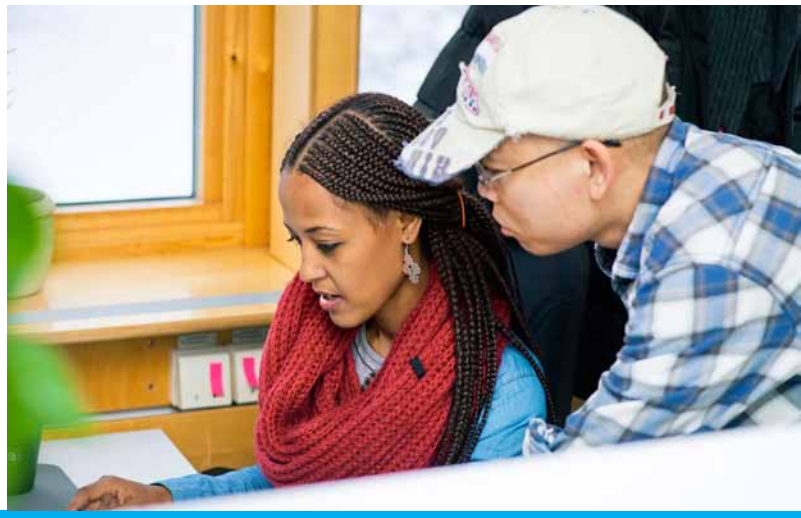
ANNUAL REPORT | 2012

UMIT Research Lab



UMIT Research Lab
Annual Report 2012

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About UMIT

UMIT Research Lab is a strategic initiative in computational science and engineering focusing on industrial applications and innovative software development.

UMIT's efforts include the establishment of a dynamic, intellectual and physical research environment enabling world-class interdisciplinary research in scientific, high-performance, distributed, real-time and visual computing. Deliverables include new models, methods, algorithms and high-quality software targeting emerging High Performance Computing (HPC) platforms and IT infrastructures.

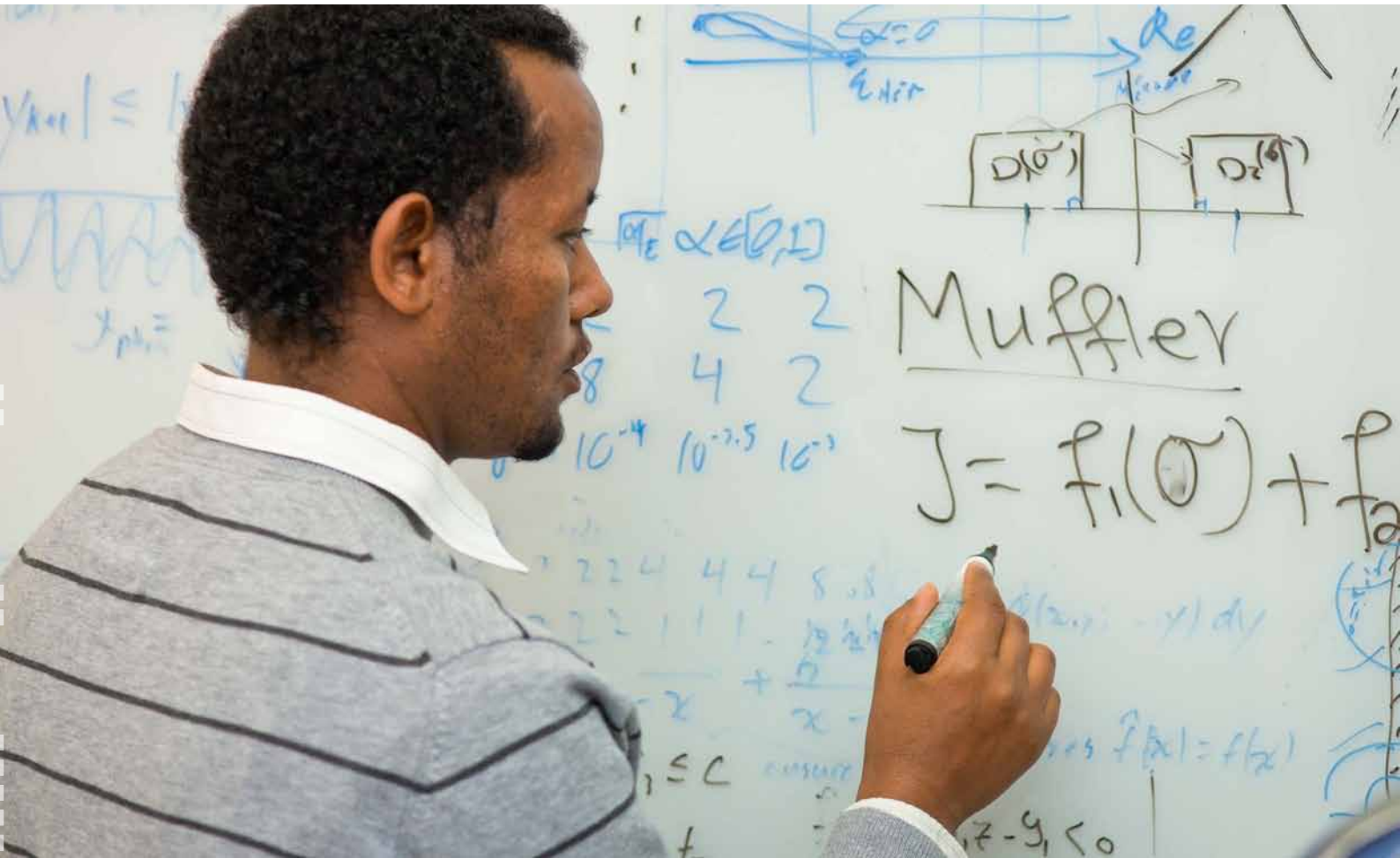
UMIT focuses on challenges and applications that have a high relevance to industry. The use of innovative techniques and collaborations with industrial partners and society are important components of the environment.

Research lab
The lab is a natural meeting place for interdisciplinary research, with affiliated staff from the departments of computing science, mathematics, mathematical statistics, physics, informatics and applied physics and electronics. Over 50 researchers and developers are involved in the UMIT initiative, and about 30 of them work in the lab. The lab offers access to key equipment and software. Seminars and workshops are centered on recent research results and common interests in numerical methods, software and hardware architectures.

Activities
During the initiation phase (2009-2013) of the UMIT project, activities include: research, establishing the physical lab environment, developing new technology and software and collaborative projects with partners from industry and society which are aiming to create new competitive products and job opportunities. The UMIT initiative has, so far, contributed to the creation of 30 new jobs. In addition, UMIT has recruited two assistant professors as well as several postdocs and PhD students. UMIT also offers recently graduated students and doctorates the opportunity to join the Research & Development (R&D) Trainee Programme.

Top-class infrastructure
The High Performance Computing Center North (HPC2N), which is part of the national meta center SNIC, provides UMIT with expertise and e-infrastructure for grid-cloud computing, high-performance and parallel computing, including effective mass-storage solutions.

Funding
The main funders are the EU Structural Fund Objective 2, Umeå municipality, Umeå University and the Baltic Donation Fund. EU FP7, Kempe Foundations, Process-IT, Skogstekniska Klustret and several other companies and organisations co-finance specific project activities.



