

## Skjemainformasjon

Skjema	SFU
Referanse	1006093
Innsendt	12.05.2013 22:09:07

## Host

### Information about host institution and center

Name of centre	InterAct - Culture for Learning
Host institution	University of Oslo
PO Box address	Pb. 1032, Blindern
Postal code / City/place	0315 OSLO
Telephone	22854218
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## Contact person

### Contact person

Name	Knut Mørken
Title	Professor
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E-mail address	knutm@ifi.uio.no

## About the centre

### About the centre

Is the centre already established at the time of application

No

Describe briefly the plans for establishing the centre (maximum 1500 characters)

Please see application documents.

Describe briefly the aims and current as well as planned activities of the centre (maximum 1500 characters)

## Application Document

### Application Document

Upload application document	<a href="#">profile_Application-SFU-MN-1.5x.pdf</a>
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## Timeline and budget

### Timeline and budget

Upload planned timeline and the activities to be conducted

[timeline\\_SFU-MN-Timeline.pdf](#)

Upload plan for financial resource acquisition

[financial\\_SFU-MN-budget.pdf](#)

Upload budget

[budget\\_SFU-MN-budget.pdf](#)

## Attachments

### Attachments

- Letter\_of\_intent\_\_\_UHR.pdf
- Letter\_of\_intent\_\_\_Helsinki.pdf
- Letter\_of\_intent\_\_\_Lund.pdf
- CV\_for\_Anders\_Malthe\_Soerenssen.pdf
- CV\_for\_Ragnhild\_Kobro\_Runde.pdf
- CV\_for\_Knut\_Moerken.pdf
- budget\_SFU-MN-budget.pdf
- financial\_SFU-MN-budget.pdf
- timeline\_SFU-MN-Timeline.pdf
- profile\_Application-SFU-MN-1.5x.pdf
- Letter\_of\_intent\_\_\_UV.pdf

### Comments

Comments to the application form (maximum 1500 characters)

Please note that the budget and financial resource acquisition plan have been combined into one document. I have agreed with NOKUT that a letter of support from the students will be emailed separately tomorrow morning.

Yours sincerely  
Knut Mørken

# Centre of Excellence in Education

## InterAct — Culture for Learning

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*Building an education that seeks excellence, not only in content and structure, but also in human relations — for students and staff.*

**InterAct:** Integration – alignment, collaboration – diversity, relevance

### Profile and Vision

Scientific work is becoming increasingly cross disciplinary. This requires scientists with broad scientific expertise who are aware of their individual personal competence in interaction with others. The Faculty of Mathematics and Natural Sciences (the MN-Faculty) [1] has long traditions for scientific excellence both in research and education, including the internationally unique Computing in Science Education initiative, [3]. With these traditions at its core, the Faculty will develop its educational programmes to ensure that our students gain the knowledge and develop the skills required to succeed both scientifically and professionally [2]. A fundamental characteristic of such an education is that it encourages learning among both students and educators, and is experienced as being *relevant*.

Higher education has traditionally been characterised by fragmentation, both from the perspective of students and education designers. The principal challenge is therefore *integration* and overall *alignment* of the individual educational elements. The structural and methodical aspects of education are vitally important, but we strongly believe that excellent education must also be based on a culture of *collaboration* — between all groups of staff, between staff and students, and between students — while at the same time encouraging *diversity*. The forming of this collaborative and inclusive *Culture for Learning* must be a primary focus.

The MN-Faculty has already initiated a broad process to address the above challenges. A Centre of Excellence in Education will provide an agent of change and act as an important focal point. The ultimate ambition of InterAct will be to contribute significant quality enhancement to education at our Faculty, our University, nationally, and even internationally.

## Computing in Science Education (CSE)

Over the past ten years, the project Computers in Science Education [3,7,10] has fundamentally reshaped education at the MN-Faculty in ways that can hardly be found at any other comparable university. This application may be viewed as an extension to general education of concrete lessons learnt from CSE (for information about educational change, see [6]): (i) increased relevance by including research and industrial problems at the bachelor level; (ii) acknowledging students as a major resource; (iii) improving possibilities for broad integration; (iv) emphasising alignment and collaboration; (v) creating a positive culture for learning with little bureaucracy.

The goal of the CSE-project has been to include a computational perspective in undergraduate education, coherently across courses, subjects, and programmes, with the students themselves programming and adapting numerical solution methods to the problems they are studying. The CSE-project initially focused on math-heavy disciplines like mathematics, physics, statistics, astrophysics and meteorology, but has recently been extended to subjects like geology and chemistry. In total CSE has affected the content of significant parts of the education in six departments, and is well supported by an equally significant proportion of the staff.

## Culture for Learning — A more detailed view

An obvious and simple idea is that educational programmes and courses should be designed by starting from the desired qualifications of the candidates, first for the programmes, and based on

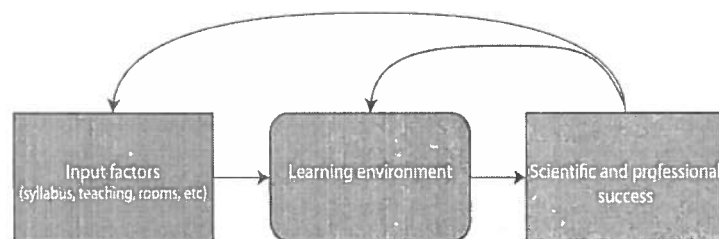


Figure 1. Backward design of education.

this, for the courses. This is the basis for the European Qualification Framework as well as for *Constructive Alignment* [5]. This model of education naturally leads to two focal areas:

1. Programme and course design – structure, methods, and content.
2. Relational learning environment – social interaction and motivation.

The development of programmes, courses and learning environment must be supported by similar focal areas for the staff:

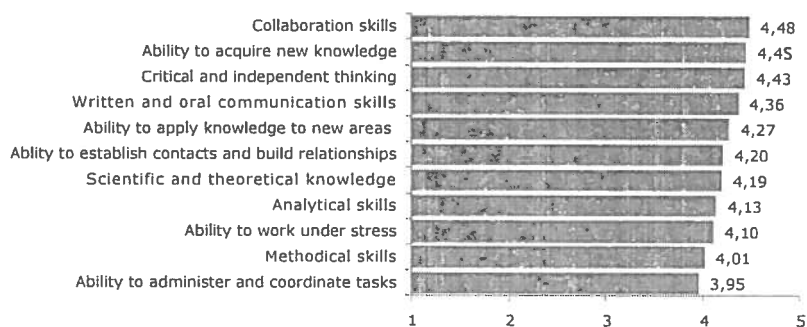
3. Didactics in science education – structure, methods, and content.
4. Staff development and culture – social interaction and motivation.

The emphasis of InterAct will be on education at bachelor and master levels, with particular emphasis on the first half of the bachelor level. Success in changing the culture for learning will also influence the PhD level.

### Programme and course design — integration, alignment, diversity, relevance

Programme design starts by determining appropriate learning outcomes for the programme, both scientific ones as well as purely professional competences, see the figure to the right, taken from [14]. The challenge

Figure 5.8: Importance of different qualifications for hiring — all employers



is then to continuously ensure that all input elements, examinations and other evaluations are aligned with the learning outcomes. In addition, students' prior education and preconceptions should be taken into account. It is also a fact that different personalities need different learning strategies — this should influence our approach to teaching.

Finally, it must be emphasised that regular monitoring of the learning outcomes is essential — there is little help in using a map for navigation if the map is wrong!

### Relational learning environment — alignment, collaboration, diversity

A purely technical approach to alignment misses the personal and relational facet of the learning environment. Both from experience and from psychology it is well known that if someone is to seek learning and development they must feel secure, that they belong, and are respected by others and themselves [9]. In particular, a mutual experience of belonging and trust may foster extensive learning and development within the student group — peer-to-peer learning. At a time when there is much focus on online learning it is wise to remember that a good learning environment and social skills cannot just be downloaded from the Internet, simply because good human relations also require physical interaction [12].

### Didactics in science education — integration, alignment, relevance

Didactics is clearly at the core of educational development. However, didactics has become a discipline of its own, with the result that science is often taught without much input from didactic

specialists. On the other hand, scientific progress may influence education in deep ways that only scientists are initially aware of, as is the case with CSE. This illustrates how both scientists and didactic specialists, and therefore education, can benefit from better integration and alignment.

### **Staff development and culture — alignment, collaboration, diversity**

University education is generally referred to as fragmented, and the teaching culture as privatised. In contrast, general alignment means that everyone involved in education must have a clear and common goal. And continuous development requires academics to reflect on individual teaching practices and learn from colleagues and literature, just as in research. It is impossible to force this change; instead it must be facilitated with positive motivation and incentives that simultaneously encourage alignment, collaboration and individual diversity.

