KTH Mechanics

SE-100 44 Stockholm, Sweden

Activity Report 2010

Contents

Preface

This report gives a short overview of the structure and activities at the department of Mechanics, KTH during the year of 2010. More information may be found at the department web site http://www.mech.kth.se.

The teaching activity of the department during 2010 included basic, intermediate, advanced-level as well as graduate courses in mechanics, fluid mechanics and structural mechanics given for students and programmes from almost all schools at KTH.

The scientific activity of the department resulted in the defences of 7 doctoral theses and presentations of 6 licentiate theses during 2010. The publication list for the department this year consists of 57 publications in archival journals, 44 publications in conference proceedings and 13 internal reports, for a total of 114 publications.

Stockholm in April 2010

Dan Henningson, department chairman

Anders Eriksson, department vice chairman

1 Introduction

The department of Mechanics is one of the seven departments within the School of Engineering Sciences at KTH. The Department had around 100 employees and a turnaround of about 85 MSEK during the year 2010.

Prof. Dan Henningson is the chairman of the department, with Prof. Anders Eriksson as the vice chairman. Docent Gunnar Tibert was programme responsible ('PA') for the combined MSc. programme in Engineering Mechanics, and was towards the end of the year appointed as PA also for the new Ph.D. programme of the same name. Docent Hanno Essén is the director of undergraduate studies in mechanics and Docent Erik Lindborg has the same role for fluid mechanics. Docent Anders Dahkild is the director of graduate studies. The department was managed by a group consisting of: Henrik Alfredsson, Gustav Amberg, Nicholas Apazidis, Fritz Bark, Anders Eriksson, Hanno Essén, Laszlo Fuchs, Dan Henningson (chairman), Arne Johansson, Hans Silverhag.

The undergraduate teaching activity at the department offers a comprehensive course selection in basic mechanics attended by 1 500 students, in fluid mechanics with 400 students and in structural and advanced mechanics with 200 students. With a staff including 10 professors and 18 lecturers, the department is large enough to provide an excellent research environment in a wide range of areas for about 40–50 graduate students. During the year 2010, 7 students defended their Ph.D. theses and 6 presented their Licentiate theses.

The department also, together with the Department of Solid Mechanics and the Marcus Wallenberg laboratory, serves as host for the International Masters Programme in Engineering Mechanics, which offers a broad spectrum of high level courses in solid, structural and fluid mechanics.

Mechanics of solids, structures, fluids and gases are fundamental areas within classical physics and play pivotal roles in the design and analysis for almost all branches of engineering science. Today, this position is emphasized by the increasing width of areas affected and facilitated by the ideas and methods of the subject. Mechanics, and especially fluid mechanics is the basis for almost all electricity generation, such as wind, hydro, nuclear or combustion, but is increasingly important also for the transportation sector. Another developing area is chemical and material sciences in combination where fluid mechanics leads to a deeper understanding of various physical phenomena and also leads to new technical innovations. The research methods of mechanics are also well established and are successfully used in the biological sciences, with applications to the human body. Such a cross-scientific approach opens new possibilities for a better understanding from cells to muscles and locomotion. These exciting new areas go hand in hand with the more traditional applications in a multitude of technological processes used in construction, transportation, paper manufacturing, electro-chemical and pharmaceutical industries, all contributing to the generation of new and challenging research problems. The researchers in the department are divided into seven research groups, without strict formal borders:

- The group of *Structural mechanics* (headed by Prof. Anders Eriksson) studies advanced load-carrying structures in both natural and man-made contexts. Numerical modelling is the main tool for static and dynamic equilibrium situations. The main fields of study in recent years have been on one hand flexible and deployable structures for, e.g., space structures, and on the other hand the human musculoskeletal system. For the latter, both the muscular force production, and the neuro-muscular motion planning have been major study areas. Primary applications of the developed methods are clinical investigations of movement disorders and optimal movements in sports activities.

- The *Stability, transition and control* group (headed by Prof. Dan Henningson) studies how and why orderly laminar flow transitions to chaotic turbulent flow occur. Large scale numerical experiments are often used to predict this process. In the area of flow control and optimization a step further from just analyzing and understanding flows is taken, and deals with how flows can be manipulated and optimized in order to achieve the objectives at hand. Research is performed in cooperation with universities, research institutes and industry worldwide, e.g. in projects funded by the European Union.

