innovation Cluster Drachten (a group of high-tech companies in Northern Netherlands that work together on solutions for future challenges at the cutting edge of technology).

The most prominent activities in the research field in the Netherlands are taking place at the Delft Technical University (Prof. Andrei Metrikine, Prof Jan van Wingerden) with research in the dynamics of civil structures such as pipelines and wind turbines, and uncertainty quantification, fault detection, isolation and control, at the Eindhoven University of Technology (Prof Nathan van de Wouw and Prof Rob Fey) with research interest in the field of dynamics and control, focusing on applications such as mechatronics and robotics, smart manufacturing, energy exploration processes, autonomous driving and embedded control systems and at the University of Twente (Prof Arthur Berkhoff) with a research area of active noise and vibration control. Compared to

these activities the scope of the new position will focus more on the dynamic analysis and testing for vibration control and predictive maintenance with particular applications in smart factories. Examples of International strong research groups such as Institute of Sound and Vibration in Southampton, Space Structures and Systems group in Liege, Dynamics group in Polytechnico di Torino and Dynamics Research group in Sheffield, working on different applications on dynamics and control.

### **7. Expected contributions to research**

The candidate is expected to initiate and set up their research line in the field of dynamics and vibration. The research should compete on a worldwide level and lead to publications in top journals. Obtaining substantial external funding is crucial. Supervision of PhD students is an important part of the research activities. The research is expected to cross-fertilize the existing research within the institute and should lead to a strengthening of the international reputation of the group and the institute.

### **8. Expected contributions to teaching**

The candidate will contribute 30% of their time to teach mainly at the master programme in Mechanical Engineering<sup>1</sup> and the bachelor and master programmes Industrial Engineering and Management<sup>2</sup> and will play an active role in the development of these educational programmes. She/he is expected to participate in the teaching programme of specialized courses concerning dynamics and vibration, multibody dynamics, flexible structures, and other related topics. Furthermore, the candidate will be involved in supervising bachelor and master students.

### **9. Expected contributions to the organization**

The candidate is expected to have an active interest and to provide a positive contribution to the management and organizational tasks of the institute. At the level of the FSE, the candidate will contribute to the organization of the faculty, for example by participating in working groups and committees, in the fields of teaching, research and management. The candidate will participate in relevant national and international organizations.

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<sup>1</sup> Details of the MSc Mechanical Engineering can be found at <https://www.rug.nl/ocasys/ucg/vak/showpos?opleiding=6700>

<sup>2</sup> Details of the Industrial Engineering and Technology programmes can be found at <https://www.rug.nl/ocasys/fwn/vak/showpos?opleiding=3753> (BSc) and <https://www.rug.nl/ocasys/fwn/vak/showpos?opleiding=6396> (MSc)