### **Quality in Established Educational Activities**

CSE was awarded the University of Oslo's price for good learning environment in 2011, and NOKUT's second price for educational quality in 2012. CSE has been applauded by both students and staff, and has been presented in numerous invited talks, both nationally and internationally [8,11,13]. InterAct aims to release the synergy resulting in integrating and aligning education at the Faculty, with CSE as a model. The following are a few examples from the education portfolio that illustrate both quality and diversity.

#### **Programme and course design**

**CSE — updated learning outcomes and alignment.** The CSE-project started with an essential update to the learning outcomes at the Faculty level (included in strategic plan): integration of a computational perspective, wherever natural. This computational perspective can easily be integrated from the first semester. The challenge has been to align individual maths and science courses to coherently support this, initially within the maths-heavy programmes.

**CSE — relevance and research.** As a result of CSE, students are able to work on relevant problems from research and industry already in the first semesters. In physics, this has led to a few students becoming active researchers and producing a scientific journal paper already at bachelor level [4].

The science of meteorology is completely dependent on numerical simulations. Traditionally, this has been absent from bachelor level education. In Oslo this has now changed fundamentally because of CSE.

**The Study lab — alignment and diversity.** The Department of Informatics has been actively involved in CSE, and has formed the Study lab group to focus on the complete learning experience for first year bachelor students. An important part of the work is innovation and alignment both within and between courses, horizontally and vertically. Financed by Norwegian Opening Universities, tools are being developed to support diversity by providing exercises based on students' current skill level. Some of the tools are being further developed for use in Chemistry.

**Problem based learning.** The School of Pharmacy established a new, innovative 5-years Master Curriculum in 2003, providing interdisciplinary courses with an extensive use of problem-based learning, student projects, and laboratory courses. The students are guided through all elements of drug development as well as provision of drug related information to other health-care providers and patients.

**Integration and alignment in chemistry.** Laboratory work is an integral part of science education. Through the use of so-called pre-labs and video based instruction, the Department of Chemistry has achieved good alignment between lectures, tutorials, and laboratory teaching.

### **Relational learning environment**

**ForVei** (acronym from Norwegian). The ForVei team offers second semester students coaching to help them to utilise their personal resources. ForVei is rated very highly by the students, and student politicians are demanding that ForVei also become available at the other faculties. ForVei was first established at NTNU by Ilan Dehli Villanger, and received NOKUT's third price for educational quality in 2010. Mr Villanger moved to the MN-Faculty in 2011. Recently, ForVei has become part of a wider focus on student wellbeing, including relation building reception meetings, and overnight seminars early in the first semester.

**Study lab – Sonen.** The Study Lab at the Department of Informatics runs "Sonen" (The Zone), a project-based meeting place for students enthusiastic and curious about all aspects of computer science. Sonen provides a social learning environment based on fun and experimentation, and has attracted considerable attention by media. There are currently ideas for creating a "MN-Sone" for the whole Faculty.

**Laboratories.** Subjects like biology and the geosciences involve both fieldwork and laboratory work. These are teaching elements that contribute very positively to the learning environment and general student wellbeing, and encourage social interaction between students and educators.

**Award for excellent learning environment.** Educators at the Department of Physics have received the University price for excellent learning environment several times. The most recent winner was Cathrine Wahlstrøm Tellefsen who was awarded the price in 2012 for establishing a common bi-annual seminar for all teaching assistants at the Faculty, as well as for her excellent work with the learning environment in FYS1000 — an elementary, but broad physics course for students who specialise in other subjects.

**New learning centre.** Vilhelm Bjerknes' (VB) building was recently renovated and now houses an integrated Faculty library with a coffee bar and extensive facilities for informal student interaction, seminar rooms and lecture halls, a help desk for study related questions, and the office of the Faculty student board. The basement contains the popular RF-kjelleren, a popular meeting place for students both during the daytime and in the evenings. VB functions well as the natural learning centre for many students during the first semesters. The excellent new Computer Science building serves a similar purpose for computer science students.

### **Didactics in science education**

**CSE.** Compared to classical science education, the CSE-project introduces a new and fundamentally different scientific framework in which most relevant equations can actually be solved (numerically). The theory can therefore be developed without the severe constraints of pencil-and-paper based mathematical solution methods. A consequence is that well-established folklore about how science should be taught must be questioned and adjusted. This new perspective has resulted in several new textbooks authored by staff at the MN-Faculty.

**School labs.** The MN-Faculty has established schools labs at the institution level (Physics, Chemistry, Biology, and Geology) to provide courses and events for students and teachers from secondary schools, softening the transition between school and university. Together with the Norwegian Centre for Science Education, the School Lab in physics leads the international IRIS-project that investigates the priorities behind first-year science and technology students' educational choice, and the experiences of these students during their first year in higher education. Questions from one of their questionnaires have been reused by the Study Lab, and used as part of the basis for their work.

### **Staff development and culture**

**CSE.** The essence of CSE is systematic and aligned use of computations in mathematics and most undergraduate science courses. The primary challenge is therefore not scientific, but rather how



to obtain such broad and aligned collaboration. Essential keys to the success are: (i) friendly communication that values diversity, (ii) broad agreement on overall goals, (iii) support for course development, and (iv) friendly and simple reporting with little bureaucracy. These have ensured that both individual teachers and the departments have managed to adjust and collaborate in new ways. CSE has included students (teaching assistants) in the development of new teaching materials and teaching tools, giving them a sense of ownership of their own education and establishing new collaborations between teachers and students. A notable effect of the CSE-project is that the annual CSE-seminars have become the main Faculty forum for discussing general educational questions.

## **Work packages**

The work of InterAct is conveniently divided into four work packages indicated by the structure in the previous sections. The centre management will communicate the vision of the centre; oversee and monitor the work in the work packages, making sure there is overall integration and alignment; maintain close contact with all departments and relevant student organisations as well as with external bodies, and organise Faculty-wide seminars and social gatherings.

A leader and an advisor will lead a work group for each work package. Members of the work group will typically be senior staff members advising on the tasks and advocating their importance to the rest of the Faculty. Students will be represented in all work packages, and student feedback will be essential for evaluation.

This application is to a large extent a generalisation to general education of what has been learnt through CSE. Further development of CSE and its integration into general education will be a primary area of focus in all of the work packages.

### **Overall management (NOK 3 021 000, Full-time equivalents: 1.65)**

The estimated annual cost for each work package is given together with the full-time equivalents. These numbers give an indication of the resources required to manage the centre and its activity. In reality most of the staff at the MN-Faculty will be involved in this work.

### **WP1. Programme and course design (NOK 2 545 000, Full-time equivalents: 2.10)**

Leader: Assoc. Prof. Ragnhild Kobro Runde, Advisor: Prof. Anders Malthe-Sørensen.

The objective of this work package is to revise and improve the alignment in the Faculty's education, based on the principle of Constructive Alignment (Figure 1). This is an extensive work pack-

age that will involve virtually all staff, and must therefore be strongly supported by WP4. WP1 will initially focus on the three bachelor programmes in mathematics, informatics and physics. Students and student bodies will participate actively in the work.

1. Develop improved learning outcomes for programmes and courses based on the MN-Faculty's strategy for education, emphasising both scientific and professional competence.
2. Develop a framework for monitoring and evaluation of attainment of learning outcomes and the learning environment in cooperation with the Faculty of Educational Sciences.
3. Develop innovative input factors (including teaching methods) and make sure these and the evaluation methods are aligned with the learning outcomes.
4. Establish mechanisms for regular revision of the learning outcomes.

### **WP2. Relational learning environment (NOK 3 390 000, Full-time equivalents: 2.20)**

The objective of WP2 is to establish an environment that encourages students to focus on deep learning and personal development. It is well known that if someone is to seek learning and development they must feel secure, that they belong, and are respected by others and themselves — this provides the basis for challenging students scientifically.

1. Based on ForVei, work systematically to establish good relations between students, and between students and staff. Examples: Reception day, programme seminars, encourage meta-reflection on learning among students, engage with student bodies.
2. Identify and remove negative influences in the learning environment.
3. Provide positive motivation for learning. Examples: Sonen, Chemistry shows, CSE.
4. Facilitate and encourage learning among students. Example: Student-driven courses.

### **WP3. Didactics in science education (NOK 2 565 000, Full-time equivalents: 2.35)**

The objective is to better integrate and align the different didactics groups at or close to the MN-Faculty and to better integrate and align didactics with the sciences, and then to use this resource actively in developing teaching and education, in collaboration with the group for University pedagogy at the Faculty of Educational Science. The didactics groups include the School Labs in different sciences, the Norwegian Centre for Science Education, the Department of Teacher Education and School Research, the Study Lab at the Department of Informatics, as well as some individuals.

