

OPTIMIZATION AND  
SYSTEMS ENGINEERING

# ANNUAL SEMINAR 2014

Tapio Westerlund

CHAIRMAN OF THE OSE GROUP

CENTER OF EXCELLENCE IN  
OPTIMIZATION AND SYSTEMS ENGINEERING  
ÅBO AKADEMI UNIVERSITY

TURKU, FINLAND, NOVEMBER 14, 2014



## About the OSE research group

- ▶ For the period 2010–14, Åbo Akademi University has appointed four internal Center of Excellences within research:
  - ▶ *Cell Stress and Molecular Aging*
  - ▶ *Democracy: A citizen perspective*
  - ▶ *Optimization and systems engineering*
  - ▶ *Post-secular culture and a changing religious landscape*
  
- ▶ The internal CoE in Optimization and Systems Engineering (OSE) is focusing on theory, methods and algorithms in systems engineering, optimization and statistics, as well as their applications in science and engineering. The group bridges the systems engineering, systems theory and mathematical disciplines at ÅAU.



## Key facts about the OSE research group

### ► Steering group:

Prof. Tapio Westerlund  
Process design and  
systems engineering



Optimization

Prof. Henrik Saxén  
Thermal and flow  
engineering



Engineering

Prof. Paavo Salminen  
Mathematics



Mathematical statistics

Prof. Mikael Lindström  
Mathematics



Systems theory

### ► Funding sources:

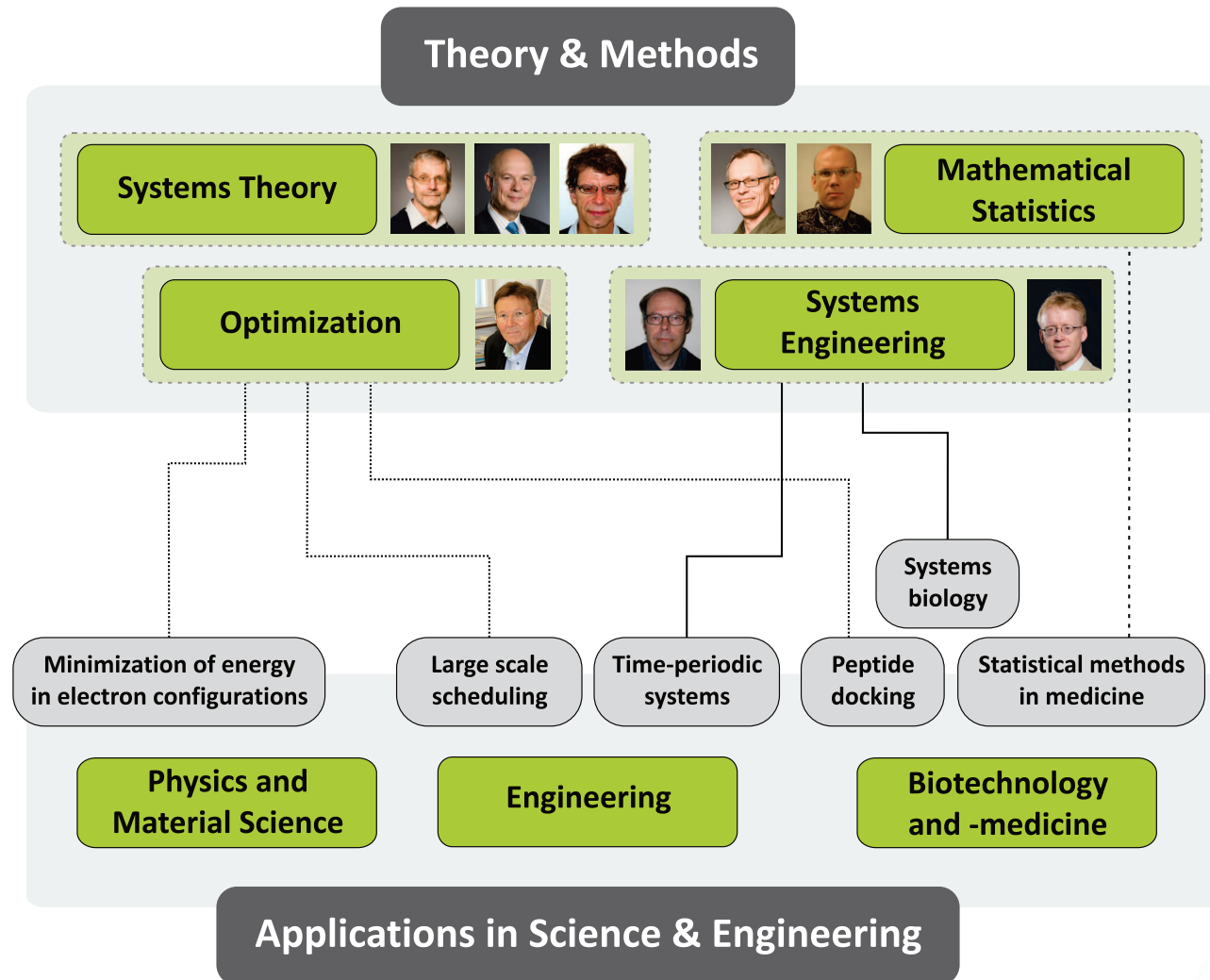
- Foundation of Åbo Akademi University: 1.2 MEUR 2010–14
- Academy of Finland, EU, Outotec Research: 2.0 MEUR 2008–13