- The *Fluid physics laboratory* (headed by Prof. Henrik Alfredsson) deals with five main research areas at present: fundamental studies of transition to turbulence in boundary layer flows, high Reynolds number and complex turbulent flows, multiphase flows, e.g. fibre suspension flows related to paper industry, internal compressible flows and shock wave research with applications to shock focusing. The experimental research has access to most modern measurement equipment for fluid flows and several high quality flow research rigs. The compressible flow research is coupled to KTH CICERO, Center for Internal Combustion Engine Research Opus, where gas management of IC engines are studied with the aim to increase efficiency and also to significantly reduce emissions such as CO_2, NO_x and unburned hydrocarbons. Although most research projects within the laboratory are of basic character, collaboration with industry (e.g. aeronautical, vehicle and paper industry) is common.

- The research group for *Applied fluid mechanics and multiphase flows* (headed by Prof. Laszlo Fuchs) focuses on fluid mechanical problems arising in different applications and in particular turbulent mixing, transport in single and multiphase systems as well as flows involving phase change and chemical reactions. Examples of such flows include the process industry (such as papermaking and pharmaceuticals), propulsion and energy conversion systems. The group has close collaboration and common areas of interest with other groups at the department, in particular the Fluid physics group and KTH CICERO.

- The *Turbulence group* (headed by Prof. Arne Johansson) is active in different areas of turbulence research, including modelling and simulations of high Reynolds number flows, development of subgrid models for Large Eddy Simulations (LES), multiphase turbulent flows and simulation of reactive flows. In the latter project we focus on a wall-jet flow configuration

and use a fully compressible flow code for the simulations. In collaboration with the Stability transition and control group we develop a new code with high-order compact finite difference schemes with the aim of simulating high Reynolds number turbulent pipe flow. A collaboration project with Airbus concerns active flow separation control by means of vortex generators. Another growing research area is the study of geophysical flows through theoretical development and simulations, in particular flows subjected to strong stratification. A new research subject is the study of quasi-geostrophic turbulence, i.e., large scale turbulence strongly affected by the combined effects of rotation and stratification.

- The group of *Physio-chemical fluid mechanics* (headed by Prof. Gustav Amberg) studies problems in fluid mechanics dominated by effects such as capillarity, phase change, heat and mass transfer, etc. Examples of application areas are micro fluidics and materials processes.

- In the group of *Theoretical and applied mechanics* (headed by Dr. Hanno Essén) research is performed in the following areas: dynamical systems with discontinuous forces, non-linear acoustics, statistical mechanics with magnetic interaction forces, kinetic gas theory, and asymptotic methods in classical and quantum mechanics.

Personnel related matters during 2010

Retirements

Our experienced student administrator Anne-Marie Olofsson retired during 2010.

New appointments during 2010

Fredrik Lundell, Elena Gutierrez-Farewik, Philipp Schlatter, and Gunnar Tibert were appointed as senior lecturers during the year.

Carolina Eneqvist was employed in our administration.

Eleven new graduate students started their Ph.D. education at the department during 2010.

We had several post-docs and guest students at the department during the year. Eva Voronkova from St Petersburg State University worked as a post-doc sponsored by SI, the Visby programme. Antonio Segalini from University of Bologna worked as a FLOW Post-doc. Mireia Altimira from University of Navarra worked as a post-doc.

Awards, prizes and funding

Jens Fransson was awarded a 'starting independent research' grant from ERC.
Dan Henningson was awarded a Humboldt prize.
Philipp Schlatter was awarded a Göran Gustafsson prize.

The department was successful in obtaining funding from many different sources. In addition to a continued and increased funding from VR, new funding came from the strategic research areas in E-science, climate and energy. A wide variety of funding was obtained (STEM, Vindforsk, WSC, Vinnova, SNIC, EU, Promobilia, ESA, GGS, FHS and others).

Miscellaneous

Gunnar Tibert was given the responsibility for the new combined international Masters programme in Engineering Mechanics. He also was given the responsibility for the Doctors programme with the same name.

The planning for a re-building of our premises at Teknikringen 8 was intense during the year, but the planning came to a long temporary stop in the autumn.

A minor reorganization of offices was performed in the autumn.

Work on course and teaching strategy for the future was continued.

Common department activities

The academic year 2009/2010 was ended by a boat trip on lake Mälaren on June, 1st. The department also gathered for a Christmas dinner at restaurant Ulriksdals Wärdshus on December 15.

The research groups have had a number of formal and informal gatherings.