1. Develop further the didactic perspective in the training of university educators.
2. Contribute didactic reflection to the planning of education and teaching.
3. Develop further the training of teaching assistants (students and PhDs).

4. Develop and improve the education of science teachers, including continuing education of teachers already in employment.

#### **WP4. Staff development (NOK 713 000, Full-time equivalents: 0.35)**

Leader: Prof. Knut Mørken, Advisor: Coord. of studies, Hanne Sølna

The objective is to establish an environment where innovation and creativity is natural and encouraged, not only in research, but in all areas of relevance for a university career, not least education. This requires positive and including relations that value diversity, supported by ambitious and motivating goals. The mutual interdependence of research and education will be emphasised, and involvement in education encouraged by a positive incentive system that aims to level the prestige of education and research, in accordance with the Faculty's strategy.

1. Use informal and formal meetings to emphasise the value and importance of positive relations. Communicate ambitious, but realistic goals for education.
2. Establish an educator academy where excellence in teaching and education is recognised and rewarded, using the academy at the Faculty of Engineering at Lund University as a model. Make active use of incentives like PhD-positions as recognition for education development, and employ student assistants for course development.

### **Potential for innovation and dissemination**

#### **Innovation**

Research and innovation in InterAct will occur in three forms: (i) Through CSE and similar initiatives, the students will be enabled to do research already at the bachelor level, (ii) Educators will apply their analytical approach to research also to education, (iii) Didactic and other research on education. With all the scientific expertise at the MN-Faculty the potential for innovation is vast.

#### **Dissemination**

By construction, the centre is broad and comprises eight science departments. Its aim is to establish an environment for reflection and enhancement of education in, but also between, all departments. This in itself translates into significant dissemination.

Within the University there are natural dissemination channels like the central Department of Student and Academic Affairs, informal contact with colleagues at other faculties, and Rector and the central management team who actively support this application.

The MN-Faculty has received direct funding from the Ministry of Education for developing a na-

tional guide for implementation of CSE at universities and university colleges [10], and for establishing a national resource group for CSE [15]. The latter is coordinated via close collaboration with the Norwegian Association of Higher Education Institutions (UHR). We will continue to use and develop this link for national dissemination of results from InterAct.

## **Organisational plan**

The formal organisation of InterAct will comprise:

- A centre leader, Prof. Knut Mørken, whose role will be to oversee the activities and daily running of the centre, together with the MN-Faculty's coordinator of studies, Hanne Sølna, who will act as deputy leader. An administrative officer will support the Centre and its two leaders — this will comprise the management team of InterAct.
- A board consisting of the two leaders, the dean of education, three representatives of the Faculty's scientific staff, and two student representatives.
- An advisory board consisting of 2-4 internationally recognised specialists on science education, and one representative from outside the University, typically from industry.

The management team will work closely with the dean of education and the leaders of the work packages. The centre leader will have an official seat in the Faculty's bodies for education management, including regular meetings with student bodies.

InterAct will have a physical location near the Faculty administration, and 1-2 days a week will be meeting days where there will be relevant seminars, common lunch and informal discussions. The departments will also be encouraged to host such events at regular intervals.

## **Collaborative partners**

The centre will seek advice from national and international partners. These may change over time, but initially they are likely to be (i) The Academic Development Unit at the Faculty of Engineering at Lund University, Sweden (confirmed), (ii) The Department of Educational Research and Inter-media, University of Oslo (confirmed), (iii) The Computer Science Department at Helsinki University (confirmed), (iv) The Centre for Research and Development of Higher Education at Helsinki University (not confirmed), (v) The Norwegian Association of Higher Education Institutions (confirmed), (vi) A relevant Norwegian company with success in developing human potential, like Snøhetta Group of Architects (not confirmed).

## References

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<http://www.uib.no/filearchive/kompetanse-2020-rapport-16-02-11-.pdf>
15. Portal with CSE resources. <http://www.mn.uio.no/english/about/collaboration/cse/portal-with-resources/>

## Letters of intent and other attachments

1. Genombrottet, Academic Development Unit, The Faculty of Engineering, Lund University, Sweden.
2. Department of Computer Science, Helsinki University, Finland.
3. The Norwegian Association of Higher Education Institutions.
4. Department of Educational Research and Intermedia, University of Oslo.
5. Letter of support from the Student Council at the MN-Faculty.
6. Budget.
7. Time-line.
8. CV for Knut Mørken.
9. CV Ragnhild Kobro Runde.
10. CV for Anders Malthe-Sørensen.



# Centre of Excellence in Education InterAct — Culture for Learning

## Proposed budget and financial resource acquisition

Activity / Work package	2014	2015	2016	2017	2018	Sum	Full-time equivalents
<i>Centre management – overall integration and alignment</i>							
Centre leader, Knut Mørken, 25% *	2,750,000	2,970,000	3,045,000	3,130,000	3,210,000	15,105,000	8.25
The faculty coordinator of studies, deputy leader, Hanne Solha, 20%	325,000	340,000	350,000	365,000	380,000	1,760,000	1.25
Administrative officer	195,000	215,000	225,000	240,000	250,000	1,125,000	1.00
Web development and adm.support, 20%	875,000	925,000	975,000	1,025,000	1,075,000	4,875,000	5.00
Initiatives: expenditure for development & implementation of ideas across the wps *	175,000	185,000	195,000	205,000	215,000	975,000	1.00
Travel & courses *	810,000	935,000	930,000	925,000	920,000	4,520,000	
Diverse operational expenditures *	200,000	200,000	200,000	200,000	200,000	1,000,000	
Advisory board, external members: compensation & travel *	50,000	50,000	50,000	50,000	50,000	250,000	
	120,000	120,000	120,000	120,000	120,000	600,000	
<i>WP1. Programme &amp; course design</i>							
WP1. Programme & course design	2,315,000	2,430,000	2,550,000	2,660,000	2,770,000	12,725,000	10.50
Work package leader Ragnhild Kobro Runde, 30% *	330,000	340,000	355,000	370,000	380,000	1,775,000	1.50
Adjunct position, 10% *	110,000	115,000	120,000	125,000	130,000	600,000	0.50
Didactics' network, 9x10% position from all departments	1,075,000	1,125,000	1,175,000	1,225,000	1,275,000	5,875,000	4.50
Heads of studies at the departments, 8x10%	800,000	850,000	900,000	940,000	985,000	4,475,000	4.00
<i>WP2. Relational learning environment</i>							
WP2. Relational learning environment	3,070,000	3,225,000	3,385,000	3,555,000	3,715,000	16,960,000	11.00
Work package leader, 20%	220,000	225,000	235,000	245,000	255,000	1,180,000	1.00
"ForVe" team Ilan D. Villanger and Linda Sørensen; social facilitating & counselling	1,850,000	2,000,000	2,150,000	2,310,000	2,460,000	10,770,000	10.00
Start up seminars for programstudents	1,000,000	1,000,000	1,000,000	1,000,000	1,000,000	5,000,000	
<i>WP3. Didactics in science education</i>							
WP3. Didactics in science education	1,930,000	2,640,000	2,775,000	2,910,000	2,570,000	12,825,000	11.75
Work package leader, 50% from second half of 2014 *	260,000	510,000	535,000	560,000	585,000	2,450,000	2.25
Didactics' network, 9x10% position from all departments	1,075,000	1,125,000	1,175,000	1,225,000	1,275,000	5,875,000	4.50
Doctorate Scholarship, from second half of 2014	375,000	775,000	825,000	875,000	450,000	3,300,000	4.00
Adjunct professor *	220,000	230,000	240,000	250,000	260,000	1,200,000	1.00
<i>WP4. Staff development – culture for learning</i>							
WP4. Staff development – culture for learning	670,000	695,000	710,000	735,000	755,000	3,565,000	1.75
Centre leader, Knut Mørken, 25% *	325,000	340,000	350,000	365,000	380,000	1,760,000	1.25
The faculty coordinator of studies, deputy leader, Hanne Solha 10%	95,000	105,000	110,000	120,000	125,000	555,000	0.50
Seminars & gatherings *	250,000	250,000	250,000	250,000	250,000	1,250,000	
<b>Total costs</b>	<b>10,735,000</b>	<b>11,960,000</b>	<b>12,465,000</b>	<b>12,990,000</b>	<b>13,020,000</b>	<b>61,170,000</b>	<b>43.25</b>
Financing from NOKUT (costs indicated by *)	-3,000,000	-3,000,000	-3,000,000	-3,000,000	-3,000,000	-15,000,000	25%
Financing from UIO	-7,735,000	-8,960,000	-9,465,000	-9,990,000	-10,020,000	-46,170,000	75%
<b>Total financing</b>	<b>-10,735,000</b>	<b>-11,960,000</b>	<b>-12,465,000</b>	<b>-12,990,000</b>	<b>-13,020,000</b>	<b>-61,170,000</b>	<b>43.25</b>



