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Eindhoven Multiscale Institute Annual Report 2012

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Title
Eindhoven Multiscale Institute
Annual Report 2012

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Preface

The Eindhoven Multiscale Institute was initiated in 2012 as one of the interfaculty top research institutes at TUE, with the objective of reinforcing the leading position of TU/e in multiscale research. The institute aims at bringing together researchers from different disciplines in the interdisciplinary area of multiscale science, to achieve cross-fertilization and create knowledge spillovers. In addition to providing an internal infrastructure for multiscale researchers at TUE, the institute aims at providing further exposure to the multiscale research activities at TUE, and at strengthening the ties of the multiscale research community at TUE with (potential) industrial partners.

As for any new organization, the inaugural year of EMI was characterized by the development of basic infrastructure, such as the website, secretariat, and a comprehensive list of internal-/external-academic and industrial contacts. In addition, and more importantly, several events were organized to highlight EMI, notably, an academic/industrial workshop (May) and an inaugural symposium with reputed international speakers (October). In addition, the EMI colloquium series, one of the central activities of the institute, was launched.

This first annual report of the Eindhoven Multiscale Institute presents an overview of the events organized by EMI in 2012 and the development of the infrastructure of the institute. In addition, this report contains a financial section to render an account of the expended financial means.

1 General Information

1.1 Introduction

The endeavor to connect phenomena at disparate length and time scales is ubiquitous in the scientific and engineering disciplines. Although the systems, processes and methodologies under consideration display a wealth of diversity, all these efforts share a common goal: to bridge length and time scales in order to understand emergent behavior at a scale that is orders of magnitude larger than the underlying elementary phenomena. Multiscale problems therefore form a research field in which there is enormous potential for knowledge spillovers and cross fertilization between the various scientific and engineering disciplines and, conversely, where significant progress in the individual disciplines can only be achieved by enabling and facilitating such knowledge spillovers.

To reinforce the leading position of TU/e in multiscale research an interfaculty *Eindhoven Multiscale Institute* (EMI) is established.

2 Mission statement

The mission of the Eindhoven Multiscale Institute is:

To nucleate, enable and exploit scientific breakthroughs in the research on emergent behavior of complex systems and processes by bridging length and time scales.

The Eindhoven Multiscale Institute will nurture both scientific and educational excellence in multiscale problems and techniques across the disciplines at TU/e.

2.1 Organization

The organizational structure of the Eindhoven Multiscale Institute is summarized in Figure 1 below. EMI is administered by an executive committee, composed of four people from distinct participating faculties. The members of the executive committee are appointed by and accountable to the supervisory board, consisting of the rector of the university and representatives from the leading participating faculties. The supervisory board moreover appoints from the members of the executive committee a director and deputy director. The director is responsible for the day-to-day operation of the institute, and sees to the realization of the mission of the institute and the execution of its activities. The deputy director observes the tasks of the director at his absence. Appointments in the executive committee cover a period of 2 years, with at most 3 consecutive appointments.

The executive committee is supported by a management team, which comprises at least one representative from each participating faculty. The members of the management team are appointed by the executive committee.