2012- A brief review

2012 was the concluding year in a three year EU-project of establishing UMIT as a research center in computational science. The strategy of combining fundamental research in a multidisciplinary environment with innovation and industrial collaboration was proved to pay off in high competition several prestigious projects were granted, with UMIT researchers in a leading role with academia and industry.

New people
10 new researchers joined UMIT during the year including assistant professors; David Cohen, Christian Engström, and lecturer; Lina Schelin. Postdoc; Luis Tomas Bolivar,
PhD students; Juan Carlos Araujo-Cabarcas, Martin Björklund, and Kosten Selome Tesfatsion. Research assistants; Johan Dyrlind, Ugis Lacis, Mats Johansson, and Tomas Sjöström.

Seminars and infrastructure
Seminar series is essential for a creative environment and for stimulating multidisciplinary activities. Regular seminars are held on Fridays by UMIT staff or invited guests. The 2012 UMIT Day was held in January in Vindeln - including steaming hot tubs and snow bathing - and in July on the Shrimp Boat in Umeå river.

In May 2012 was the inauguration of the new supercomputing cluster Abisko at HPC2N in Umeå University - providing 318 nodes with 15264 processors, up to 512 GB RAM per node and a theoretical performance maximum of 158,75 teraflops/s.

Impacts of UMIT on society
The start-up of UMIT was part of a project funded by Umeå city, Umeå University and EU Structural Funds of strengthening the regional industry by increasing academic collaboration and spin-offs. The three year project has involved 50 academic researchers and engineers, 26 sub-projects in collaboration with 24 companies/ organizations for development of new industry processes, products or services, new computational software and new business opportunities.

The result shows that UMIT has contributed in the creation of 30.5 new jobs, 3 new companies and 3 new products/services. One spin-off company from the UMIT environment is Elastisys AB that provides powerful software management tools for elastic computer systems, such as grids and clouds.

New projects
In competition with 700 other consortiums, the UMIT lead consortium was among the fortunate 20 proposals awarded a national grant in the VINNOVA program *Challenged Driven Innovation*. The project, titled *Simovate*, addresses simulation and simulator based development of products and processes in the automotive, manufacturing and process industries and has a budget of 20 MSEK during 2012-2014. The goal is a new platform and methodology that supports the entire development chain from early concept simulation, system engineering simulation to marketing and training simulators. Participants include Algoryx Simulation, Atlas Copco, Enmesh, Linköpings University, LKAB, Optimation, Oryx Simulations, SKF, Skogforsk, Svea Teknik, Volvo Construction Equipment, Volvo Trucks.

The Swedish Research Council announced in Nov 2012 the second largest grant ever (20 MSEK) to Prof. Erik Elmroth at UMIT for the project *Cloud Control*.

A third larger project beginning in 2012 was NOSEG - a Swedish-Finnish-Norwegian collaboration project (5 MSEK) to develop new numerical methods and software for the simulation of nonsmooth power electronics with application to Smart Grids and wind energy, during 2012-2014. From UMIT the project is run by Dr. Claude Lacoursière.

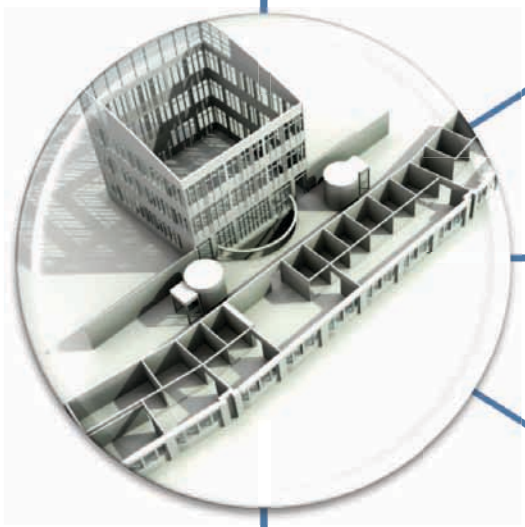
Focus for 2013
In 2013, UMIT will focus on the running the existing and new projects in close collaboration with our partners and fertilizing the minds in the UMIT reseachers by providing a creative research environment. A symposium in numerical analysis and computational mathematics is planned in May 2013. Experiments with emerging technologies will be held, e.g., visual simulation in the web browser and desktop 3D printers.

Research

- Fundamental and applied research, publishing over 50 papers in leading scientific journals and conference proceedings as well as five doctoral theses per year
- Eight research groups with significant external economic support.
- Substantial collaboration with other science clusters, for example IceLab and CLiC

UMIT Research Lab

- 75 researchers, engineers, and developers
- A creative environment for education, research, and innovation
- Significant international exchange – 10 guest researchers per year
- Nationally leading research centre, renowned internationally



Education

- Reforming the use of computers and numerical methods in technical mathematics within the civil engineering programs at Umeå University.
- 200 students meet UMIT staff throughout the courses and student projects every year

Innovation and collaboration

- A widely used technology platform for simulation-based development and design
- Five new spin-off companies/ products
- Establishment in Umeå by a major company within the core areas of UMIT.

Funding

- External funding of 10 MSEK annually from EU FP7 and Horizon 2020
- External funding of 10 MSEK annually from national funding agencies and fundations
- External funding of 5 MSEK annually from our collaboration partners

Some project highlights...

Algoryx awarded as one of Sweden's most promising companies

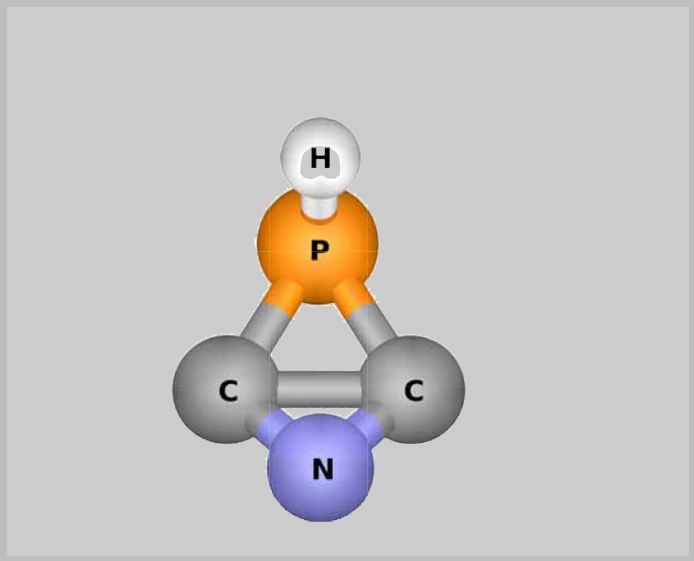
The Umeå University spinn-off simulation company Algoryx was awarded as one of Sweden's 33 most promising young tech-companies. The list was made by the Swedish magazines/newspapers Ny Teknik and Affärsvärlden.

20 million grant for cloud control

Erik Elmroth, professor at the Department of Computing Science, is the leader of a cross-disciplinary project with collaboration between Umeå University and Lund University with complementing expertise on cloud management and control of computing systems. The goal of the research is a flexible infrastructure that can automatically adapt to user needs and geographical placement. The project is funded by a 20 million SEK framework grant from the Swedish research council (VR).