# Centre of Excellence in Education InterAct — Culture for Learning

## Proposed budget and financial resource acquisition

Activity / Work package	2014	2015	2016	2017	2018	Sum	Full-time equivalents
<i>Centre management - overall integration and alignment</i>	2,750,000	2,970,000	3,045,000	3,130,000	3,210,000	15,105,000	8.25
Centre leader, Knut Mørken 25% *	325,000	340,000	350,000	365,000	380,000	1,760,000	1.25
The faculty coordinator of studies, deputy leader, Hanne Sølna, 20%	195,000	215,000	225,000	240,000	250,000	1,125,000	1.00
Administrative officer	875,000	925,000	975,000	1,025,000	1,075,000	4,875,000	5.00
Web development and adm.support, 20%	175,000	185,000	195,000	205,000	215,000	975,000	1.00
Initiatives: expenditure for development & implementation of ideas across the wp's *	810,000	935,000	930,000	925,000	920,000	4,520,000	
Travel & courses *	200,000	200,000	200,000	200,000	200,000	1,000,000	
Diverse operational expenditures *	50,000	50,000	50,000	50,000	50,000	250,000	
Advisory board, external members: compensation & travel *	120,000	120,000	120,000	120,000	120,000	600,000	
<i>WP1. Programme &amp; course design</i>	2,315,000	2,430,000	2,550,000	2,660,000	2,770,000	12,725,000	10.50
Work package leader Ragnhild Kobro Runde, 30% *	330,000	340,000	355,000	370,000	380,000	1,775,000	1.50
Adjunct position, 10% *	110,000	120,000	120,000	125,000	130,000	600,000	0.50
Didactics' network, 9x10% position from all departments	1,075,000	1,125,000	1,175,000	1,225,000	1,275,000	5,875,000	4.50
Heads of studies at the departments, 8x10%	800,000	850,000	900,000	940,000	985,000	4,475,000	4.00
<i>WP2. Relational learning environment</i>	3,070,000	3,225,000	3,385,000	3,555,000	3,715,000	16,950,000	11.00
Work package leader, 20%	220,000	225,000	235,000	245,000	255,000	1,180,000	1.00
"ForVel" team: Ilan D. Villanger and Linda Sørensen, social facilitating & counselling	1,850,000	2,000,000	2,150,000	2,310,000	2,460,000	10,770,000	10.00
Start up seminars for programstudents	1,000,000	1,000,000	1,000,000	1,000,000	1,000,000	5,000,000	
<i>WP3. Didactics in science education</i>	1,930,000	2,640,000	2,775,000	2,910,000	2,570,000	12,825,000	11.75
Work package leader, 50%, from second half of 2014 *	260,000	510,000	535,000	560,000	585,000	2,450,000	2.25
Didactics' network, 9x10% position from all departments	1,075,000	1,125,000	1,175,000	1,225,000	1,275,000	5,875,000	4.50
Doctorate Scholarship, from second half of 2014	375,000	775,000	825,000	875,000	450,000	3,300,000	4.00
Adjunct professor *	220,000	230,000	240,000	250,000	260,000	1,200,000	1.00
<i>WP4. Staff development - culture for learning</i>	670,000	695,000	710,000	735,000	755,000	3,565,000	1.75
Centre leader, Knut Mørken, 25% *	325,000	340,000	350,000	365,000	380,000	1,760,000	1.25
The faculty coordinator of studies, deputy leader, Hanne Sølna 10%	95,000	105,000	110,000	120,000	125,000	555,000	0.50
Seminars & gatherings *	250,000	250,000	250,000	250,000	250,000	1,250,000	
<b>Total costs</b>	<b>10,735,000</b>	<b>11,960,000</b>	<b>12,465,000</b>	<b>12,990,000</b>	<b>13,020,000</b>	<b>61,170,000</b>	<b>43.25</b>
Financing from NOKUT (costs indicated by *)	-3,000,000	-3,000,000	-3,000,000	-3,000,000	-3,000,000	-15,000,000	25%
Financing from UiO	-7,735,000	-8,960,000	-9,465,000	-9,990,000	-10,020,000	-46,170,000	75%
<b>Total financing</b>	<b>-10,735,000</b>	<b>-11,960,000</b>	<b>-12,465,000</b>	<b>-12,990,000</b>	<b>-13,020,000</b>	<b>-61,170,000</b>	<b>43.25</b>

# Curriculum Vita

**Knut Martin Mørken**  
**Professor**

**Department of Mathematics**  
**Faculty of Mathematics and Natural Sciences**  
**University of Oslo**

**Date:** May 12, 2013

**Date and place of birth:** Tønsberg, Norway, July 17, 1957.

**Citizenship:** Norwegian.

**Civil status:** Married to Helen since 1980. Five children: Rebekka (1986), Daniel (1989), Sara (1991), Debora (1996), Hannah (2000).

## Education

- Cand. mag, University of Oslo, 1979.
- Cand. real., Department of Informatics, University of Oslo, June 1984.
- Dr. Scient, Department of Informatics, University of Oslo, June 1989.

## Employment

- Research Fellow, Department of Computer Science, University of Reading, England, February 1982 – July 1982.
- Research Assistant, Department of Informatics, University of Oslo, Aug. 1, 1984 – March 31, 1990.
- 1. amanuensis (Associate Professor), Department of Informatics, University of Oslo, April 1, 1990 – April 30, 1995.
- Professor, Department of Informatics, University of Oslo, May 1, 1995 – February 28, 2013.

## Present positions

- Professor, Department of Mathematics, University of Oslo, March 1, 2013 – present.
- Member of the Centre of Mathematics for Applications, a centre of excellence funded by the Norwegian Research Council, 2003 – present.
- Project leader for education development at the Faculty of Mathematics and Natural Sciences, 50 % position, August 1, 2012 – present.

## Further qualifications

- Attended five day course based on the book *Clear Leadership: Sustaining Real Collaboration and Partnership at Work* by Gervase R. Bushe, Autumn 2012.
- Certified practitioner of the Myers Briggs Step 2 personality inventory, February 2013.

## Contributions to education

I have always enjoyed teaching, and over the past ten years education has become an increasingly dominant part of my work. This all started when in 2000 I was asked to take responsibility for revising and teaching the traditional, introductory course in mathematics by providing a variant with a more computational perspective. From the beginning, I envisaged this computational perspective to be based on programming, not merely the use of advanced calculators. As a result of the major, national educational reform in 2003 the variants other than the computational one were terminated.

**CSE.** The 2003 reform of education, and the forming of the centre of excellence in research in the same year, Centre of Mathematics for Applications (CMA), brought together researchers from mathematics, informatics and physics with a common vision for a coherent and aligned computational perspective on mathematics and science. This led to the formation of the project *Computing in Science Education*, for which I have been leader since the project was formalised.

In 2005 the CSE vision was included in the MN-Faculty's strategic plan, with leadership support from the Dean of Education, Annik Myhre, and administrative support from the Faculty's coordinator of

studies, Hanne Sølna. Since then CSE has become well established at the Faculty, particularly in the math-heavy disciplines.

**Dissemination of CSE.** CSE has been developed in all math-heavy subjects, and increasingly in other subjects. It has also been presented in numerous talks, particularly guest lectures, but also at conferences, nationally and internationally. The main contributors to this have been Morten Hjorth-Jensen and Anders Malthé-Sørensen from physics, Hans Petter Langtangen from Informatics, and Øyvind Ryan from the CMA, in addition to myself. These are the key figures, but it must be emphasised that many others, including many students, have contributed significantly.

**Personal contribution.** In addition to teaching one of the key CSE courses in the first term and developing relevant teaching materials, I have had a focus on securing wide support for the CSE idea. This has become more systematic in recent years through close collaboration with Hanne Sølna. In addition to securing broad local support for CSE, the two of us have worked closely with the Ministry of Education and Mette Mo Jakobsen at The Norwegian Association of Higher Education Institutions to encourage implementation on a national basis. In this respect, CSE may also serve as a concrete template for the broad collaboration and alignment that is strongly advocated in the new national plan for engineering education.

**General education.** Since 2011 I have worked closely with Hanne Sølna in trying to identify the success behind CSE and bring the enthusiasm of CSE to education in general. Mainly through her deep interest in true collaboration and understanding of people have I been led to consider carefully the role of human relations in education. This is often overlooked by politicians, management and most others, but literature on psychological growth and practical experience tells a different story. For this reason both Hanne and I have become certified practitioners of the Myers-Briggs type inventory, I have studied relevant literature from psychology, and I have learnt from specialists. The ultimate result is the broad focus on all areas of education evident in the application for the MN-Faculty to become a centre of excellence in education, with particular emphasis on human relations and culture, both among students and staff.

