

# Faculty of Mathematics and Natural Sciences (FMNS)

## *Johann Bernoulli Institute for Mathematics and Computer Science (JBI)*

### Profile Report

Discipline: Applied Mathematics (Toegepaste Wiskunde)  
Level: Tenure Track Assistant Professor  
Fte: full time (1.0 fte)

#### 1. Scientific discipline

Applied Mathematics is concerned with the development and study of mathematical and computational methods broadly applicable in science and engineering. Candidates with an interest in mathematical modelling, simulation, and computational mathematics, preferably related to computational fluid dynamics or numerical mathematics are particularly encouraged to apply.

#### 2. Vacancy

This position is opened by the Board of the Faculty (EMK/gl/16/00319) and will be embedded in the Johann Bernoulli Institute for Mathematics and Computer Science, basic unit Computational Science and Numerical Mathematics. The position falls within the framework of 'Career Paths in Science 3' ('Bèta's in Banen 3'). Please see link for [criteria and conditions](#).

#### 3. Selection Committee

Prof.dr. J.B.T.M. Roerdink	(scientific director of JBI, Chair)
Prof.dr. H. Trentelman	(deputy director Undergraduate School FMNS)
Prof.dr.ir. R.W.C.P. Verstappen	(group leader Computational Science and Numerical Mathematics)
Prof.dr. A.J. van der Schaft	(group leader Systems, Control and Applied Analysis)
Prof.dr.ir. N.M. Maurits	(Professor of Clinical Neuroengineering)
Irina Chiscop	(student member)
Prof. dr. ir. B.J. Geurts	(ext. member, professor of Multiscale Modeling and Simulation, University of Twente)

#### *HR advisor:*

Mr. L.A. Boomsma, Human Resources Department

#### 4. Research area

Computational Science constitutes a broad interdisciplinary area between Mathematics, its applications, and Computer Science, where new insights are obtained from computer simulations. Scientific computing has become a powerful means for doing research; its impact upon science and engineering has already been profound. In part this can be attributed to the rapid advancement of computers, which has certainly increased the range of solvable problems. Moreover, computational mathematics plays a central, and often critical, role in the development of scientific computing. The problems of interest require numerical computations for their resolution. Conversely, the development of efficient computational approaches – which compromises models and algorithms – requires an understanding of the mathematical properties of the problem considered. The research area can thus be characterized by a very close interaction between theoretical, computational and applied aspect of mathematics. The computational solution of today's highly complex problems of science and engineering involves questions ranging from the design of suitable, computationally tractable models, to the

mathematical analysis of numerical algorithms. The candidate's contributions are to be geared towards improving the mathematical insight in this broad area of research. Within this wide span diverse aspects of computational mathematics can be envisioned: algorithmic issues are tied together by numerical mathematics, which conceives and analyses computational methods; challenging modelling issues can also be studied mathematically, such as multi-scale modelling, uncertainty quantification, coarse-graining, model order reduction, computational optimization, visualization and numerical data science.

### **5. Embedding: Institute and Basic Unit**

Currently the research group Computational Science and Numerical Mathematics is oriented towards Computational Fluid Dynamics (turbulence and extreme waves) and Numerical Linear Algebra (preconditioning and bifurcation analysis). One of these topics could be strengthened by the candidate; in a complementary and equally essential role (s)he can broaden the current research topics as well as the application areas. The Johann Bernoulli Institute for Mathematics and Computer Science (JBI) is part of the Faculty of Mathematics and Natural Sciences (FMNS). The profile of the institute centres around modelling and computation with a focus on science and technology, keeping a balanced mix of fundamental and applied aspects. The JBI comprises five mathematics programmes and five computer science programmes. The mathematics programmes are: "Algebra", "Dynamical Systems, Geometry & Mathematical Physics", "Statistics & Probability", "Systems, Control & Applied Analysis", and "Computational Science & Numerical Mathematics"; the latter two form the applied mathematics branch. The constituting programmes participate in seven national research schools and most of the PhD students are enrolled in an educational programme and take part in other activities offered by these schools. The JBI has a leading 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 concerns a research cluster of 60+ researchers in a number of basic disciplines (mathematics, computer science, artificial intelligence, engineering, astronomy) and various scientific application domains. The ambition is to understand and solve big data problems by exploiting the joint perspectives from both data science and complexity science.

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

The JBI has a strong position in national and international mathematics, as evidenced by participation in NWO and EU projects, publications in renowned journals and conferences, memberships of editorial boards and program committees, conference chairing, etc. Good contacts exist with the three Dutch TUs, which have been formalized through a collaboration agreement with the Applied Mathematics Institute 3TU-AMI. The Computational Science and Numerical Mathematics group has ties to industry through strong, strategic collaborations with several large national technological institutes, such as the Maritime Research Institute (MARIN), Deltares, Energy Center Netherlands (ECN), National Aerospace Laboratory (NLR) and TNO. At present the research group consists of two faculty members and 14 PhD-students. At the national level the research is embedded in the JM Burgers Center as well as in the 'Werkgemeenschap' Scientific Computing (WSC). Within the University of Groningen the candidate can explore connections between mathematics and its applications in various areas, for instance Data Science and Systems Complexity (e.g., numerical aspects of scientific visualisation and big data), Advanced Materials (particle-based simulation methods, coarse-graining, e.g.), Life and Health (where new applications areas are constantly being discovered and current computational techniques need be improved further) and Engineering (computational optimization, systems and control),

### **7. Expected contribution to research**

The candidate is expected to carry out an internationally leading research programme in his/her field of expertise and set up his/her own research group in a subfield of computational or numerical mathematics. (S)he is a strong scientist in his/her own field, as well as open to collaborations with other scientific areas. Involvement in the research theme Data Science and Systems Complexity is expected. The research should have a visibility on the worldwide level and lead to publications in top journals. The research is expected to strengthen the existing efforts within JBI. Supervision of PhD students and postdocs and obtaining substantial external funding is an important part of the research activities.

### **8. Expected contribution to teaching**

The candidate is expected to contribute to the teaching programmes of the bachelor and master programmes of Mathematics and Applied Mathematics in the Undergraduate and Graduate Schools of Science of the FMNS. (S)he will contribute both to teaching existing courses, and to the development of new courses in his/her own subfield of Applied Mathematics. This includes the supervision of bachelor and master theses. The candidate will also contribute to other relevant programmes of the Faculty. During the first 6 years of the appointment the tenure-track assistant professor will devote at most 30% of the total time to educational tasks. Once tenure has been obtained, these tasks amount to 40%.

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

During the first five years, the assistant professor is free from substantial administrative tasks. However, it is expected that (s)he will play a role in the general organisation of the research programme, such as supervising PhD students or postdocs, running a seminar series, and contribute to the organisational tasks of the research institute JBI, the (under)graduate school and the Faculty.