2 Personnel

Professors

- Alfredsson Henrik, PhD in mechanics, KTH 1983, and Docent at KTH 1985. Professor of fluid physics 1989. Director of CICERO.
- Amberg Gustav, PhD in fluid mechanics, KTH 1986, and Docent at KTH 1990. Professor of fluid mechanics 1999. Dean of the school of Engineering sciences, since December 1, 2004.
- Eriksson Anders, PhD in steel structures, KTH 1981, and Docent at KTH 1988. Professor of structural mechanics 1992. Department vice chairman 2008–.
- Fuchs Laszlo, PhD in gas dynamics, KTH 1977, and Docent at KTH 1980. Professor of fluid mechanics at LTH 1994–2007. Professor of fluid mechanics at KTH 2007.
- Henningson Dan, PhD in mechanics, KTH 1988, and Docent at KTH 1992. Professor of fluid mechanics 1999. Department chairman since July 2005. Director of Linné Flow Center –Aug. 2010. Director of the Swedish e-Science Research Centre (SeRC) from 2010.
- Johansson Arne, PhD in mechanics, KTH 1983, and Docent at KTH 1984. Professor of mechanics 1991. Secretary general for Natural and Engineering Sciences at the Swedish Research Council (VR) (July 2004-June 2010, with 75% at VR, 25% at KTH). Director of Linné Flow Center (since Sept. 2010).

Guest Professor

- Lingwood Rebecca, PhD, Cambridge 1996. Director of continued education, Cambridge University.

Adjunct professors

- Hanifi Ardeshir, PhD in fluid mechanics, KTH 1995, and Docent at KTH 2003. Adj. Professor of fluid mechanics since 2005 (40% at KTH, 60% at FOI).
- Söderberg Daniel, PhD in fluid mechanics, KTH 1999. Adj. Professor of process fluid mechanics since 2008 (20% at KTH, 80% at Innventia).

Professors/lecturers emeriti

- Bark Fritz, PhD in applied mechanics, KTH 1974. Professor of hydromechanics, 1985. Retired in 2009.
- Enflo Bengt, PhD and Docent in theoretical physics, Stockholm Univ. 1965. 'Biträdande professor' at KTH 1996. Retired in 2000.

- Lesser Martin, PhD in aerospace engineering, Cornell, Docent and Professor at LTU. Professor of mechanics at KTH 1987. Retired in 2005.
- Söderholm, Lars, PhD and Docent in theoretical physics, Stockholm Univ. 1970. Retired in 2009.

Affiliated Professors

- Nagib Hassan, IIT, Chicago, USA.
- Gutmark Ephraim. Univ. Cincinnatti, USA.

Senior Lecturers

- Apazidis Nicholas, PhD in mechanics, KTH 1985, and Docent at KTH 1994.
- Brandt Luca, PhD in fluid mechanics, KTH 2003, and Docent at KTH 2008.
- Dahlkild Anders, PhD in mechanics, KTH 1988, and Docent at KTH 1992. Director of graduate studies.
- Essén Hanno, PhD in theoretical physics, Stockholm Univ. 1979, and Docent 1986. Director of undergraduate studies.
- Fransson Jens, PhD in fluid mechanics, KTH 2003, and Docent at KTH 2006.
- Gutierrez Farewik Elena, PhD in orthopedics, KI 2003, and Docent at KTH 2007. Appointed in 2010.
- Hsieh Richard, PhD in mechanics, KTH 1978, and Docent at KTH 1980.
- Lindborg Erik, PhD in Mechanics, KTH 1996, and Docent at KTH 2001. Director of undergraduate studies in fluid mechanics.
- Lundell Fredrik, PhD in fluid mechanics, KTH 2003, and Docent at KTH 2008. Appointed in 2010.
- Nordmark Arne, PhD in mechanics, KTH 1992, and Docent at KTH 1999.
- Nyberg Christer, PhD in mechanics, KTH 1979.
- Schlatter Philipp, PhD in fluid mechanics, ETH Zürich 2005, and Docent at KTH 2009. Appointed in 2010.
- Thylwe Karl-Erik, PhD in theoretical physics, Univ. of Uppsala 1981, and Docent 1987.
- Tibert Gunnar, PhD in structural mechanics, KTH 2002, and Docent at KTH 2009. Appointed in 2010. Programme responsible for MSc. and PhD programmes in Engineering mechanics.

Lecturers, research associates and researchers

- Brandefelt Jenny, PhD in meteorology, Stockholm Univ. 2005.
- Brethouwer Geert, PhD in fluid mechanics, TU Delft 2001.
- Do-Quang Minh, PhD in fluid mechanics, KTH 2004.
- Maxe Gunnar, MSc.
- Prahl Wittberg Lisa, PhD, Lund University 2008.
- Robert Etienne, PhD, EPFL, Lausanne 2008.
- Tillmark Nils, PhD in fluid mechanics, KTH 1995. Responsible for the department's lab. facilities.
- Örlu, Ramis, PhD in fluid mechanics, KTH 2009.

Adjunct Lecturers

- Wallin Stefan, PhD in fluid mechanics, KTH 2000. Adj. lecturer in fluid mechanics with turbulence modelling application, (30% at KTH, 70% at FOI).