### Highlights – education

- Has taught courses in numerical analysis, approximation theory, signal processing and elementary calculus.
- Developed a new introductory course for first-term students in the mathematical sciences that combine calculus, numerical computation and digital representation of information, 2000 – present.
- Received the student's award for best teacher at the Faculty of Mathematics and Natural Sciences, Autumn 2003.
- Has supervised a large number of Master students in the period 1989 –present and has supervised five PhD-students, is currently supervising one PhD-student.
- Project leader for *Computing in Science Education*, 2004 – present. This is an initiative to reform the elementary teaching of the Mathematical Sciences at the University of Oslo, by introducing a computational perspective in a unified and natural way. The project has received considerable national attention.
- Leader of the board for the Bachelor programme *Mathematics, Informatics and Technology*, 2009 – present.
- Leader of a national work group that produced a guide for introducing a computational perspective at Norwegian universities and university colleges, supported by the Ministry of Education, 2010–2011.
- Leader of a national resource group *Computing in Science Education*, supported by the Ministry of Education via The Norwegian Association of Higher Education Institutions, 2012 – present.
- Member of the Think Tank at Renate, the national centre for recruitment to science and technology. This think tank discussed how the teaching of mathematics could be tailored to different personalities, based on psychology and knowledge of how the brain works, 2012 – 2013.
- Leader of a Faculty-wide group on student support, 2012 – present.

### Prizes for teaching and education

- Received the student's award for best teacher at the Faculty of Mathematics and Natural Sciences, Autumn 2003.
- CSE received the University of Oslo's prize for best learning environment in 2011.
- CSE received NOKUT's second prize for educational quality in 2012.

## Administrative work

- Administrative leader of the group for Mathematical Modelling at the Department of Informatics (comprising subgroups in image and signal processing and numerical analysis), 1993 – 1998. This administrative level ceased in 1998.
- Administrative leader of the research group in Computational Mathematics at the Department of Informatics, 1998 – February 28, 2013.
- Coordinator at the Department of Informatics for a major new teaching reform for higher education, 2001–2003.
- Member of the Board of the Faculty for Mathematics and Natural Sciences, elected as one of four representatives of the scientific staff at the Faculty, 2003–2004.
- Member of the Executive Board of the Faculty for Mathematics and Natural Sciences, 2003–2004.
- Chairman of a Faculty committee with a mandate to identify teaching challenges after the teaching reform and the challenge of reallocation of scientific resources within the University, Spring 2004.
- Deputy member of the Board of the Faculty for Mathematics and Natural Sciences, 2005–2008.
- Member of a Norwegian/Swedish group that evaluated the teaching at the Department of Informatics, University of Bergen, 2005.
- Member of the scientific committee for the Winter meetings in eVITA, a research program in computational science governed by the Norwegian Research Council, 2007–2010.
- Member of the Board of the Faculty for Mathematics and Natural Sciences, elected as only representative of the scientific staff at the MN-Faculty, 2013–2016.

## Miscellaneous

- Editor of the Computers and Mathematics column of *NORMAT*, a Nordic Mathematical Journal, 1990–1996.
- Invited to the conference *Numerical Methods in Approximation Theory*, held at the Mathematisches Forschungsinstitut Oberwolfach, Germany, November 24–30, 1991, and organised by D. Braess and L. L. Schumaker.
- Invited speaker at the conference *Mathematical Methods in Computer Aided Geometric Design*, held at Ulvik, Norway, June 16–21, 1994, and organised by M. Dæhlen, T. Lyche and L. L. Schumaker.
- Invited speaker at the conference *International Workshop on Total Positivity and its Applications*, held at Jaca, Spain, September 26–30, 1994, and organised by M. Gasca and C. A. Micchelli.
- Visiting Professor, Department of Mechanical Engineering, University of Bath, UK, spring 1998.
- Invited speaker at a workshop on the reform of the introductory mathematics teaching at technical universities, held at NTNU, Trondheim, Norway, May 2000.
- Co-organiser of the Fifth International Conference on Mathematical Methods for Curves and Surfaces, held in Oslo, June/July 2000.
- Invited to the seminar *Geometric Properties from Incomplete Data*, held at Dagstuhl, Germany, March 22–26, 2004, organised by R. Klette, R. Kozera, L. Noakes and J. Weickert.
- Co-organiser of the Sixth International Conference on Mathematical Methods for Curves and Surfaces, held in Tromsø, Norway, July 2004.
- Invited speaker at the Workshop on Geometric Modelling and Animation at the conference *Foundations of Computational Mathematics* held at Universidad de Cantabria, Santander, Spain, 30 June - 2 July 2005.
- Invited speaker at the *Fourth International Conference on Multivariate Approximation: Theory and Applications*, held at Cancun (The WESTIN Resort & Spa), Mexico, April 26–May 1, 2007.
- Co-organiser of the *Seventh International Conference on Mathematical Methods for Curves and Surfaces*, held in Tønsberg, Norway, June 2008.
- Co-organiser of *The Second International Conference on Scale Space and Variational Methods in Computer Vision*, held at Voss, Norway in 2009.
- Invited to the seminar *Geometric Modelling*, held at Dagstuhl, Germany, May 22–27, 2011, organised by Thomas Grandine, Stefanie Hahmann, Joerg Peters, and Wenping Wang.
- Invited talk and seminar at the 5th International Conference on Science and Mathematics Education in Developing Countries, March 1–3, 2012. ZAMAN UNIVERSITY, Phnom Penh, Cambodia.
- Invited talk at Conference on Computational Physics 2012. Kobe, Japan, October, 16, 2012.
- Co-organiser of the *Eighth International Conference on Mathematical Methods for Curves and Surfaces*, held in Oslo, Norway, June–July 2013.

## Publications

K. Mørken, On the parallel solution of dense linear systems, with R. W. Hockney, Report N-0811r-8, Department of Computer Science, University of Reading, England, 1982.

- K. Mørken, On two topics in spline theory: Discrete splines and the equioscillating spline, dissertation for the degree of cand. real., Dept. of Informatics, University of Oslo, 1984.
- E. Cohen, T. Lyche, and K. Mørken, Knot line refinement algorithms for tensor product B-spline surfaces, *CAGD* **2** (1985), 133–139.
- T. Lyche and K. Mørken, Making the Oslo algorithm more efficient, *SIAM Journal on Numerical Analysis*, **23** (1986), 663–675.
- T. Lyche and K. Mørken, A discrete approach to knot removal and degree reduction algorithms for splines, in *Algorithms for Approximation*, J. C. Mason and M. G. Cox (eds.), Clarendon Press, Oxford, 1987, 67–82.
- T. Lyche and K. Mørken, Knot removal for parametric B-spline curves and surfaces, *CAGD* **4** (1987), 217–230.
- T. Lyche and K. Mørken, A data reduction strategy for splines with applications to the approximation of functions and data, *IMA J. of Num. Anal.* **8** (1988), 185–208.
- K. Mørken, Contributions to the theory and application of splines, dissertation for the degree of dr. Scient., Dept. of Informatics, University of Oslo, 1989.
- E. Arge, M. Dæhlen, T. Lyche, and K. Mørken, Constrained spline approximation of functions and data based on constrained knot removal, in *Algorithms for Approximation II*, J. C. Mason and M. G. Cox (eds.), Chapman & Hall, London, 1989.
- K. Mørken, Products of splines as linear combinations of B-splines, in *Approximation Theory VI*, C. K. Chui, L. L. Schumaker, and J. D. Ward (eds.), Academic Press, Boston, 1989.
- T. Dokken, M. Dæhlen, T. Lyche, and K. Mørken, Good approximation of circles by curvature continuous Bezier curves, *CAGD* **7** (1990), 33–41.
- K. Mørken, Some identities for products and degree raising of splines, *Constructive Approximation* **7** (1991), 195–208.
- K. Mørken, Best approximation of circle segments by quadratic Bezier curves, in *Curves and Surfaces*, P. J. Laurent, A. Le Mèhautè, and L. L. Schumaker (eds.), Academic Press, Boston 1991, 331–336.
- T. Lyche and K. Mørken, Spline Wavelets on Arbitrary Knots, in *Numerical Methods in Approximation Theory*, Vol. 9, D. Braess and L. L. Schumaker (eds.), Birkhäuser, Basel, 1992, pp. 177–194.
- T. Lyche, K. Mørken, and K. Strøm, Conversion between B-spline bases using the Generalized Oslo Algorithm, *Knot Insertion and Deletion Algorithms for B-spline Curves and Surfaces*, R. Goldman and T. Lyche (eds.), SIAM Press, Philadelphia 1993, 135–153.
- T. Lyche and K. Mørken, How much can the size of the B-spline coefficients be reduced by inserting one knot?, in *Knot Insertion and Deletion Algorithms for B-spline Curves and Surfaces*, R. Goldman and T. Lyche (eds.), SIAM Press, Philadelphia 1993, 155–178.
- T. Lyche and K. Mørken, A metric for parametric approximation, in *Curves and Surfaces in Geometric Design*, P. J. Laurent, A. Le Mèhautè, and L. L. Schumaker (eds.), A. K. Peters, Wellesley MA, Boston 1994, 311–318.
- K. Mørken, Parametric interpolation by quadratic polynomials in the plane, in *Mathematical Methods in Computer Aided Geometric Design*, Morten Dæhlen, Tom Lyche, and Larry L. Schumaker (eds.), Vanderbilt University Press, Nashville 1995, 385–402.
- K. Mørken, On total positivity of the discrete spline collocation matrix, *Journal of Approximation Theory* **84** (1996), 247–264.
- K. Mørken, Total positivity and splines, in *Total Positivity and its Applications*, M. Gasca and C. A. Micchelli (eds.), Kluwer Academic Publishers, 1996, Dordrecht, 47–84.
- K. Mørken and K. Scherer, A general framework for high accuracy parametric interpolation, *Mathematics of Computation* **66** (1997), 237–260.
- T. Lyche and K. Mørken, The sensitivity of a spline function to perturbations of the knots, *BIT* **39** (1999), 305–322.
- M. Dæhlen, T. Lyche, K. Mørken, R. Schneider and H. P. Seidel, Multiresolution analysis over triangles based on quadratic Hermite interpolation, *Journal of Comp. and Appl. Math.* **119** (2000), 97–114.
- T. Lyche, K. Mørken, K., and E. Quak, Theory and Algorithms for non-uniform spline wavelets, in *Multivariate Approximation and Applications*, N. Dyn, D. Leviatan, D. Levin, and A. Pinkus, (eds), Cambridge University Press, 2001, pp. 152–187.