- Currently the group consists of about 10 professors, 10 post doc researchers and 15 PhD students
- Publications 2010–14 include 9 PhD theses, a monograph, four book chapters and over 100 peer-reviewed journal papers



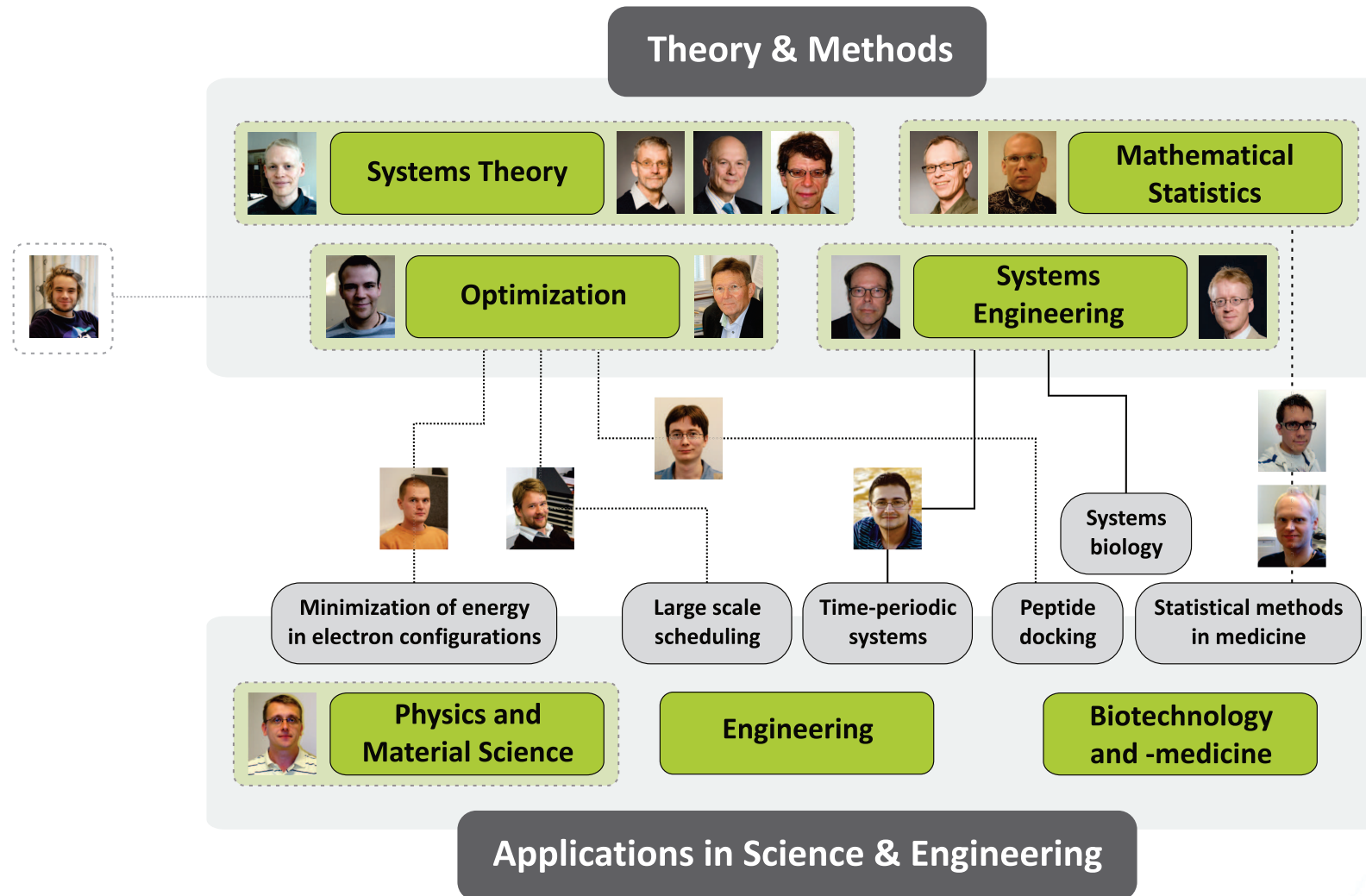
# Structure of the OSE group

*The research areas and group leaders*