Guest researchers, post-docs

- *Guest lecturer*: Professor Alessandro Talamelli, Univ. of Bologna (3 months).
- *Post-doc*: Ilak Milos, Princeton, USA.
- *Post-doc*: Xu Yechuan, Polytechnic University, Hong Kong.
- *Post-doc*: Eva Voronkova, St Petersburg State University, Russia.
- *Post-doc*: Antonio Segalini, University of Bologna, Italy.
- *Post-doc*: Mireia Altimira, University of Navarra, Spain.

Technical and administrative staff

- Bauer Nina, secretary.
- Bellbrant Karina, course administrator. Recruited from Proffice in 2010.
- Ekstrand Pär, MSc., system manager.
- Eneqvist, Carolina, staff manager. Recruited 2009, employed 2010.
- Hornk, Heide, financial manager.
- Karlström Joakim, tool maker.
- Olofsson Anne-Mari, course administrator. Retired in 2010.
- Rådberg Göran, tool maker.
- Silverhag Hans, head of administration.
- Skult Stefan, administrative assistant.

Changes in the department personnel in recent years are summarized in the following table (seen as averages over the year).

	Number of employees during 2003–2010							
Position	2003	2004	2005	2006	2007	2008	2009	**2010**
Prof./Adj. Prof.	11	10	10	10	11	11	11	**10**
Lect./Adj. Lect.	16	16	16	16	15	14	15	**18**
Ass. lect./Researcher/Adjunct	9	11	12	12	15	15	10	**10**
Technical/adm staff	10	10	9	9	9	7	9	**9**
Guest Res./Post-docs	3	5	5	4	6	5	6	**5**
Doctoral students	46	42	38	37	40	36	46	**54**
External doct. stud.	6	11	8	6	5	9	3	**2**
Total	101	105	98	94	101	97	100	**108**

Active graduate students at KTH Mechanics during 2010					
Name	Affiliation	Adv.	Start	TeknL	TeknD
Alenius Emma	MWL	LF/MÅ		12/2010	
Amer Malik	Mech	GA	11/2008		
Bagheri Shervin	Mech	DH/LB/PS	04/2006	06/2008	02/2010
Bellani Gabrielle	Mech	FL/DS	02/2006	10/2008	
Berger Marit	Mech	JB	09/2010		
Bodin Olle	Mech	LF	09/2006	03/2009	
Carlsson Andreas	Mech	GA	12/2007		
Dadfar Reza	Mech	DH	09/2010		
Dalilsafaei Seif	Mech	AE/GT	11/2008		
Deusebio Enrico	Mech	EL	01/2010		
Fallenius Bengt	Mech	JF/HAL	04/2006	05/2009	
Farkas Robert	Mech	LF	05/2009		
Fjällman Johan	Mech	LF	04/2010		
Hellström Fredrik	GM PT	LF	09/2005	03/2008	05/2010
Hosseini Mohammad	Mech	AH	12/2010		
Håkansson Karl	Mech	DS/LPW	11/2009		
Imayama Shintaro	Mech	HAL/RL	04/2010		
Kalpakli Athanasia	Mech	HAL/NT/RÖ	03/2009		
Kjellander Malte	Mech	NA/NT	05/2007	4/2010	
Klets Olesya	Mech	LGF/AE	09/2008		
Klinkenberg Joy	Mech	LB/DH	06/2009		
Kosterina Natalia	Mech	AE/LGF	11/2006	06/2009	
Kurian Thomas	Mech	HAL/JF	08/2005		06/2010
Kvick Mathias	Mech	DS/FL	11/2009		
Laurantzon Fredrik	Mech	HAL/NT	06/2007	12/2010	
Lenaers Peter	Mech	AJ/GB/PS	02/2009		
Li Qiang	Mech	DH/PS	05/2007	10/2009	
Malm (Ohlsson) Johan	Mech	DH/LB	03/2007	12/2009	
Manda Krishnagoud	Mech	AE/GT	10/2008	12/2010	
Mellgren Niklas	Mech	MV	05/2003	09/2009	
Monokrousos Antonios	Mech	DH	02/2007	06/2009	
Muld Tomas	MWL	DH/LB	04/2007	05/2010	
Odemark Ylva	Mech	JF	02/2010		
Pastuhoff Markus	Mech	HAL/NT	05/2009		
Pettersson Robert	Mech	AE/LGF/AN	09/2006	06/2009	
Pouransari Zeinab	Mech	AJ/GB	04/2009		
Rasam Amin	Mech	AJ/GB	03/2009		
Sakowitz Aleksander	Mech	LF	12/2008		
Sarmast Sasan	Mech	DH	02/2010		
Schrader Lars-Uve	Mech	LB/DH	04/2006	11/2008	11/2010
Semerano Onofrio	Mech	DH	10/2008		
Shahinfar Shahab	Mech	JF/HAL	06/2008		
von Stillfried Florian	Mech	AJ/SW	09/2007	12/2009	
Strömgren Tobias	Mech	GA/AJ	04/2005	03/2008	03/2010
Söder Martin	Scania	LF	11/2010		