- B.-G. Lee, T. Lyche, and K. Mørken, Some examples of quasi-interpolants constructed from local spline projectors, in *Mathematical Methods in CAGD: Oslo 2000*, T. Lyche and L. L. Schumaker (eds.), Vanderbilt University Press, Nashville, TN., 2001, pp. 243–252.
- M. Dæhlen, K. Mørken and L. L. Schumaker (eds.), *Mathematical Methods for Curves and Surfaces: Tromsø 2004*, Nashboro Press, May 2005.
- K. Mørken, On geometric interpolation of parametric surfaces, *CAGD* **22** (2005), pp. 838-848.
- M. Dæhlen, T. Lyche, K. Mørken and H.-P. Seidel, Multiresolution analysis based on quadratic Hermite interpolation - Part 1: Piecewise polynomial Curves, Research Report 320, Department of Informatics, University of Oslo, May 2006.
- K. Mørken and M. Reimers, An unconditionally convergent method for computing zeros of splines and polynomials, *Mathematics of Computation*, 2007, Volume **76**, pp. 845–865
- S. O. Larsen, K. Mørken and E. Samset, Segmentation of the frozen region in MR images during cryo ablation in the liver, *International Journal of Computer Assisted Radiology and Surgery* 2007, **2**, Suppl. 1, pp. 479-479.
- T. Lyche, K. Mørken and F. Pelosi, Stable, linear spline wavelets on nonuniform knots with vanishing moments, *CAGD* **26** (2009), pp. 203–216.
- P. Risholm, E. Lyche Melvær, K. Mørken, E. Samset: Intra-Operative Adaptive FEM-Based Registration Accomodating Tissue Resection, Proc. SPIE Medical Imaging, 2009.
- K. Mørken, M. Reimers and C. Schulz, Computing intersections of planar spline curves using knot insertion, *CAGD* **26** (2009), pp. 351–366.
- X. C. Tai, K. Mørken, M. Lysaker, K. A. Lie, Scale Space and Variational Methods for Computer Vision, *Proceedings of the Second International Conference*, Voss, Norway, June 1–5, 2009, Lecture Notes in Computer Science, Vol. 5567, Springer Verlag, (2009).
- M. Dæhlen, M. Floater, T. Lyche, J.-L. Merrien, K. Mørken, L. L. Schumaker, *Mathematical Methods for Curves and Surfaces, Proceedings of the Seventh International Conference*, Tønsberg, Norway, June 26–July 1, 2008, Lecture Notes in Computer Science, Vol. 5862, Springer Verlag, 2010.
- E. L. Melvær, K. Mørken, E. Samset, A motion constrained cross-wire phantom for tracked 2D ultrasound calibration. *International Journal of Computer Assisted Radiology and Surgery*, **7** (4) (2012), pp. 611-620.

### Other scientific work

- K. Mørken, Innføringskurs i Mathematica, class notes for a introductory course on the symbolic system Mathematica, held at University of Oslo for the local distributor Texcel, February 1989.
- K. Mørken, Six short articles in Nordisk Matematisk Tidsskrift (NORMAT) in the column Mathematics and Computers (as column editor), 1990–1991.
- R. Bartels, G. Greiner, K. Mørken and H. P. Seidel, *Splines in Computer Graphics*, Tutorial Notes for Eurographics '94.
- T. Lyche and K. Mørken, Lecture Notes on splines for the course INFMAT5340 at the Dept. of Informatics, University of Oslo, 1995 –2013.
- K. Mørken, Lecture note for the course MAT-INF 1100 (in Norwegian), Department of Informatics, University of Oslo, 2012.
- N. Foldnes, K. Mørken and A. I. Vistnes, A new world: The computer, computations and teaching of science (in Norwegian), Uniped (2005), a journal on University pedagogy.
- M. Hjorth-Jensen, K. Hveberg, H. P. Langtangen, K. Mørken and A. I. Vistnes, Computations in the elementary teaching of mathematics and the mathematical sciences (in Norwegian), Report from a project supported by the Flexible Learning initiative at the University of Oslo, June 2006.
- M. Hjorth-Jensen, K. Mørken, A. Myhre, and H. Sølva. Computers in Science Education: A new way to teach science? In *Ripples: Five years of flexible learning at the University of Oslo*, Susanne Kjekshus Koch (Ed.). Published by University of Oslo, 2008.
- K. Mørken, I. Simonsen, A. Malthé-Sørensen, H. Hammer, T. B. Løyning, J. E. Vatne, E. Nøst, L. O. Dahl, N. Sasaki, T. Skramstad, *Computing in Science Education. A guide for universities and colleges in Norway*. The Faculty of Mathematics and Natural Sciences, University of Oslo, 2011.
- Ø. Ryan and K. Mørken, *Fourier theory and wavelet analysis*, Lecture note for the course MAT-INF2360, Department of Mathematics, University of Oslo, 2013.

# CV – Ragnhild Kobro Runde

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## Personal data

Born: August 29, 1976

Nationality: Norwegian

Official home page: <http://www.mn.uio.no/ifi/personer/vit/ragnhilk/index.html>

## Present position

From January 2009, Associate Professor in the research group of Object-orientation, modelling, and languages, Department of Informatics (IFI), University of Oslo (UIO).

From August 2010, most of the time has been dedicated to being the leader of the Study Lab at the Department. The overall goal of the Study Lab is to further improve the general learning environment at the department, primarily for first-year students at bachelor level. In particular, the Study Lab works on ways to increase both the students' experience of mastering their courses, and their motivation for further studies in computer science. Currently, the Study Lab consists of four full-time university lecturer positions in addition to the leader, as well as affiliated technical/administrative staff and a number of students working on part-time basis with different tasks.

## Academic degrees

Dr. Scient. (Ph.D.) in Computer Science, IFI, UIO, Norway (2007). Thesis title: STAIRS – Understanding and Developing Specifications Expressed as UML Interaction Diagrams.

Cand. Scient. (M.Sc.) in Computer Science, IFI, UIO, Norway (2000). Thesis title: Utprøving og forbedring av en formalisme for parallelle prosesser (in Norwegian).

## Fields of interest and present research activities

Object-oriented programming and modelling languages, in particular UML sequence diagrams. Informatics didactics. Currently co-supervisor in a project on combining risk

analysis and security testing. Another PhD position in developing a combined Modelling and Programming Language is now being announced.

### **Previous work experience**

Jun 2008 – Dec 2008: Postdoc (25% teaching obligations), IFI, UIO.

Feb 2007 – Jun 2008: Researcher at the SARDAS project (funded by RCN), IFI, UIO.

Jan 2002 – Jan 2007: Ph.D. scholarship (25% teaching obligations), IFI, UIO.

Jan 2001 – Dec 2001: University lecturer, IFI, UIO.

### **Courses in pedagogy**

Achieved basic pedagogical competence at UIO in 2002 (estimated 100 working hours). Has later taken most of the courses in university pedagogics offer by UIO (estimated a total of 162 working hours in addition to the basic competence), including learning and learning environment, and educational leadership.