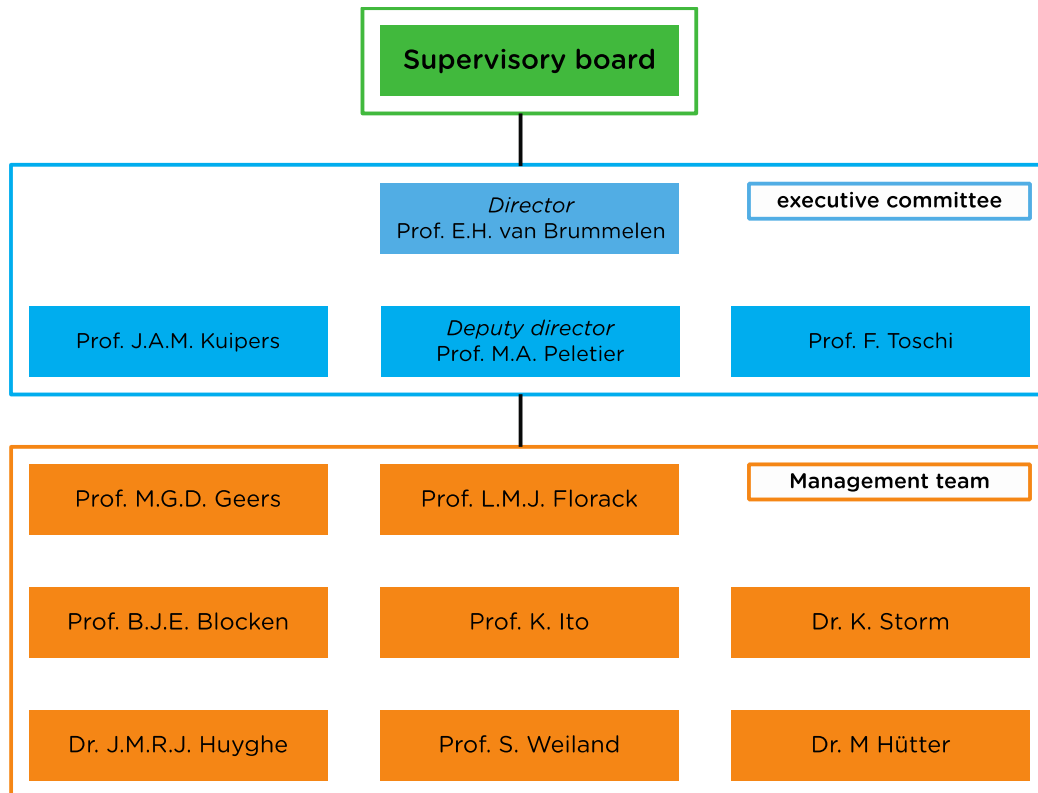


Figure 1 Organizational structure of the Eindhoven Multiscale Institute

Executive committee
Prof.dr.ir. E.H. van Brummelen (Director) (Department of Mechanical Engineering, Department of Mathematics and Computer Science)
Prof.dr. M.A. Peletier (Deputy director) (Department of Mathematics and Computer Science)
Prof.dr.ir. J.A.M. Kuipers (Department of Chemical Engineering and Chemistry)
Prof.dr. F. Toschi (Department of Applied Physics)
Management team
Prof.dr.ir. B.J.E. Blocken (Department of the Built Environment)
Prof.dr. L.M.J. Florack (Department of Mathematics and Computer Science, Department of Biomedical Engineering)
Prof.dr.ir. M.G.D. Geers (Department of Mechanical Engineering)
Dr.sc.nat. M. Hütter (Department of Mechanical Engineering)
Dr.ir. J.M.R.J. Huyghe (Department of Mechanical Engineering)
Prof.dr. K. Ito (Department of Biomedical Engineering)
Dr. C. Storm (Department of Applied Physics)
Prof.dr. S. Weiland (Department of Electrical Engineering)

Membership of the Eindhoven Multiscale Institute is open to permanent scientific-staff members of TU/e. The institute accepts group memberships and individual memberships. If a group membership is granted, then all eligible members of that group receive individual memberships. The executive committee of the institute decides on membership requests.

The institute has neither personnel of its own. The institute has no housing of its own. For Colloquium presentations and courses/seminars/workshops the facilities of the Institute for Complex Molecular Systems (ICMS) are used.

3 Events

The Eindhoven Multiscale Institute organizes workshops, symposia and colloquia, with the following threefold aim:

1. To enable and facilitate knowledge spillovers, cross-fertilizations and collaborations between researchers of the various scientific and engineering disciplines;
2. To enrich the knowledge pool on multiscale research at TU/e;
3. To improve the exposure of multiscale research at TU/e, and connecting researchers with academic and industrial counterparts.

3.1 Workshops

"Multiscale Challenges in Industrial Applications"

Date: 14 May 2012
 Location: TU Eindhoven, Zwarte doos, film zaal
 Participants: appr. 60

Program

- Harm van der Werff (DSM research), *Multi-scale modelling of Dyneema(r) fibers and its composite armour*
- Herman Wijshoff (Océ Technologies), *Inkjet printing: bridging the scales*
- Han Slot (TU/e), *Bridging scales in polymer rheology*
- Krassimir Velikov (Unilever), *Multi-scale challenges in the design of fast-moving consumer goods*
- Tim Peeters (Tata Steel), *From macro to micro in the world of steel*
- Sorin Pop (TU/e), *Moving interfaces across scales: from pore to core*

3.2 Symposia

"Opening Symposium of the Eindhoven Multiscale Institute"

Date: 24 – 26 October 2012
 Location: TU Eindhoven, Auditorium, Blauwe zaal
 Participants: appr. 100
 Specifics: 1) On the first day of the symposium, the Eindhoven Multiscale Institute was formally opened by TU/e rector Hans van Duijn, the first EMI director Harald van Brummelen, and ICMS scientific director Bert Meijer, by performing a special multiscale experiment; see <http://vimeo.com/52292573> and Figure 2.
 2) The presentation of Prof. Alfio Quarteroni was open to the general public as a studium generale lecture. Approximately 350 people attended this presentation; see Figure 3.



Figure 2 Official opening of the Eindhoven Multiscale Institute by means of a multiscale experiment conducted by Profs. Van Duijn (rector), Meijer and Van Brummelen.



Figure 3 Studium generale lecture by Prof. Alfio Quarteroni as part of the EMI opening symposium.