(cont.d)

Active graduate students at KTH Mechanics during 2010					
Name	Affiliation	Adv.	Start	TeknL	TeknD
Tahir Abdul Malik	Mech	GA	08/2008		
Tammisola Outi	Mech	DS/FL	06/2006	03/2009	
Tempelmann David	Mech	DH/AH	03/2007	12/2009	
Tysell Lars	FOI	LF			02/2010
Vallgren Andreas	Mech	EL	02/2007	06/2010	11/2010
Wang Ruoli	Mech	LGF/AE	06/2007	10/2009	
Wang Yue	Mech	LF	02/2010		
van Wyk Stevin	Mech	LF/LPW	08/2009		
Zhang Feng	Mech	AD	02/2010		
Zhu Lailai	Mech	LB/GA/MDQ	09/2009		

3 Economy

The financial state of the department is summarized in the table and diagrams below. The seemingly extremely positive result for the year 2008 was to a large extent related to the moving of Prof. Laszlo Fuchs from Lund University to KTH.

KTH Mekanik, resultat

RESULTATRÄKNING 2010 (kSEK)	GRU	FOFU	Totalt
Gruanslag	20 283	0	20 283
Fofuanslag	0	26 093	26 093
Bidrag fr externa finansiärer	0	39 649	39 649
Övriga intäkter	289	1 108	1 397
Finansiella intäkter	13	50	63
SUMMA INTÄKTER	20 585	66 900	87 485
	0	0	0
Personalkostnader	10 846	35 581	46 426
Lokalkostnader	1 287	7 996	9 283
Resor och traktamenten	10	1 843	1 853
Drift och övrigt	1 003	4 607	5 610
Gemensamma kostnader	7 341	9 582	16 922
Avskrivningar	17	419	436
Finansiella kostnader	0	0	0
SUMMA KOSTNADER	20 503	60 028	80 531
ÅRETS KAPITALFÖRÄNDRING	82	6 872	6 954

RESULTATRÄKNING (kSEK)	2003	2004	2005	2006	2007	2008	2009	2010
Gruanslag	14 723	14 519	16 089	15 784	14 779	15 580	14 764	20 283
Fofuanslag	20 381	19 070	20 294	22 231	23 355	25 206	23 823	26 093
Externa intäkter	31 577	30 276	26 586	24 991	24 594	35 593	30 987	41 109
SUMMA INTÄKTER	66 681	63 865	62 969	63 006	62 728	76 379	69 574	87 485
SUMMA KOSTNADER	64 158	65 448	64 506	63 267	63 665	64 733	68 769	80 531
ÅRETS KAPITALFÖRÄNDRING	2 523	-1 582	-1 537	-261	-937	11 646	804	6 954