### **Teaching experience**

Currently teaching compiler technique at master level. Extensive experience teaching courses at bachelor level, including the first and second course in (object-oriented) programming, digital representation, algorithms and data structures, programming languages and database systems.

### **Selected professional duties**

Served in several periods as a representative in the teaching committee and the board at the Department of Informatics, as well as one period in the PhD council at the Faculty of Mathematics and Natural Sciences.

The last couple of years participated in Faculty working groups on different aspects of education with a focus on the students and their learning experiences.



# Curriculum Vitae

ANDERS MALTHE-SØRENSSEN

Department of Physics, University of Oslo, Norway

Phone: 22 85 64 77

Email: malthe@fys.uio.no

Born: 13/02/69

h-index: 19

Citations: 1649

## Professional Experience

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- 2012–2013 Visiting Professor, Collaboratory for Advanced Computing and Simulations, University of Southern California, Los Angeles, USA
- 2006– Professor, Department of Physics, University of Oslo.
- 2004–2008 Group leader and Education coordinator, Physics of Geological Processes.
- 2005–2006 Associate Professor, Department of Physics, University of Oslo.
- 2002–2004 Division lead, Physics of Geological Processes, a Center of Excellence. Developed the new cross-disciplinary master program for PGP.
- 2001–2002 Vice president of Technology in Photonyx, now Ignis, a company developing a light modulator for use in displays and tunable fiber-optics. Assisted in raising \$7.5m of venture capital. Responsible for research management and technology development. Inventor of the main technology patents.
- 1999–2003 One of three initiators of the Petroleum Implications of Sill Intrusions initiative, a multi-disciplinary three-year program with 10 industrial collaborators and a total budget of \$2.0m.
- 1999–2001 Post-doc at University of Oslo. Visiting Scholar at Stanford University.
- 1995–2003 Co-author of FramView, a simulation tool for modeling geological deformations based on a discrete element model, as part of a collaboration between Fracton and Conoco.
- 1998–1999 Post-doc at Fluid rock interactions strategic university program at UiO.
- 1994–1995 Visiting scientist at IBM Watson research center.

## Education

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- 1998 Dr. scient. in Physics, University of Oslo.
- 1994 Cand. scient. in Physics, University of Oslo (top 1%).
- 1992 Russian Language Course, Norwegian Defence School for Intelligence and Security (best candidate overall, Russian, and military)
- 1990 Cand. mag. in Physics, University of Oslo (top 1%).

## Awards, prizes, and grants

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- 2012 Fulbright Scholar (2012–2013)
- 2012 Received a 5 MNOK Institute Strategic Project grant for “Multiscale physics on the computer” from the Norwegian Research Council as one of 6 co-applicants in a collaboration between NTNU, UiO and UMB in Norway.
- 2012 Received the Prize for Excellent Education from the Ministry of Education and Research (300 000 NOK)
- 2012 Received a 10 MNOK grant for “Production from gas-filled and liquid-rich tight rocks - fundamentals” from Statoil as one of two co-applicants.
- 2011 Received the Prize for Best Learning Environment for the Computing in Science Education project at the University of Oslo (250 000 NOK)
- 2011 Received a 3.5 MNOK grant for “Numerical modeling of shale-gas extraction processes” from VISTA/Statoil (as PI).
- 2010 Received a 5.7 MNOK grant for “Permanent CO<sub>2</sub> storage by *in situ* injection in ultramafic rocks” from the the NRC (as PI).
- 2008 Received a 7.5 MNOK grant for “Mechanisms of Primary Migration” from the NRC (as 1 of 4 co-applicants).

### Awards, prizes, and grants (continued)

2005	Received a 6.5 MNOK grant for “Hydrocarbon maturation in aureoles around sill intrusions in organic-rich sedimentary basins” from the NRC (as 1 of 5 co-applicants).
2004	Received a 4.7 MNOK grant for “Formation of Piercement Structures in Sedimentary Basins” from the NRC (as PI).
2003	Received a 5 MNOK grant for “Emplacement Mechanisms and Magma Flow in Sheet Intrusions in Sedimentary Basins” from the NRC (as 1 of 3 co-applicants).
2001	Fridtjof Nansen prize for young researchers.
2000	Norwegian member of Scientia Europea, a European conference of young elite scientists within Physics, Chemistry, and Biology.
1999	Post-doc grant (2 years) from the Norwegian Research Council.
1999	His Majesty the King’s Gold Medal for best dr. scient. thesis at the Faculty of Mathematics and Natural Sciences, University of Oslo.
1995	IBM Prize for excellent achievements in parallel computing.

### Teaching experience

2011–	Chairman for the program committee for the Physics, Astronomy and Meteorology bachelor program at the University of Oslo. Wrote a 500-page introductory physics textbook “Introduction to Mechanics: An integrated numerical and analytical approach” to be published in 2013/2014.
2008–	
2007–	Developed and lectured a new course integrating seamlessly the use of numerical methods in introductory mechanics at Department of Physics, UiO.
2005–	Developed and lectured a new integrated course Disordered systems and percolation (FYS4460), at Department of Physics, UiO. Developed Matlab based interactive exercises and a 250 pages text-book.
2003–2007	Developed the new cross-disciplinary master program for PGP. Designed three new cross-disciplinary courses. Chairman of program committee for the Master program.
1994–2004	Lecturer and teaching assistant in physics courses on all levels at Department of Physics, UiO.

### Academic record

Published 37 papers in international research journals with referee (3 in Nature), presented 28 invited talks at conferences and universities (17), and for industry (11), 15 contributed talks and posters, co-authored 18 invited talks, and 20 contributed talks and posters.

8 PCT/US patents granted.

Successfully supervised 13 Master students and 4 PhD students. Currently supervising 3 Master students and 6 PhD students.

## Patents

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1. A. MALTHER-SØRENSEN, J. FEDER, T. WALMANN, T. JØSSANG, G. WAGNER, H. H. HARDY. Method of modeling of faulting and fracturing in the earth. Priority Data: 09/542,307; 4 April 2000 (2001). International Publication Number: WO 01/75588 A1. Licence right owner: Conoco Inc.
2. A. MALTHER-SØRENSEN, E. ZIMMER, T. NATERSTAD, B. JACOBSON. Method and device for a variable optical attenuator. Priority Data: 9 June 2002. International Publication Number: US 6897995/B2, NO 318004/B1. Licence right owner: Photonyx Ltd. Patent filed world-wide.
3. A. MALTHER-SØRENSEN, E. ZIMMER, T. NATERSTAD, B. JACOBSON. Method and device for a variable optical attenuator. Publication date: 07/08/2004, International Publication Number: US 6897995/B2, NO 318004/B1. Licence right owner: Photonyx Ltd. Patent filed world-wide.
4. A. MALTHER-SØRENSEN, J. FEDER, T. WALMANN, T. JØSSANG, G. WAGNER, H. H. HARDY. Method of modeling of faulting and fracturing in the earth. Published 08/08/2006. United States Patent 7089166. Licence right owner: Conoco Inc.
5. A. MALTHER-SØRENSEN, J. FEDER, T. WALMANN, T. JØSSANG, G. WAGNER, H. H. HARDY. Method of modeling of faulting and fracturing in the earth. Published 05/09/2006. United States Patent 7043410. Licence right owner: Conoco Inc.
6. A. MALTHER-SØRENSEN, J. FEDER, T. WALMANN, T. JØSSANG, G. WAGNER, H. H. HARDY. Method of modeling of faulting and fracturing in the earth. Published 04/18/2006. United States Patent 7031891. Licence right owner: Conoco Inc.

## Selected research articles

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1. D. KOEHN, A. MALTHER-SØRENSEN, C. W. PASSCHIER The structure of reactive grain boundaries under stress containing confined fluids. *Chemical Geology* (2006) **230**, 207–219, (11 citations).
2. A. MALTHER-SØRENSEN, B. JAMTVEIT, AND P. MEAKIN Fracture Patterns in Chemical Decomposition of Solids. *Physical Review Letters* (2006) **96**, 245501, (21 citations).
3. H. SVENSEN, S. PLANKE, L. CHEVALLIER, A. MALTHER-SØRENSEN, F. CORFU, AND B. JAMTVEIT Hydrothermal venting of greenhouse gases causing Early Jurassic global warming, *Earth and Planetary Science Letters* (2007) **256**, 554–566, (68 citations).
4. A. MAZZINI, H. SVENSEN, G. G. AKHMANOV, G. ALIOSI, S. PLANKE, A. MALTHER-SØRENSEN, B. ISTADI Triggering and dynamic evolution of the LUSI mud volcano, Indonesia, *Earth and Planetary Science Letters* (2007) **261**, 375–388, (74 citations).
5. S. POLTEAU, A. MAZZINI, O. GALLAND, S. PLANKE, A. MALTHER-SØRENSEN, B. ISTADI Saucer-shaped intrusions: Occurrences, emplacement and implications, *Earth and Planetary Science Letters* (2008) **266**, 195–205, (35 citations).
6. B. JAMTVEIT, A. MALTHER-SØRENSEN, O. KOSTENKO Reaction enhanced permeability during retrogressive metamorphism, *Earth and Planetary Science Letters* (2008) **267**, 620–627, (20 citations).
7. K. IYER, B. JAMTVEIT, J. MATHIESEN, A. MALTHER-SØRENSEN, J. FEDER Reaction-assisted hierarchical fracturing during serpentinization, *Earth and Planetary Science Letters* (2008) **267**, 503–516, (19 citations).