UMIT assisting a local company in developing forest technology

Researchers from UMIT participated in the development of a new tracked bogie for forestry machinery with the goal to reduce the ground damages and increase mobility in rough terrain. The project has resulted in a patent and new collaboration. But most important, it´s a step in the right direction of a better environment and more sustainable forestry. Other participants in this project are Vimek, Swedish Agricultural University and Skogstekniska Klustret.



A new supercomputer

During the spring of 2012 the new super computer, Abisko was inaugurated at HPC2N at Umeå University. Abisko consists of 15,264 processor cores and 44 terabytes of RAM. It can perform 58 trillion calculations per second.
This enables even further more complex and demanding computations. And is a resource in collaborations with industry and society.

Simovate

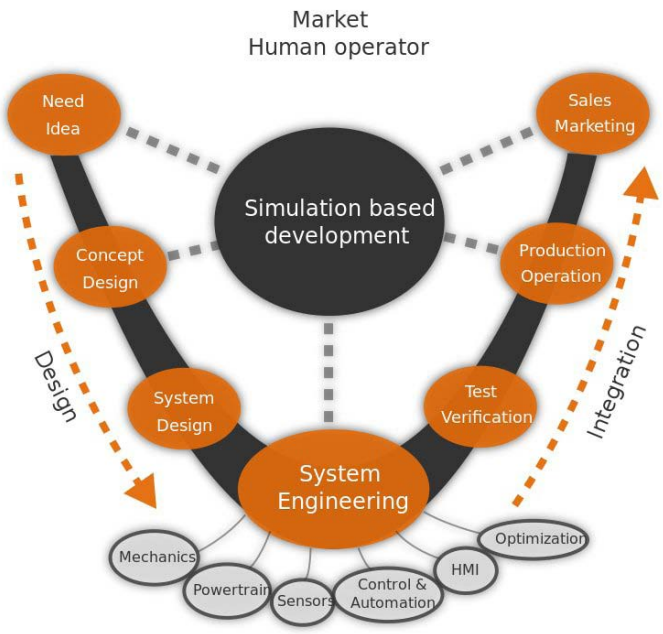
”Simovate is an interdisciplinary mobilization aiming at higher effiency and innovation with simulation in product and process development.”

-Martin Servin,
Simovate project coordinator

Mats G Larson
Professor in computational mathematics and Simovate project leader.

Martin Servin
Assistant professor in physics and Simovate project coordinator.

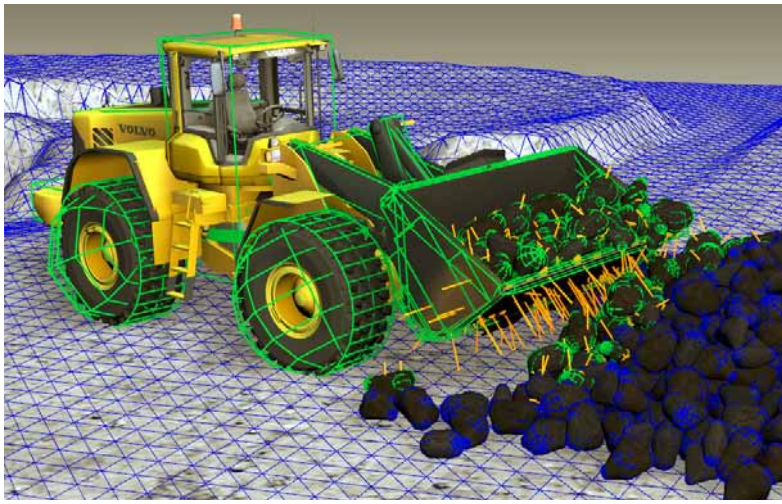
Simulation is a very important tool for the industry. Large scale solutions as well as details regarding specific components are simulated in advanced computer programs, and are used in all parts of the process, from the initial development process to the final training phase. A common problem is that the simulation tools are specialized to one specific part and purpose of the simulation, for example the hydraulics of a vehicle, the dynamics of a gravel pile or the real time simulation where operators are trained to handle the vehicle. Thus, making simulations to study entirely new vehicle concept for handling granular material is a great challenge.



-There are also a lot of difficulties in the interfaces between the design tools and simulation tools. This affects the cooperation between different professions and slows down the development. Simovate aims to remedy this, says Martin Servin, assistant professor and project coordinator in Simovate.

The consortium is led by UMIT research Lab at Umeå University. Other participants include Algoryx Simulation, Atlas Copco, Enmesh, Linköpings universitet, LKAB, Optimation, Oryx Simulations, SKF, Skogforsk, Svea Teknik, Volvo Construction Equipment, Volvo Trucks. The project has a budget of 20 million SEK during 2012-2013, where Vinnova and the industry is contributing with the equal amount of funds.
The goal is integrated simulation systems and methodology that can be used in the whole development process. -Idea, concept, system, training and marketing. The solution should be available on a common platform consisting of both commercial and free tools and eventually as a cloud service.

-With effective tools, engineers can faster find a way from idea to solution and the long-term goal is to increase competitiveness and growth in the in the automotive, engineering and process industry, says Martin Servin. High functional simulation tools are crucial for the whole innovation process.



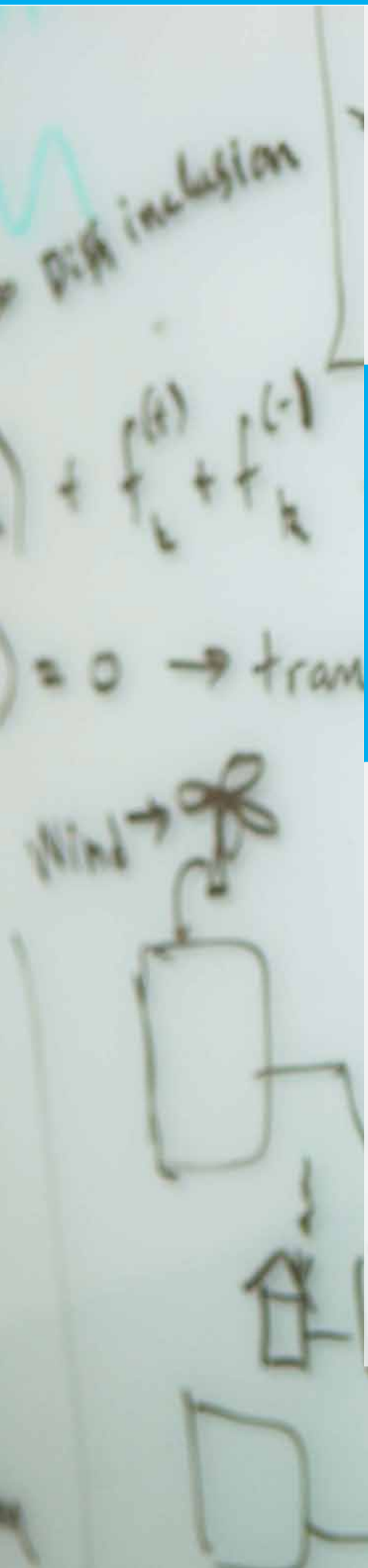
A new associate

In 2012, Christian Engström joined UMIT Research Lab and the Department of Mathematics and Mathematical Statistics. He currently builds up a group focusing on analysis and discretization of partial differential equations relevant for problems currently studied in physics and engineering. Two PhD students will join the group in 2013 and a postdoc will be employed in 2014.