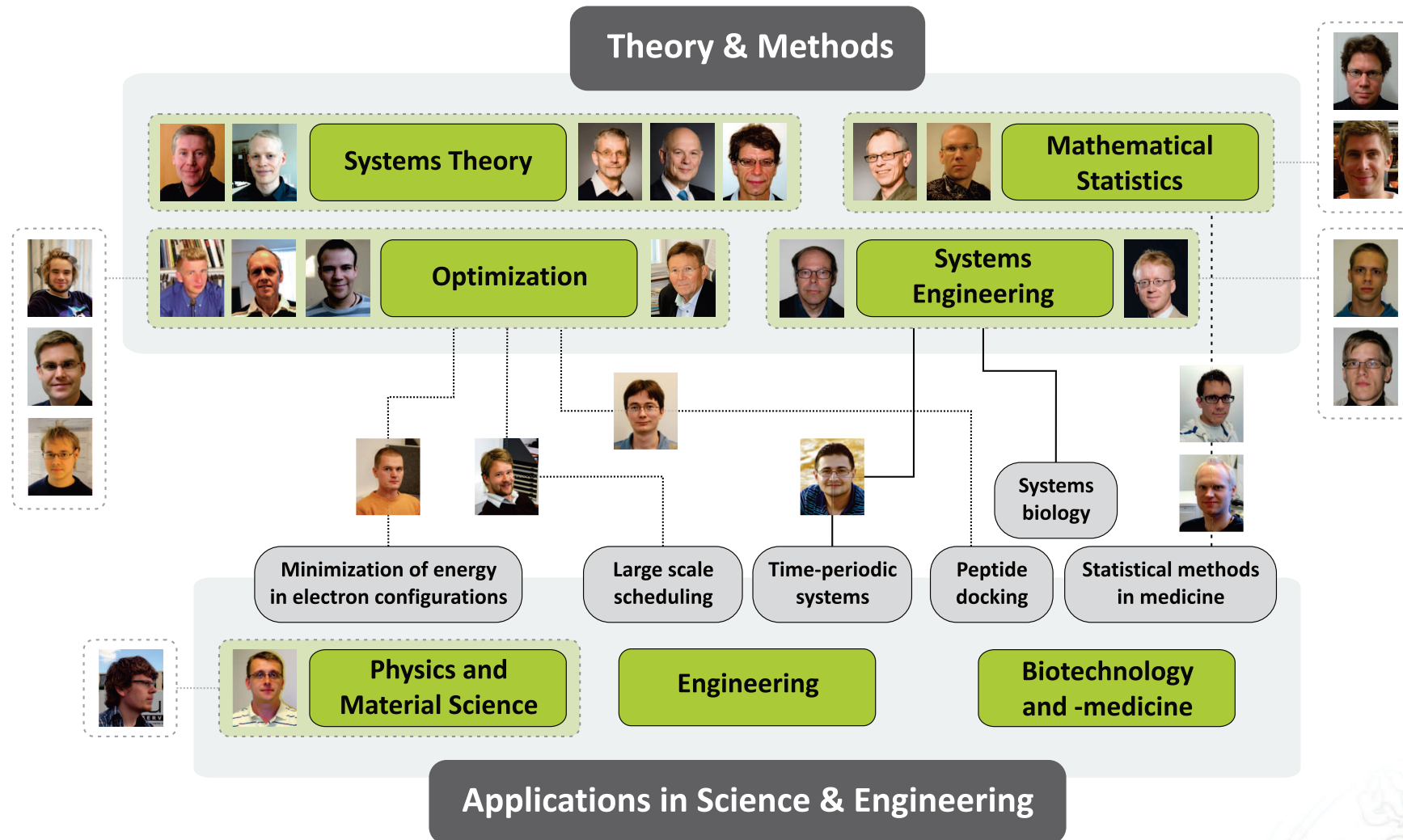
# Structure of the OSE group

*People with direct financing*



# Structure of the OSE group

*People with direct financing and some affiliated researchers*



This year's OSE seminar is dedicated to a great Finnish-Swedish astronomer and mathematician