8. A. RØYNE, B. JAMTVEIT, J. MATHIESEN, A. MALTHER-SØRENSEN Controls on weathering rates by reaction induced hierarchical fracturing, *Earth and Planetary Science Letters* (2009) **275**, 364–369, (15 citations).
9. B. JAMTVEIT, C. PUTNIS, A. MALTHER-SØRENSEN Reaction induced fracturing during replacement processes, *Contributions to Mineralogy and Petrology* (2009) **157**, 127–133, (21 citations).
10. O. GALLAND, S. PLANKE, E. R. NEUMANN, A. MALTHER-SØRENSEN Experimental modelling of shallow magma emplacement: Application to saucer-shaped intrusions, *Earth and Planetary Science Letters* (2009) **277**, 373–383, (20 citations).
11. A. NERMOEN, O. GALLAND, E. JETTESTUEN, K. FRISTAD, Y. P. PODLADCHIKOV, H. SVENSEN, A. MALTHER-SØRENSEN Experimental and analytic modeling of piercement structures *Journal of Geophysical Research - Solid Earth* (2010) **115**, 2010JB007583. (1 citation).
12. J. TRØMBORG, J. SCHEIBERT, D. S. AMUNDSEN, K. THØGERSEN, A. MALTHER-SØRENSEN Transition from static to kinetic friction: insights from a 2D model, *Phys. Rev. Lett.*, (2011) **107**, 074301. (5 citations).
13. B. JAMTVEIT, M. KOBCHENKO, H. AUSTRHEIM, A. MALTHER-SØRENSEN, H. SVENSEN Porosity evolution and crystallization-driven fragmentation during weathering of andesite, *Journal of Geophysical Research - Solid Earth* (2011), **116**, 2011JB008649. (0 citations).
14. M. KOBCHENKO, H. PANAH, F. RENARD, D. K. DYSTHE, A. MALTHER-SØRENSEN, A. MAZZINI, J. SCHEIBERT. 4D imaging of fracturing in organic-rich shales during heating. *Journal of Geophysical Research - Solid Earth*, (2011) **116** 2011JB008565. (1 citation).
15. A. RØYNE, P. MEAKIN, A. MALTHER-SØRENSEN, B. JAMTVEIT, D. K. DYSTHE Crack propagation driven by crystal growth. *Europhysics letters*, (2011) **96** 24003. (1 citation).
16. D. S. AMUNDSEN, J. SCHEIBERT, K. THØGERSEN, J. TRØMBORG, A. MALTHER-SØRENSEN A 1D Model of Precursors to Frictional Stick-Slip Motion Allowing for Robust Comparison with Experiments, (2012) *Tribology Letters* **45** 357. (1 citation).

The Mathematics and Natural Sciences Student Council  
Postboks 120 Blindern,  
0314 Oslo



Matematisk-naturvitenskapelig  
studentutvalg

## Letter of Support

The faculty for Mathematical and Natural Sciences has made great strides in improving their study programmes the last six years. As student representatives we have seen how a more thorough approach on how to give students the potential to fulfill their potential has led to several positive reforms. The content of many study programmes has seen an increased relevance and the learning environment has improved. We especially want to highlight ForVei and the focus on bringing students and teachers closer together from the get-go. Such reforms make it easier for each student to perform his or her best. In our opinion there is no better candidate for a centre of excellence in higher education than the faculty for Mathematical and Natural Sciences at the University of Oslo.

Torkil Vederhus

Master student in Computer Science, recent rector candidate, and active student politician for five years

Stian Lågstad

Bachelor student in Computer Science and current leader of the Student Council at the MN-Faculty

Geir Ulvik

Bachelor student in Materials, Energy and Nanotechnology and current chairman of Realistforeningen

13.05.2013

University of Oslo

Faculty of Mathematics and Natural Sciences

P.O Box 1032 Blindern

0315 Oslo, Norway

Date: 08.04.2013

Your ref.:


Our ref.:

### Letter of intent

The Department of Educational Research and Intermedia hereby confirms its willingness to collaborate with the proposed center of excellence "InterACT" led by the Faculty of Mathematics and Natural Sciences at the University of Oslo.

The Department of Educational Research and Intermedia has through its group for academic development (FUP) for a long time assisted the Faculty of Mathematics and Natural Sciences (the MN-faculty) in the pedagogical training of their educators. FUP supports the MN-faculty in their increased focus on educational quality and will contribute to the initiative with earmarked resources. In particular, FUP will collaborate with the proposed center of excellence in education, InterACT, by helping to establish a measurement suite aimed to document changes in the learning culture within the faculty.

Sincerely yours

  
Ola Stafseng, Head of Dept.



**Department of Educational Research**  
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2013-05-07

**LUNDS UNIVERSITET**  
Lunds Tekniska Högskola

*Genombrottet*  
*Academic Development Unit, LTH*  
*Roy Andersson*

## Letter of intent

The Faculty of Mathematics and Natural Sciences at the University of Oslo (the MN-faculty) and the Faculty of Engineering at Lund University (the LTH) share common values underpinning development of education and teaching staff. On this basis the two institutions wish to support each other in further developing their educations. In particular, the LTH will assist the MN-faculty in establishing a unit for education development, while the MN-faculty will assist the LTH towards introducing a coherent computational perspective in their educations. The cooperation may involve strategic advice, participation in seminars, seats in boards, or other adequate activities.

On behalf of the Academic Development Unit, LTH

A handwritten signature in black ink, appearing to read 'Roy Andersson'.

Roy Andersson  
Ass. Professor  
+46-46-2224907  
Roy.Andersson@cs.lth.se



6 May 2013

## Letter of intent

The Department of Computer Science at the University of Helsinki has had status as a Centre of Excellence in Higher Education in Finland for two consecutive periods, 2007-2009 and 2010-2012. The department has developed a culture of education with broad participation from its staff with a focus on continuous quality enhancement and student empowerment. As the Head of Studies at the department, Jaakko Kurhila has visited the Faculty of Mathematics and Natural Sciences (the MN-faculty) on several occasions, and on the invitation of the MN-faculty accepts a suitable advisory role for the proposed Centre of Excellence in Education.

Jaakko Kurhila, PhD

Head of Studies

Department of Computer Science, University of Helsinki, Finland

kurhila@cs.helsinki.fi, p. +358 9 191 51358

Tietojenkäsittelytieteen laitos  
Matemaattis-luonnontieteellinen tiedekunta

Institutionen för datavetenskap  
Matematisk-naturvetenskapliga fakulteten

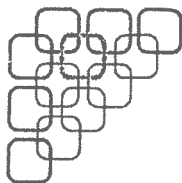
Department of Computer Science  
Faculty of Science

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## UNIVERSITETS- OG HØGSKOLERÅDET

The Norwegian Association of Higher Education Institutions

Det matematisk-naturvitenskapelige fakultet  
Universitetet i Oslo  
ved prodekan Solveig Kristiansen  
0316 OSLO

*Your reference:*


*Our reference:*  
13/129-1


*Our date:*  
08.05.2013

### Letter of intent

The Norwegian Association of Higher Education Institutions (UHR) has since 2011 had a collaboration with the Faculty of Mathematics and Natural Sciences at the University of Oslo (the MN-faculty) in the implementation of the new national framework for engineering education. The collaboration is anchored around the CSE (Computing in Science Education) project at the MN-faculty. Calculations by computer, the scientific content of the CSE-project, is in itself important for engineering education. But coherent implementation of CSE requires a holistic view of education and broad collaboration across traditional disciplines, and may therefore serve as a tool for implementing the core values of the new national framework. The proposed centre of excellence in education at the MN-faculty is focused around the same values and is therefore highly relevant for education in general, and engineering education in particular. The UHR would therefore like to extend its collaboration with the MN-faculty and work to disseminate the results, experiences and best-practices of the centre, in line with its general mission statement.

Yours sincerely

  
Ola Stave  
generalsekretær

  
Mette Mo Jakobsen  
seniorrådgiver