Program

- Harald van Brummelen (TU/e), *Goal-Adaptive Techniques for Multiscale Problems*
- Alfio Quarteroni (EPFL, Politecnico di Milano), *The challenge of complexity*
- Martin van Hecke, (Leiden University), *Weakness and Weirdness of Marginal matter*
- Wim Briels (Twente University), *Memory Matters*
- Peter Bolhuis (University of Amsterdam), *Bridging length and time scales in complex biomolecular systems*
- Andro Mikelić (Université Lyon), *A Rigorous Derivation of the Equations for the Biot-Kirchhoff-Love Poroelastic Plate*
- Jan Carmeliet (ETH Zürich), *Urban Energy and Microclimate: Wind tunnel experiments and Multiscale modeling*
- Erik van der Giessen (University of Groningen), *On computational ‘microscopes’ for mechanical behaviour*
- Karsten Reuter (Technische Universität München), *Towards a first-principles chemical engineering*
- Jan Nordbotten (University of Bergen/ Princeton University), *Multilevel inexact linear solvers for finite volume discretizations*
- Hans Kuipers (TU/e), *High Pressure Fluidization - A Multi-Scale Approach*
- Federico Toschi (TU/e), *Modeling particle transport across the scales*
- Sergio Conti (Universität Bonn), *Formation of microstructure in compressed elastic sheets*

3.3 Colloquia

- Prof.dr. Majid Hassanizadeh (Utrecht University, Dept. of Earth Sciences)
Darcy lecture - Capillarity in Porous Media, on Micro- and Macroscale, Revisited
(12 November 2012)
- Dr. ir. Bernd Ensing (University of Amsterdam, Van 't Hoff Institute for Molecular Science)
Recent progress in multiscale molecular dynamics simulation
(18 December 2012)

4 Infrastructure

4.1 Secretariat and organizational support

In March 2012, Miss Bianca Magielse was appointed to provide part time (0.1 fte) secretarial support for the Eindhoven Multiscale Institute.

4.2 Website

In 2012 the website of the Eindhoven Multiscale Institute was set up within the TU/e internet infrastructure. The website can be found at the webpage of the Top Research Groups or with a direct link <http://www.tue.nl/emi>.

Much effort has been made to create a website where participants can be informed about Research, Education and Events within the Eindhoven Multiscale Institute. The website moreover serves to facilitate registration of participants for events.

4.3 Mailing list

To facilitate the communication with its members, the Eindhoven Multiscale Institute maintains an up-to-date mailing list. The mailing list currently* consists of persons from the following groups:

- **Internal academic members (312)**
 - *Department of Mechanical Engineering*
 - Combustion Technology (22)
 - Energy Technology (12)
 - Manufacturing Networks (5)
 - Mechanics of Materials (24)
 - Multiscale Engineering Fluid Dynamics (10)
 - Polymer Technology (5)
 - Process Technology (10)
 - Structure and Rheology of Complex Fluids (50)
 - *Department of Chemical Engineering and Chemistry*
 - Chemical Process Intensification (8)
 - Chemical Reactor Engineering (6)
 - Macromolecular and Organic Chemistry (14)
 - Materials and Interface Chemistry (19)
 - Molecular Catalysis (2)
 - Multi-scale Modeling of Multiphase Flows (24)
 - Polymer Reaction Engineering (1)
 - *Department of Mathematics and Computer Science*
 - Centre for Analysis, Scientific Computing, and Applications (33)

* Reference date 21 September 2013.

- *Department of Applied Physics*
 - Elementary Processes in Gas Discharges (8)
 - Mesoscopic Transport Phenomena (9)
 - Theory of Polymers and Soft Matter (19)
 - Transport in Permeable Media (3)
 - Turbulence and Vortex Dynamics (18)
- *Department of Biomedical Engineering*
 - Biomedical Chemistry (5)
 - Biomedical Image Analysis (9)
 - Chemical Biology (15)
 - Orthopaedic Biomechanics (3)
 - Soft Tissue Biomechanics & Tissue Engineering (1)
- *Department of the Built Environment*
 - Building Physics and Services (2)
 - Structural Design (8)
- *Department of Electrical Engineering*
 - Control Systems (1)
 - Electromagnetics (3)
 - Electromech. and Power Electronics (1)
 - Electro Optical Communication (1)
- **External academic members(14)**
 - Université de Lyon
 - RWTH Aachen University
 - University of Twente
 - Delft University of Technology
 - Univeristy of Amsterdam
 - Centre for Mathematics and Computer Science
 - Erasmus MC
 - University of Groningen
 - Université de Poitiers
- **Industrial members(8)**
 - DPI (Dutch Polymer Institute)
 - Philips
 - ASML
 - Océ
 - IHC Merwede
 - MTI Holland
 - NRG (Nucleaire dienstverlening voor Energie, Milieu en Gezondheid)
 - TASS

5 Financial Report

For the period 2012-2015, the executive board of Eindhoven University of Technology has placed an annual budget of 50 k€ at the disposal of the Eindhoven Multiscale Institute. The expenditure in 2012 amounted to 14.540 €. A breakdown of the expenditure in 2012 is presented in Table 1 below.

Item	Cost (€)
Symposium	9.744
Colloquium series	426
Secretariat	3.600
Representation	770
Total	14.540

Table 1 Breakdown of the expenses of EMI in 2012