The UMIT environment has led to new scientific collaborations and new research directions. For example, Christian has together with Martin Berggren and Eddie Wadbro a new project concerning optimization of plasmonic nanostructures. Another project aims for a greater understanding of how resonance frequencies change with damping. In mathematics it is often assumed that a system does not have losses and the motion of the system is harmonic in time. However, in reality, the oscillations in the system are damped because of energy losses, such as friction. Taking such losses into account in a mathematical model increases the difficulties in the analysis and computation of resonances of this model. Moreover, to reflect reality better, physical systems are often described with several coupled equations.
Problems involving coupled systems and also considering losses at the same time are found in research areas such as fluid dynamics, acoustics, quantum mechanics, and electromagnetic field theory. Possible applications include calculations of sound pressure levels, instabilities in engines, semiconductor lasers, and plasmonic nano-antennas.

As a first step the group will develop theory and numerical codes in the field of nano-optics. This research can lead to several new applications in various fields including microscopy, molecular sensors, and computer chips.

– Part of the establishment of UMIT Research Lab was the recruitment of young talented researchers, to become the future research leaders in the area of computational science. We are very happy to welcome Christian to Umeå University and we see big promise already, e.g., starting new collaborations, awarded a grant from the Swedish Research Council and now forming a new research group, says Martin Servin, coordinator at UMIT.



- **Applied mathematics**
- **Computational design optimization**
- **Computational mathematics**
- **Distributed systems**
- **Interactive multiphysics and complex mechanical systems**
- **IT management**
- **Parallel and scientific computing**

UMIT unites excellent fundamental research in computational science and engineering with innovative and application-oriented research and software development. Within UMIT there are scientists from the areas of computing science, mathematics, physics, informatics and engineering. The science produced is internationally competitive and has strong support from VR, the Swedish Foundation for Strategic Research and the EU's 7th Framework Program.

Three global technology trends that will radically change our use of simulations and computations:

- Convergence in the technologies behind CAD/CAE, technical and scientific computing and visualisation
- More powerful computers through parallelism and multi-core architectures
- Everything becomes embedded in the web-browser and connected through scalable and flexible IT-infrastructures.

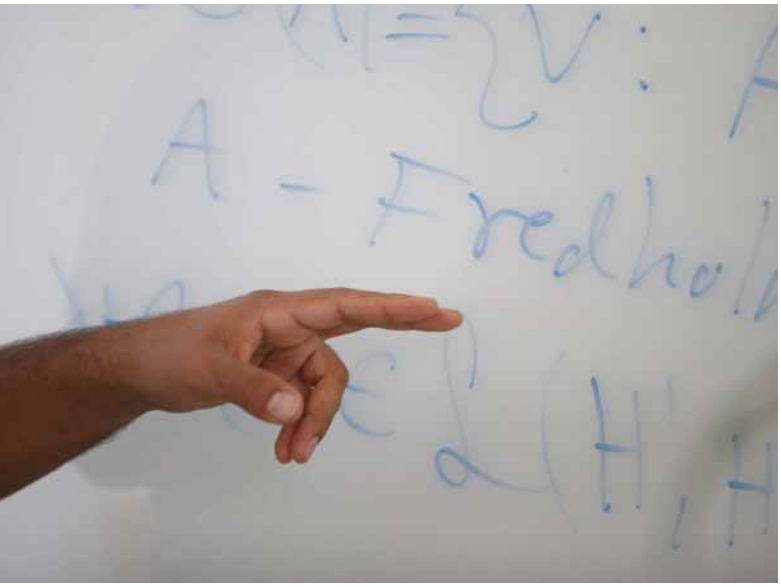
Applied mathematics

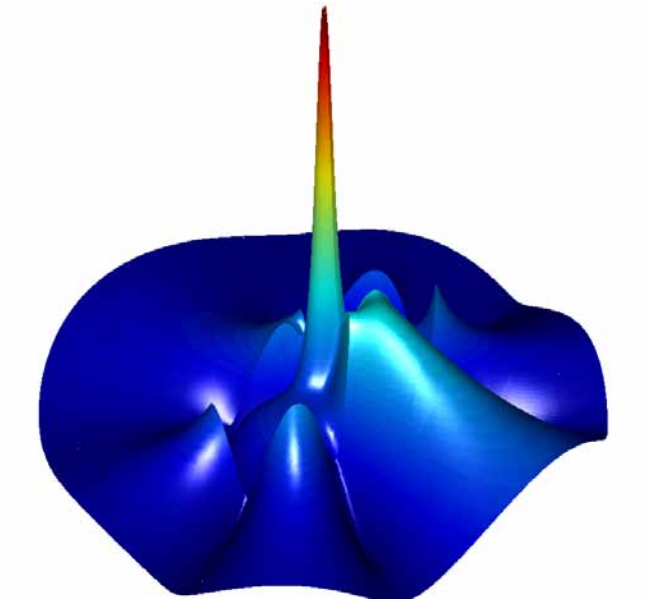
The objective of this new research group is to study the whole chain from the physical modeling, over mathematical analysis and approximation theory to software development. In particular, the research concerns the analysis and numerical solution of non-linear spectral problems and simulation of wave phenomena.

One research direction of the group is photonic crystals, which are periodic structures with promising optical properties. These structures have many applications in optical communication, spectroscopy and photonic crystal nanocavity lasers. This project aims for a greater understanding of how quantum mechanical effects and losses affect the performance of these structures.

Another research focus is the analysis and computation of resonances in open structures. Possible applications include calculations of sound pressure levels in compressor blade rows, instabilities in aircraft engines, semiconductor lasers, single- atom detection using micro disk resonators, and plasmonic nano-antennas.

Several of the proposed projects require interplay between spectral theory, finite element discretization and linear algebra. Physical understanding and optimization are also highly important for the success of the projects. Therefore, members of the group collaborate closely with the physics department and other groups within UMIT Research Lab.





Research focus
We work on spectral theory of operator-valued functions relevant for problems in science and engineering and discretization of partial differential equations with high order finite element methods.

Applications
Simulations of wave phenomena, multiphysics, and design of structures in nano-optics.