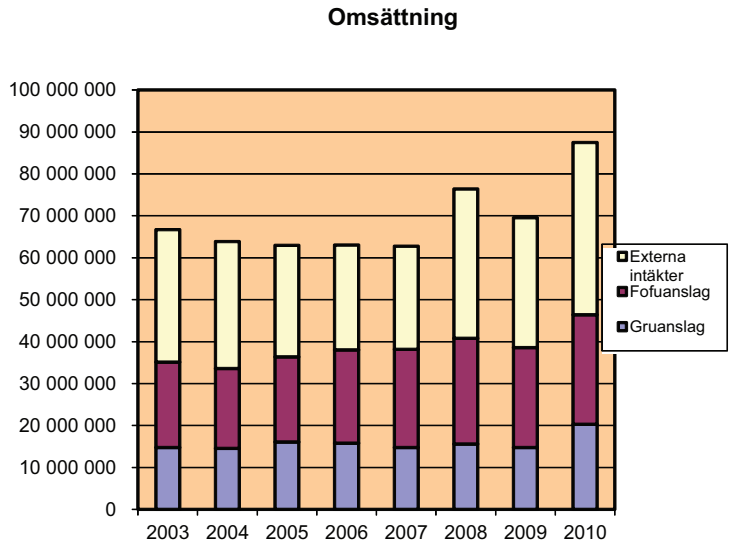

Figure 1: Turnaround in SEK during 2003–2010

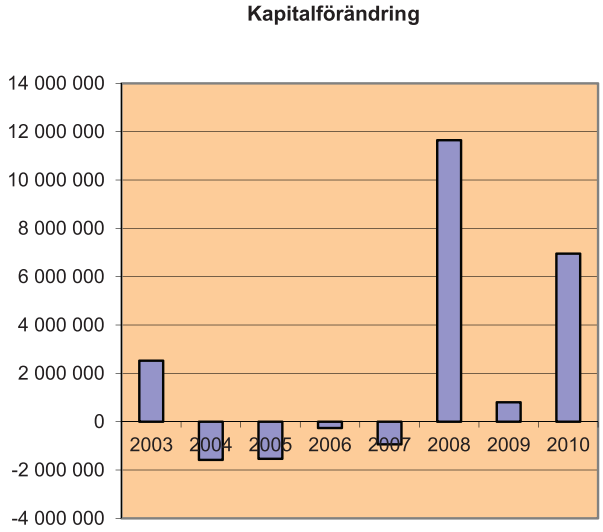

Figure 2: The surplus/deficit in SEK during 2003–2010

4 Teaching activities

4.1 Undergraduate courses

These data refer to the academic year 2009/2010.

Basic courses mechanics				
Progr.: Year	Code	Credit	Name	Responsible
K, Bio : 1	SG1102	6,0	Mechanics, Smaller course	Lindborg
OPEN : 1	SG1102	6,0	Mechanics, Smaller course	Lundell
E : 2	SG1102	6,0	Mechanics, Smaller course	Nordmark
MT : 1	SG1102	6,0	Mechanics, Smaller course	Maxe
S : 2	SG1107	7,5	Mechanics	Thylwe
ME : 1	SG1108	7,5	Applied Physics, Mechanics	Hsieh
I : 1	SG1109	8,0	Mechanics for I	Essén
F : 2	SG1113	6,0	Mechanics, Continuation course	Apazidis
F : 1	SG1130	9,0	Mechanics I	Apazidis
CL : 2	SG1130	9,0	Mechanics I	Apazidis
BD : 1	SG1130	9,0	Mechanics I	Nyberg
M : 1	SG1130	9,0	Mechanics I	Nyberg
T : 1	SG1131	11,0	Mechanics I	Nyberg
P : 1	SG1130	9,0	Mechanics I	Thylwe
M : 2	SG1140	6,0	Mechanics II	Thylwe
T : 2	SG1140	6,0	Mechanics II	Nyberg
P : 2	SG1140	6,0	Mechanics II	Bark
CL: 3	SG1140	6,0	Mechanics II	Bark
Advanced courses				
All : 4	SG2126	7,5	Nonlinear dynamics	Nordmark
All: 4	SG2127	3	Research methodology in mechanics	Brandefelt
All : 3	SG2150	7,5	Rigid body dynamics	Essén
Advanced courses structural mechanics				
S : 3	SG1801	7,5	Structural mechanics	Eriksson
S : 4	SG2802	7,5	Membranes, plates and FEM	Tibert
S : 4	SG2803	7,5	Num. modelling and simulation	Eriksson
All : 4	SG2860	7,5	Finite element modelling	Eriksson
All : 4	SG2870	7,5	Non-linear FEM	Tibert
Basic courses fluid mechanics				
T : 2	SG1216	6,0	Thermodynamics	Dahlkild
T : 2	SG1217	6,0	Fluid mechanics	A. Karlsson
M, P : 3	SG1220	6,0	Fluid mechanics for engineers	Lundell
Advanced courses fluid mechanics				
All : 4	SG2211	6,0	Vehicle aerodynamics	Talamelli
All : 4	SG2212	7,5	CFD	Hanifi & Schlatter
All : 4	SG2213	3,0	Appl. comp. fluid dynamics	Wallin
All : 4	SG2215	7,5	Compressible flow	Alfredsson
All : 3	SG2214	7,5	Fluid mechanics, General course	Dahlkild
All : 4	SG2218	7,5	Turbulence	Alfredsson

All : 4	SG2219	7,5	Advanced compressible flows	Alfredsson, Tillmark & Dahlkild
All : 4	SG2221	7,5	Wave motion and stability	Fransson & Brandt
F : 3	SG2223	9,0	Fluid mechanics	Lindborg & Fransson
All : 4	KF2050	6,0	Paper process technology	Söderberg

The numbers of students based on hås/håp: 8*(hås+håp)/2 during the years 2003-2010 are summarized in the following table. Note that data refer to the academic year ending in the year given.