- ▶ Born in Turku December 1740
- ▶ Defended his thesis titled *Aphorismi mathematico-physici* at Åbo Akademi University in June 1760 (<http://urn.fi/urn:nbn:fi:fv-12050>)
- ▶ Moved to Uppsala in 1763 to work at Uppsala University as a mathematics lecturer. From 1766 he was a professor of mathematics at the Uppsala Nautical School.
- ▶ Full member of the Russian Academy of Sciences and Professor of Astronomy in St Petersburg in 1771.
- ▶ Professor of Mathematics at Åbo Akademi University 1775–1780
- ▶ Successor to Leonhard Euler in 1783 on his chair at the Mathematics Department at the Russian Academy of Sciences in St Petersburg



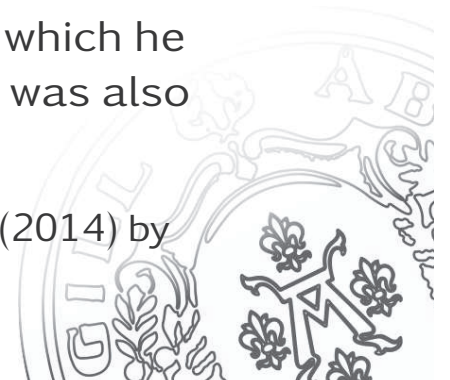
## Professor Anders Johan Lexell

Lexell was born in Turku on December 24th 1740 and died on December 11th 1784 (Julian calendar: November 30). He was a Finnish-Swedish astronomer, mathematician and physicist, and was professor of mathematics at Åbo Akademi University 1775–1780. Most of his career was, however, made as professor in astronomy and mathematics at the Russian Academy of Science in St Petersburg, where he is known as Andrei Ivanovich Leksel.

Lexell was one of the most prolific members of the Russian Academy of Sciences at that time, having published 66 papers during his 16 years there. A statement attributed to Leonhard Euler expresses high approval of Lexell's works: "Besides Lexell, such a paper could only be written by D'Alambert or me". Lexell was unmarried, and was a close friend of Leonhard Euler and his family. He witnessed Euler's death at his house and succeeded Euler to the chair of the mathematics department at the Russian Academy of Sciences, but unfortunately died the following year himself.

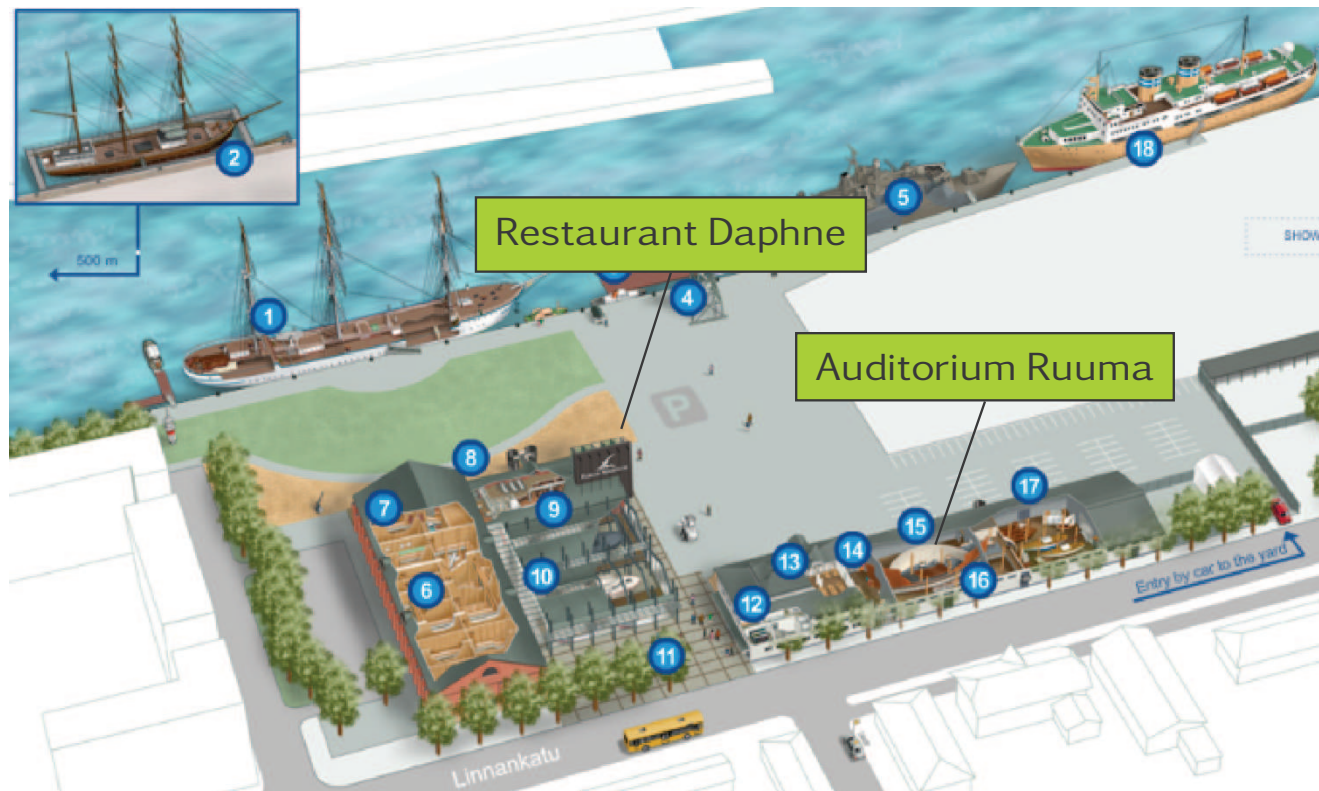
Lexell made important discoveries in polygonometry and celestial mechanics; the latter led to a comet being named in his honour, as is the lunar crater Lexell. La Grande Encyclopédie states that he was the prominent mathematician of his time who contributed to spherical trigonometry with new and interesting solutions, which he took as a basis for his research of comet and planetary motion. His name was also given to a theorem of spherical triangles.