Projects
- Spectral analysis and approximation theory for a class of operator functions.
- Finite element approximations of time-dependent problems in nano-optics

Results
- New spectral theory for block operator matrices
- New Galerkin spectral approximation theory for qudratic eigenvalue problems
- New perturbation theory to study non-self-adjoint perturbations of self-adjoint rational eigenvalue problems
- Development of a high-order interior penalty method code

Collaborations
ETH Zurich, EPFL, TU Berlin, TU Wien, University of Bern, University of Zagreb

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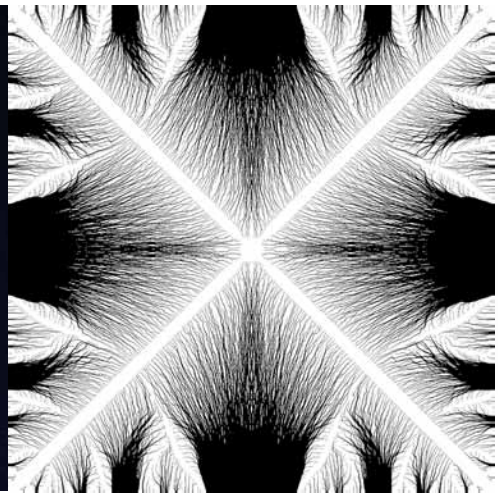
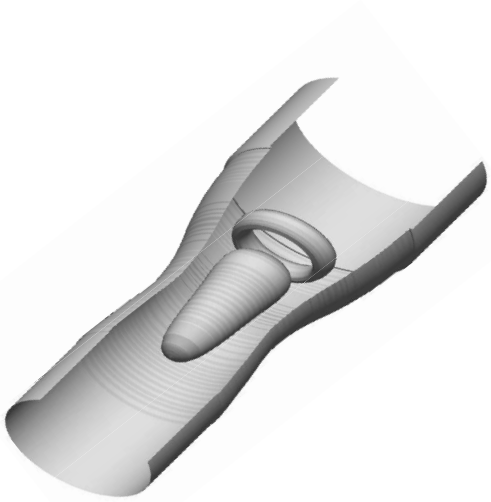
Computational design optimization

Computational design optimization is based on the idea of exploiting the power of computer simulations and optimization in the design process.

The primary objective of the research group in computational design optimization is to develop and analyze methods comprising physics based mathematical modeling, computer simulations, and optimization. The purpose is to find the particular shape or material arrangement of an object that yields the most favorable performance. Presently, we focus particularly on problems and situations where the measure of performance involves acoustic or electromagnetic wave propagation effects. We also consider problems that, from a methodological perspective, are closely related to design optimization, for example off-line optimal control problems and inverse problems, that is, the problem of determining properties of a system from observations.

The core competence of the group lies within the scientific computing aspects of design optimization. However the group members work with and make contributions to the whole chain of activities needed for successful results: mathematical modelling of the physical system, discretization of the mathematical problem, construction of suitable numerical methods, and efficient implementations of the algorithms. Moreover, we have also carried out work on experimental assessment of the optimized designs on manufactured prototypes.





Computational mathematics

The objective of the research group in Computational mathematics at Umeå University is to conduct research on novel computational methods for the solution of partial differential equations and to promote its application in education, science and engineering. Our research is cross-disciplinary and located in the intersection between mathematics, computer science, physics and applications.

Our research is particularly geared towards developing adaptive finite element methods, developing efficient and robust methods for solving multiscale and multiphysics problems and finding efficient solutions to large-scale problems using various model-reduction techniques. Applications are found, for instance, in the simulation of complex mechanical systems and in biomechanics. The group's activity spans several projects that are run in close collaboration with industrial partners. Together with SKF, we are developing new model-reduction methods with improved local accuracy for the simulation of, for example, rolling bearings and gear wheels. Together with Surgical Science, we are developing finite element methods for the real-time simulation of the deformation of, for example, organs, membranes and threads for use in surgical simulators. Another project in the same field is performed in collaboration with Karolinska Institutet and KTH, where we are developing a model for simulating blood flow through a beating human heart. Together with FOI, we are also modelling dispersion in urban environments to predict the outcome of accidents involving toxic gases.

Research focus
Our work is focused on computational methods for partial differential equations. We develop models for the simulation of multiphysics and multiscale phenomena, together with large-scale problems.

Applications
Applications are found in simulations of complex mechanical systems and in biomechanics.

Projects
- Development of a two phase fluid solver for design optimization
- Error estimates for polynomial and non-symmetric eigenvalue problems
- Modelling higher order partial differential equations on surfaces
- Modelling soft materials for surgery simulators
- Model reduction for localized stresses on rolling bearings
- Urban dispersion modelling of gases

Results
- New finite element method for the Kirchoff-Love plate equation
- New model reduction methods implemented in SKF software
- Fundamental principles in mathematics and numerics, such as error estimation and optimal spanning of data
- Parallel two phase fluid solver developed

Collaborations
FOI, Karolinska Institutet, KTH, SKF, Surgical Science

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Distributed Systems

The Umeå University distributed systems' research focuses flexible and scalable IT infrastructures, and covers a range of topics central to cloud and grid computing.

Research drivers are compute and data intensive applications requiring, e.g., elastic locality-aware infrastructures to meet the rapid capacity and locality variations of industrial services and large-scale distributed environments that enable coordinated use of federated resources for eScience.

Research outcomes include autonomous infrastructure management systems and sophisticated tools for creating cloud-enabled applications. Examples of recent results include algorithms for Virtual Machine (VM) scheduling in clouds, methods for improved live migration of VMs, and algorithms for cloud elasticity control. Further results include tools and principles for (energy) monitoring and accounting, as well as fair-share scheduling systems.

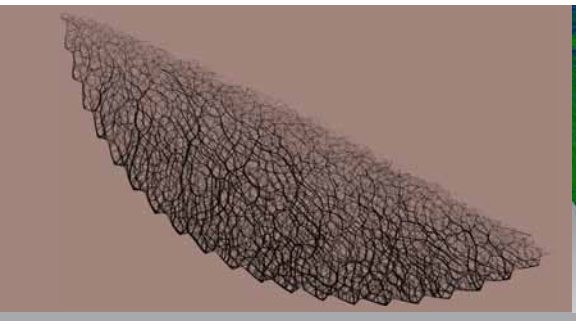
Ongoing projects with immediate industrial benefit include collaboration with Hawc International AB with focus on transforming Hawc's platform for feature film editing into a cloud service. Another result with industrial application is the creation of the Elastisys spinoff company, with focus on cloud auto-scaling and a product based on the elasticity research.

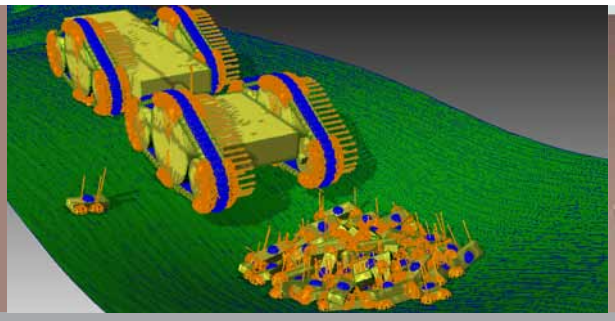
Interactive multiphysics and complex mechanical system

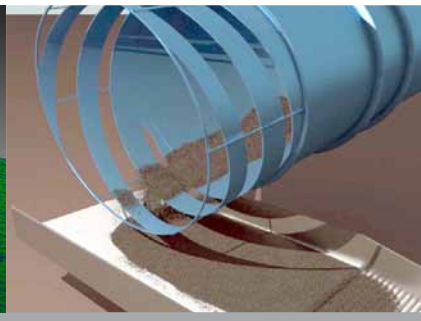
How can the real world, with all its complexity and dynamics on different time and length scales, fit in a computer program? Well, it cannot, something has to go. The question is what properties of the real world need to be captured in order to make a virtual replica realistic. And then there is the question of how to make the computations fly, e.g., to make applications run at interactive rate or exploit the full potential of a supercomputer.