Number of students during 2002-2009								
Courses	2003	2004	2005	2006	2007	2008	2009	**2010**
Basic mechanics	1496	1504	1442	1371	1403	1232	1295	**1518**
Upper level mechanics courses	72	96	52	48	42	35	45	**47**
Fluid mechanics	408	352	514	425	363	367	439	**431**
Structural mechanics	317	262	183	146	133	179	159	**136**

4.2 Master's thesis projects

Master's theses during 2010		
Name	Title	Examiner
Walldén, Benedikt	Normalmoder i kopplade dämpade system	H. Essén
Bagheri, Faranggis	Numeriska simuleringar av polymer i turbulent kanalströmning	L. Brandt
Yu, Zhang	Muscle driven forward dynamics simulation of human walking based on experimental data	L. Gutierrez-Farewik
van den Herrewegen, Inge	Analysis of sit-stand-sit movements in adults with rheumatic arthritis	L. Gutierrez-Farewik
Amaral Neto, Joao	Yield optimization based on wind resource	L. Brandt
Farahanikia, Alireza	Forces on Lagrangian particles in turbulent wall-bounded flow	P. Schlatter
Wang, Qiong	Numerical simulation of blood flow in bifurcating pipe	L. Brandt
Ritterbusch, Rafael	Implementation of an agglomeration model into Ansys CFX 12.1 and CFD single phase cyclone simulations	A. Dahlkild
Kékesi, Timea	CFD study of flow separation control using jets	A. Dahlkild
Tavakkoli Avval, Pouria	Cross-bridge modelling of skeletal muscles	A. Eriksson

Björkman, Magnus	Numerical simulations of the flow in a refiner	A. Dahlkild
Daurskikh, Anna	Design and deployment simulation of the inflatable moon house	G. Tibert
Shabbir, Saddaf	Modelling, analysis and optimization of a NES for the air intake system of a vehicle	A. Nordmark
de Boer, J.P.	Dynamics of a tidal estuary	H. Alfredsson
Eriksson, Daniel, Gasch, Tobias	Finite element modelling of reinforced concrete and verification of the concrete material models available in Abaqus	G. Tibert
Finnström, Calle	Numerical investigation of secondary flows in a compressor cascade	D. Henningson
Xingyu, Xiang	Production evaluation of wind farms-too to improve production analysis method	L. Fuchs
Khoshparvar, Soheil	Stress analysis of Bepicolombo boom deployment system subjected to random vibrations	G. Tibert

4.3 Graduate courses

These data refer to the academic year 2009/2010. In addition several reading courses were also given.

- SG3105 Fluid mechanics for graduate students (Lindborg, Dahlkild, Söderholm)
- SG3112 Turbulence (Alfredsson)
- SG3113 Compressible flow for graduate students (Alfredsson)
- SG3114 Numerical methods in fluid mechanics (Hanifi, Schlatter)
- SG2221 Wave motions and hydrodynamic stability (Brandt, Fransson)
- SG3128 Vehicle aerodynamics (Talamelli)

5 Research activities

5.1 Doctoral theses defended

Shervin Bagheri

Thesis title: Analysis and control of transitional shear layers using global modes
Date: February 12, 2010
Faculty opponent: A. Bottaro, University of Genova
Evaluation committee: Professor Gunilla Kreiss, UU, Professor Lennart Löfdahl, Chalmers, Docent Henrik Sandberg, KTH.
Main advisor: Professor Dan Henningson

Lars Tysell

Thesis title: Hybrid grid generation for viscous flow computations around complex geometries
Date: February 19, 2010
Faculty opponent: Professor Nigel Weatherill, University of Birmingham
Evaluation committee: Docent Michel Cervantes, LTU, Docent Johan Revstedt, LTH, Dr. Per Weinerfelt, SAAB Aerospace.
Main advisor: Professor Laszlo Fuchs

Tobias Strömgren

Thesis title: Model predictions of turbulent gas-particle shear flows
Date: March 29, 2010
Faculty opponent: Professor Martin Sommerfeld, Martin-Luther-Universität Halle-Wittenberg
Evaluation committee: Professor Lars Davidsson, Chalmers, Dr. Pavel Kudinov, KTH, Docent Johan Revstedt, LTH
Main advisor: Professor Gustav Amberg

Fredrik Hellström

Thesis title: Numerical computations of the unsteady flow in turbochargers
Date: May 26, 2010
Faculty opponent: Dr. Ricardo Martinez-Botas, Imperial College
Evaluation committee: Professor Lars-Erik Eriksson, Chalmers, Docent Per Tunestål, LTH, Professor Hans-Erik Ångström, KTH
Main advisor: Professor Laszlo Fuchs

Thomas Kurian

Thesis title: An experimental investigation of disturbance growth in boundary layer flows
Date: June 11, 2010
Faculty opponent: Professor Edward White, Texas A&M University
Evaluation committee: Dr. Simone Camarri, Universita di Pisa, Doctor Valery Chernoray, Chalmers, Dr. Per Elofsson, Scania
Main advisor: Professor Henrik Alfredsson