Sources: Professors in Finland, ISBN 951-95189-6-7, A Comet of the Enlightenment (2014) by Johan C.-E. Stén, ISBN 978-3-319-00618-5, and Wikipedia.





## About the venue



*“The Forum Marinum Maritime Centre is a lively and versatile center for maritime activities, comprising a national special maritime museum, and the Finnish Navy Museum.”*



ANNUAL SEMINAR IN  
OPTIMIZATION AND SYSTEMS ENGINEERING

# SEMINAR PROGRAM

- |       |   |       |   |
|-------|---|-------|---|
| 10.00 | <b>Professor Tapio Westerlund</b><br>Chairman of the OSE group<br><i>Opening statement</i>  | 13.30 | <b>Ray Pörn, Novia University<br/>of Applied Sciences</b><br><i>Quadratic reformulation techniques<br/>for 0-1 quadratic programs</i>       |
| 10.05 | <b>Professor Montaz Ali</b><br><i>Transformation-based and differential<br/>equation-based approaches for MINLPs</i>                              | 14.00 | <b>Jan Kronqvist, Åbo Akademi University</b><br><i>An extended supporting hyperplane<br/>algorithm for generally convex MINLP</i>           |
| 10.50 | <b>COFFEE</b>   | 14.30 | <b>COFFEE</b>   |
| 11.15 | <b>Professor Montaz Ali</b><br><i>Algorithms for solving MINLPs under partial<br/>differentiability and non-differentiability<br/>assumptions</i> | 15.00 | <b>Vladimir Korotkov, University of Turku</b><br><i>Stability in the problem of selecting project<br/>portfolios with multiple criteria</i> |
| 12.00 | <b>LUNCH</b><br><i>Restaurant Daphne</i>  | 15.20 | <b>Kaisa Joki, University of Turku</b><br><i>A proximal bundle method for<br/>nonsmooth DC optimization</i>                                 |
|       |   | 15.40 | <b>Seppo Pulkkinen, University of Turku</b><br><i>Ridge-based methods and applications to<br/>spatiotemporal data</i>                       |



## Invited speaker

*Professor Montaz Ali, Witwatersrand University, South Africa*

- ▶ received his BSc and MSc degrees in mathematics from Dhaka University, Bangladesh in 1982 and 1983
- ▶ PhD degree in stochastic global optimization from Loughborough University, UK in 1994
- ▶ Research Fellow at Plymouth University, UK and Åbo Akademi University 1995 – 1996
- ▶ currently at Witwatersrand University, Johannesburg, South Africa
  - ▶ 1997–2012 School of Computational and Applied Mathematics
  - ▶ 2013– Transnet Center for Systems Engineering
- ▶ research interests include stochastic methods for global optimization, nonlinear optimization, optimal control and mixed-integer nonlinear programming
- ▶ is the author or coauthor of more than 60 scientific papers in refereed international journals