The research addresses multidomain modeling, numerical methods, and software for fast multibody system dynamics with nonsmooth phenomena. Variational time-stepping of large-scale rigid multibody systems with frictional and impacting contacts, mesh free solid and fluids, and mechatronic systems (vehicles, robots) are of particular interest, as well as sparse direct, iterative and parallel solvers of the resulting linear complementarity problems. The approach allows for fast and stable simulation with large time-steps. One domain of applications is real-time visual interactive simulators for training, education, design & prototyping and computer games. Another domain is the research and development of complex and large-scale systems with simulation as a tool to for understanding the dynamics and to find the best approaches for optimization and control. During the past year, numerical solution techniques for strongly coupled multibody systems with closed loops, e.g. tracks or cloth, have been further developed and applied in prototyping projects. The multiphysics framework have been extended to include electronics and hydraulics as multibody constraints and constraint regularization and stabilization terms have been derived from conventional viscoelastic constitutive laws for contacts and for deformable solids. The latter have been implemented and used for large-scale simulation of granular materials (>1M bodies), compared to the conventional discrete element method (DEM) and applied for the outlet design optimization in iron pellets production. The possibilities of embedding interactive physics in the web browser have been explored.

During 2013, we will focus on the parallelization of the solvers for large-scale multibody systems, make validation of granular flows, extend the viscoelastic solid to plastic and make models of forestry terrains. In collaboration projects we will work with simulation based design of granular flow systems, terrain vehicles and wind wills as well as the art of coupling different simulation tools using the standards from html5 and functional mock-up interface (FMI).







Research focus
Models and algorithms for fast simulation of vehicles, robots, biomechanics, granular matter, fluids, cables and cloth, electronics and hydraulics.

Applications
- Visual realtime interactive simulation.
- Simulation based design, and optimization.
- Control of complex mechanical systems

Projects
- Modelling and simulation of granular matter and machines
- Applications of non-smooth mechanics to rough terrain vehicles
- Modelling and simulation of the complex forestry environment
- Browser physics
- Multibody systems with electronics and hydraulics

Results
- Realtime cables using multiresolution and massless contacts
- Constraint fluid – 1M incompressible SPH-particles in interactive time on GPGPU
- SPOOK stepper – a variational integrator for multibody systems with physics-based constraint regularization and stabilization and nonsmooth dynamics
- Sabre – high-performance block sparse factorisation of symmetric indefinite matrices
- Large-scale granular matter (>1M bodies) and machines.

Collaborations
Algoryx, LKAB, Olofsfors, Oryx, Vimek, Skogstekniska Klustret, SLU

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IT management

The IT management group consists of 15 scholars that strive to raise the level of academic work in the field of information systems, in methodological rigor, conceptual depth and managerial applicability.

Our research and teaching focuses on the role of IT for firms in a number of industries. The objective of our research is to generate findings and develop concepts that will help firms improve their capacity to address IT-related challenges, while advancing the state of knowledge in IT research and related disciplines. The relevance of our research is ensured by the active participation of partners from a range of industries. Against this backdrop, we focus on how IT and digital capabilities can be used to innovate business performance. We critically analyse the opportunities and risks attached to the development and utilisation of information and communications technologies in contemporary organisations. We examine how to analyse corporate and business strategies, competitiveness and how organisations set up and manage structures, processes, human resources and technologies to deliver on their objectives. More specifically, we focus on the social, managerial and political issues involved in the introduction and operation of information and communications technologies in organisations. For more information visit: http://www.itmanagementgroup.se/

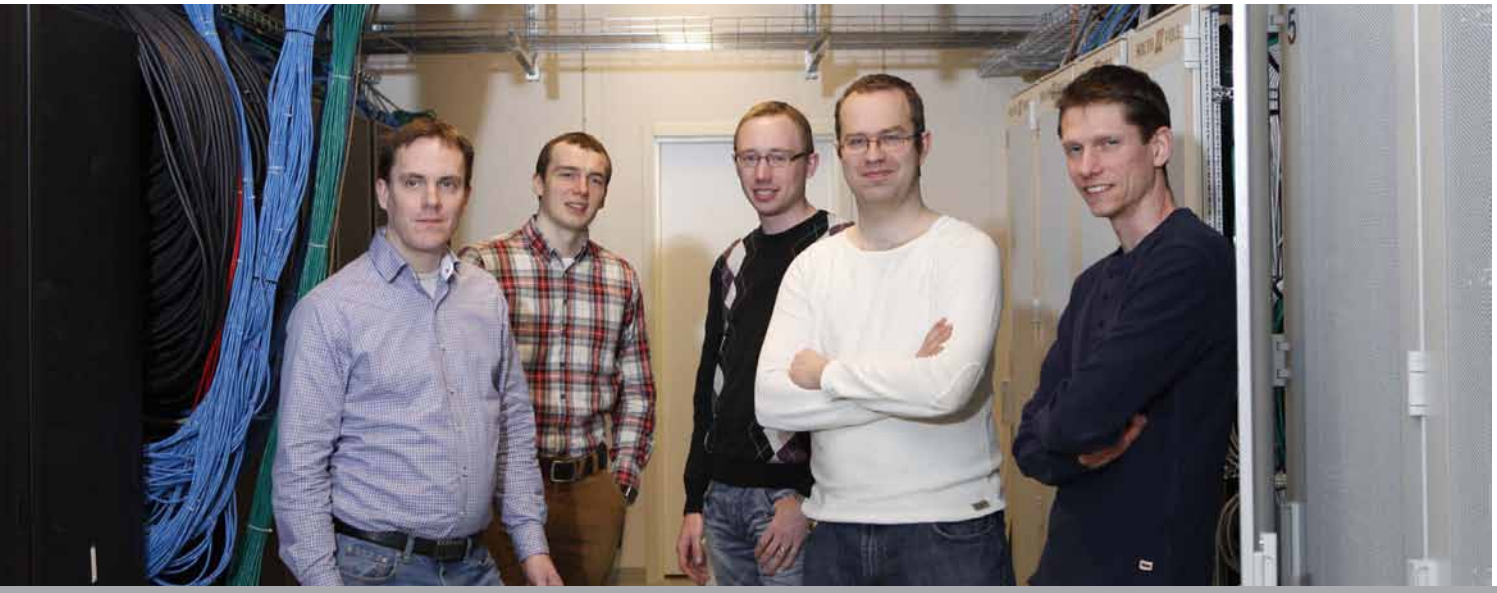
Parallel and scientific computing

Parallelism is here to stay! Today, most computers, from laptops to supercomputers, are based on so-called multicore architectures. Connecting many hundreds of powerful, and possibly heterogeneous, multicore nodes using a high-performance interconnect leads to truly massive parallel systems with a tremendous performance potential.

This evolution makes it possible to solve even more complex and large-scale computational problems in science and engineering. At the same time, there is an immense demand for new and improved scalable, efficient, and reliable numerical algorithms, library software and tools. This is essential, so that computations are carried out in a reasonable time and with the accuracy and resolution required.

Matrix computations are both fundamental and ubiquitous in the Computational Sciences, e.g. in the modelling and simulation of problems ranging from galaxies to nanoscale, and in real-time airline scheduling and medical imaging. Computing the Google PageRank vector of all web pages on the Internet is called the world´s largest matrix computation of today - with a hyperlink matrix of n-by-n, with n > 20 billion.

Besides such large-scale problems, there are many challenging matrix computations in the design and analysis of linear control systems. Modeling interconnected systems (e.g. electrical circuits) and mechanical systems (e.g. multibody contact problems) can lead to descriptor systems. Periodic models arise in several practical applications, e.g. the control of rotating machinery. We are investigating how to exploit the inherent structure of several of the associated matrix problems.



Research focus
Design of efficient and reliable algorithms for structured and dense matrix computations targeting many-core architectures and massive parallelism.

Applications
Applications can be found in, for example, control system design and analysis, biochemistry, and molecular dynamics.

Projects
- Parallel and cache-efficient algorithms and data structures for multi-core and hybrid architectures
- Design of parallel algorithms for eigenvalue problems, matrix factorizations, matrix equations, and matrix functions
- Algorithms and tools for computing structural information of general and structured matrix pencils and polynomials
- Metabolic flux analysis
- Design, analysis and evaluation of numerical algorithms for the stabilization of linear systems with periodic coefficients

Results
Novel theory, algorithms, library software and tools to be used as building blocks for various applications

Collaborations
Algoryx, DLR, IBM, Niconet, ScaLAPACK; several Universities, e.g., KI, Berkeley, Cornell, ETH, EPFL, Fudan, HU Berlin, UC Louvain, Univ. of Denver, Univ. of Tenneessee, Knoxville, Uppsala Univ.

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List of publications | 2012

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Collaboration brings innovation

It is the interplay that allows Umeå University to contribute to new innovations, according to Mats G. Larson, project leader of UMIT Research Lab. An interplay where the researchers provide valuable knowledge to companies, while the companies bring new and interesting problems back to science as well important knowledge about systems and processes.

As the director of UMIT Research Lab, Larson finds himself in the midst of an intensive and dynamic environment that aims to broaden and deepen the fundamental research within several scientific disciplines, while, at the same time, striving to complement the organisation with an application-oriented perspective in direct collaboration with industry and companies.

“The essential thing is that there is a scientific development that drives UMIT. We have come a long way in our understanding of how new software and services can be used to process large quantities of information and how we can create new opportunities for industrial and scientific simulations”, Larson explains.

The knowledge that the research at UMIT provides may lead to strong and rewarding collaborations with industry. It is this interplay that opens up new innovations, products and services that help to generate growth for our partners.

“UMIT has an important role in transferring knowledge and technology from the university to industry. In this way, we may see a competence improvement within our industrial partners´ organisations that makes them more competitive,” Larson says.

This interplay goes in both directions. While the university provides knowledge to the industry, the scientists get valuable and new problems back together with important knowledge about systems and processes. This, in turn, leads to new education and research initiatives and gives the university a better overview of the topics that are important from the perspective of society and industry.

“I want UMIT to be a unit that delivers strong fundamental research that leads to distinguished scientific publications, while, at the same time, being able to run education, research and development projects in close collaboration with industry,” Larson says.

The UMIT environment constitutes a melting pot for interplay and collaboration, from which potential increases in innovativeness and growth are generated.

Mats G. Larson is a professor at the Department of Mathematics and Mathematical Statistics at Umeå University.

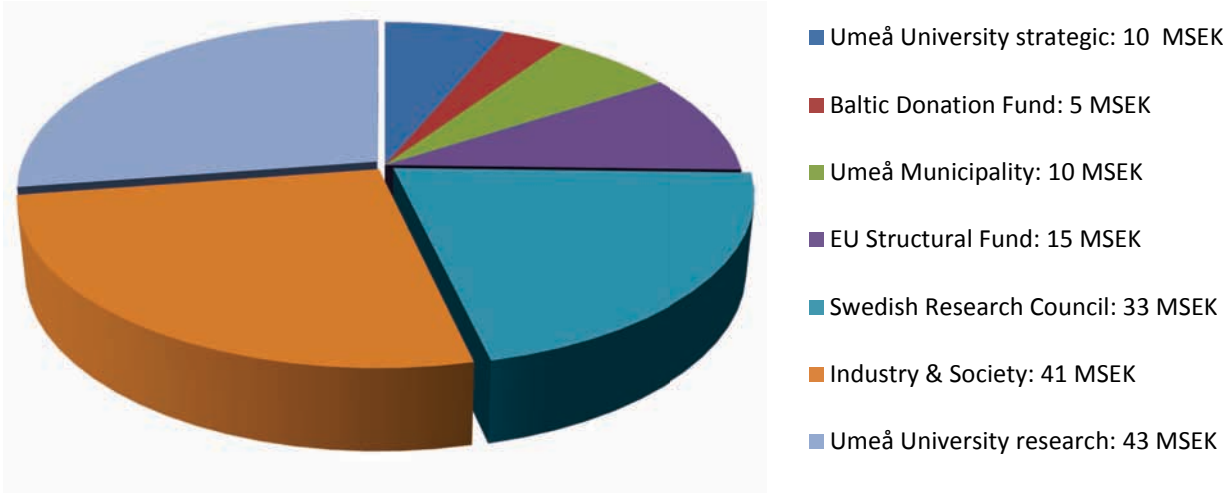
Industry collaborations 2009-2012

- Algoryx Simulations
- Argentum AB
- Atlas Copco
- DAS Audio
- Enmesh
- Eurocon
- FOI
- German Aerospace Center
- IBM Haifa Research Labs
- Komatsu Forest
- LKAB
- Monitoring Control Center
- M-Real
- Olofsfors
- Sorubin
- Optimation
- Oryx Simulations
- Outokumpu
- ProcessIT Innovations
- SAP Research
- SCA
- SKF
- Skogstekniska Klustret
- SP Trätek
- Sveaskog
- Sveriges Lantbruksuniversitet
- Södra Skogsägarna
- Tam Craft
- Umevatoriet
- Valutec
- Vimek
- Volvo CE
- Volvo Trucks

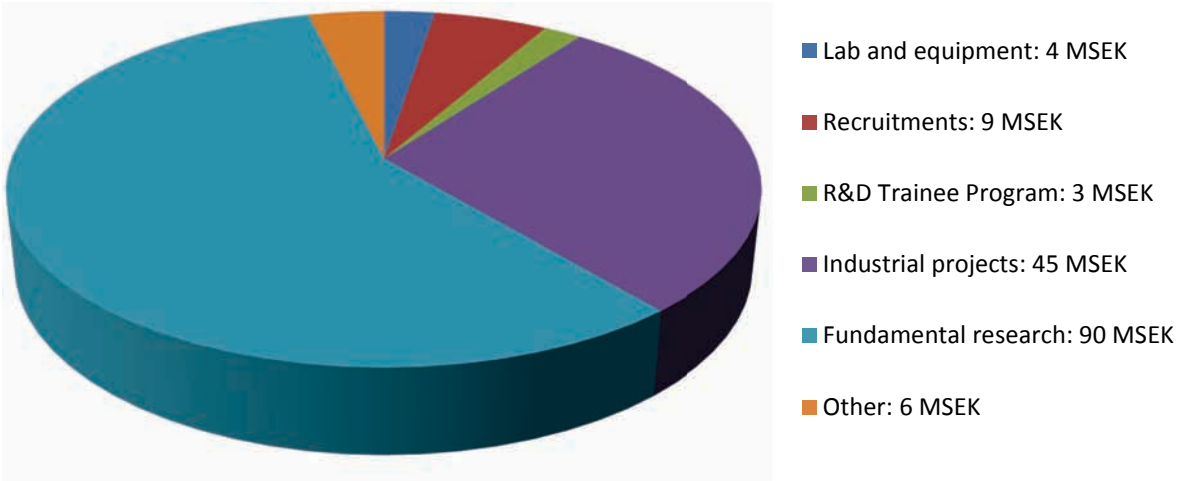
The UMIT project was initiated in 2009 with a total funding budget of 40 MSEK distributed over a five-year period. Founding financiers are the Baltic Donation Fund (5 MSEK), the EU Structural Fund – Objective 2 (15 MSEK), Umeå municipality (10 MSEK) and Umeå University (10 MSEK).

In addition to the initial funding of 40 MSEK, UMIT had, by the end of 2012, raised 51 MSEK from external sources for the co-financing of specific projects, e.g. EU FP7, EU Bottnic-Atlantica, FOI, Kempestiftelserna, LKAB, ProcessIT Innovations, SKF, Skogtekniska Klustret, Sorubin, Surgical Science, Valutec, VINNOVA and VR - The Swedish Research Council. This is in line with UMIT´s vision of an external funding of 15 MSEK annually and a strong support for both fundamental science and for applied research in industry collaboration. By the end of 2012, our affiliated scientists had in total been granted 33 MSEK from VR since 2009. The research financed by faculty and the industrial doctoral school during the same amounts to 43 MSEK.
UMIT's (expected) finances and expenses for the years 2009–2014 are displayed below.

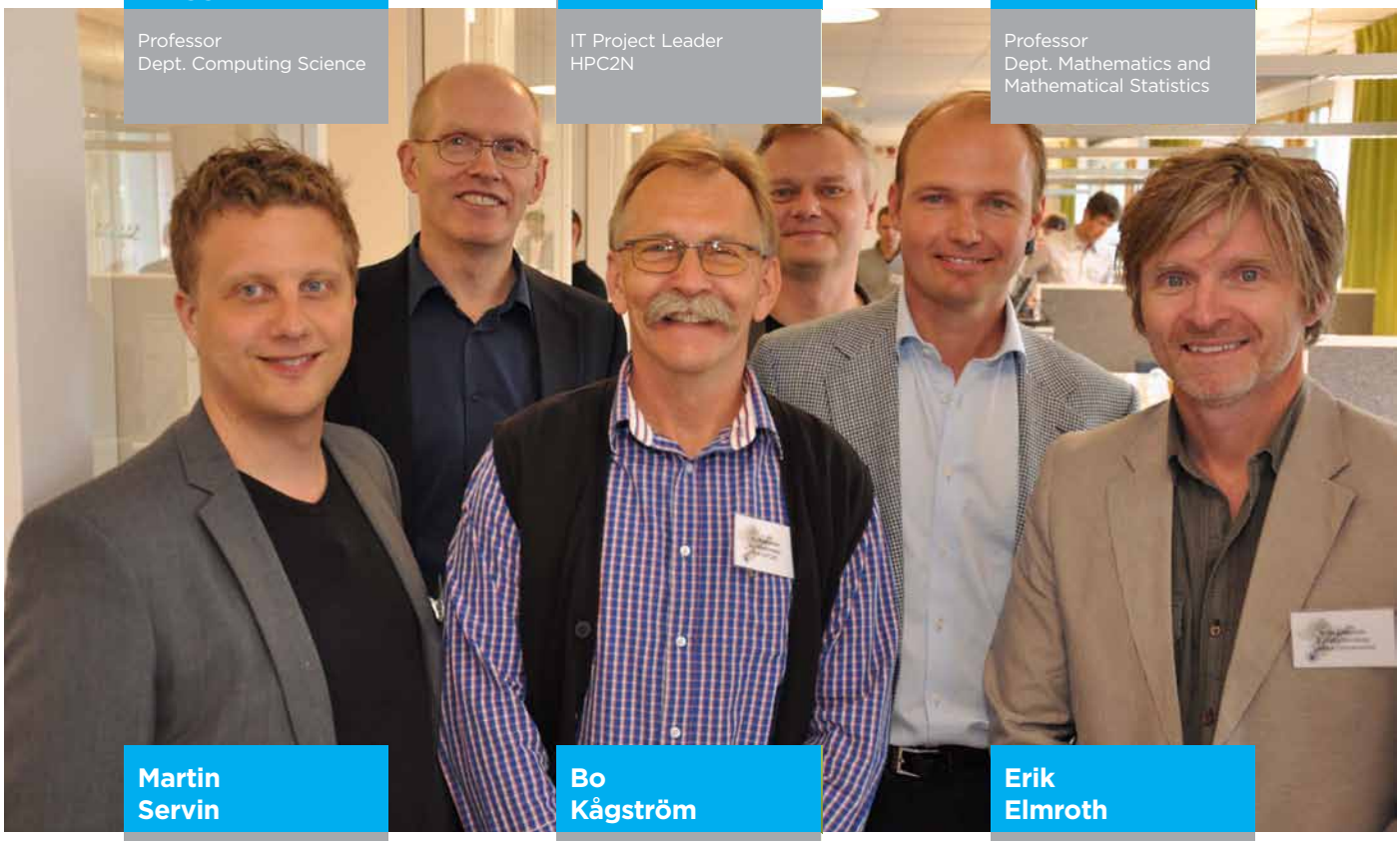
Financing (2009 - 2015), total 157 MSEK



Budget (2009 - 2015), total 157 MSEK



Management group



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Assistant Professor
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Dept. Computing Science

Robin Norman

Project Officer

Margareta Brinkstam

Administrator

Anna Nordström

Administrator

Linus Jundén

Coordinator, R&D Trainee programme

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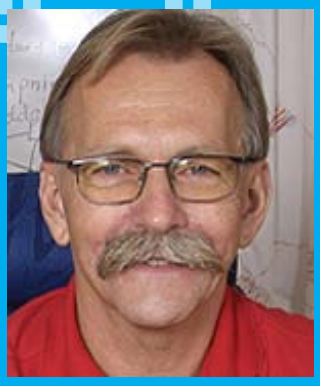
Deputy Vice-Chancellor, Professor, Umeå University
Chairman of the UMIT board

Åsa Rasmuson-Lestander
Dean of the faculty of Science and Technology, Professor, Umeå University

Mats G. Larson
Board member, Professor, Umeå University



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Board member, Professor, Umeå University

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Christian Engström

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Johan Dyrlind

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Linus Jundén, coordinator R&D Trainee Programme
Dr Joakim Lundin, project management

The UMIT project was initiated in 2009 by Umeå University as a strategic initiative for research within advanced simulation and software technology. The project includes a physical laboratory environment on campus, the recruitment of young scientists and the formation of research groups in close collaboration with industrial partners and society. The environment is highly interdisciplinary with scientists from the areas of, for example, computing science, mathematics and physics.

The purpose of the UMIT project is to create a leading research centre within modelling, simulation, numerical meth-ods, IT infrastructure, software, visualisa-tion and the application of these areas in industry. The main funders are Umeå University, Umeå municipality, the Baltic Foundation and EU Structural Fund – Objective 2.

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En investering för framtiden

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Europeiska regionala utvecklingsfonden