Lars-Uve Schrader

Thesis title: Receptivity of boundary-layer flows over flat and curved walls
Date: November 12, 2010
Faculty opponent: Professor Gregoire Casalis, ONERA, Toulouse
Evaluation committee: Dr. Markus Kloker, Universität Stuttgart, Docent Jesper Oppelstrup, KTH, Dr. Per Weinerfelt, SAAB Aerospace
Main advisor: Docent Luca Brandt

Andreas Vallgren

Thesis title: Dynamic properties of two-dimensional and quasi-geostrophic turbulence
Date: November 19, 2010
Faculty opponent: Professor Guido Boffetta, University of Turin
Evaluation committee: Professor Peter Ditlevsen, Niels Bohr Institute, Copenhagen, Professor Jonas Nycander, SU, Docent Anna-Karin Tornberg, KTH
Main advisor: Docent Erik Lindborg

5.2 Licentiate theses presented

Malte Kjellander

Thesis title: On dynamics and thermal radiation of imploding shock waves
Date: April 16, 2010
External examiner: Professor Gabi Ben-Dor, Ben-Gurion University of the Negev
Main advisor: Docent Nicholas Apazidis

Tomas Muld

Thesis title: Analysis of flow structures in wake flows for train aerodynamics
Date: May 28, 2010
External examiner: Dr. Shia-Hui Peng, FOI
Main advisors: Dr. Gunilla Efraimsson/Professor Dan Henningson

Andreas Vallgren

Thesis title: Statistical characteristics of two-dimensional and quasigeostrophic turbulence
Date: June 14, 2010
External examiner: Dr. Johan Nilsson, SU
Main advisor: Docent Erik Lindborg

Emma Alenius

Thesis title: CFD of duct acoustics for turbocharger applications
Date: December 13, 2010
External examiner: Dr. Federico Piscaglia, Politecnico di Milano
Main advisors: Professor Mats Åbom/Professor Laszlo Fuchs

Krishnagoud Manda

Thesis title: Finite element simulations of biphasic articular cartilages with localized metal implants
Date: December 16, 2010
External examiner: Dr. Ingrid Svensson, LTH
Main advisor: Professor Anders Eriksson

Fredrik Laurantzon

Thesis title: Flow measuring techniques in steady and pulsating compressible flows
Date: December 17, 2010
External examiner: Dr. Björn Lindgren, Scania CV
Main advisor: Professor Henrik Alfredsson

5.3 Publications

5.3.1 Publications in archival journals

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5.3.2 Other publications

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59 Angele K.P., Cehlin M., Högström C.M., Odemark Y., Henriksson M., Tinoco H., Lindqvist H., Hemström B., 2010, Flow mixing inside a control-rod guide tube — part II: experimental tests and CFD-simulations, *Proceedings of the 18th International Conference on Nuclear Engineering, May 17–21, Xi'an.*

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73 Kvick M., Håkansson K.H., Lundell F., Söderberg D., Prahl Wittberg L., 2010, Fibre Streaks in Wall Bounded Turbulent Flow, *7th Int. Conf. on Multiphase Flow, May 30 – June 4, Tampa, Florida, USA*.

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82 Prahl Wittberg L., Revstedt J., Lundell F., 2010, Hydrodynamic interaction among multiple spherical particles, *7th Int. Conf. on Multiphase Flow, May 30 – June 4, Tampa, Florida, USA.*

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98 Wang R.L., Gutierrez-Farewik E.M., 2010, How a rigid foot-ground contact model could affect induced acceleration analysis: A parametric study, *Proceedings of 2010 IUTAM symposium on Analysis and simulation of human motion.*

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5.3.3 Technical reports (TRITA)

Unfortunately, a book-keeping mistake has lead to an incorrect numbering, cf. below.
ISSN 0348–467X, ISRN number given below.

102 Bagheri S., 2010, Analysis and control of transitional shear layers using global modes, *Doctoral thesis*, KTH/MEK/TR–10/01–SE.

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104 Hellström F., 2010, Numerical computations of the unsteady flow in turbochargers, *Doctoral thesis*, KTH/MEK/TR–10/03–SE.

105 Kjellander M.K., 2010, On dynamics and thermal radiation of imploding shock waves, *Licentiate thesis*, KTH/MEK/TR–10/03–SE.

106 Kurian T., 2010, An experimental investigation of disturbance growth in boundary layer flows, *Doctoral thesis*, KTH/MEK/TR–10/04–SE.

107 Laurantsen F., 2010, Flow measuring techniques in steady and pulsating compressible flows, *Licentiate thesis*, KTH/MEK/TR–10/09–SE.

108 Manda K., 2010, Finite element simulations of biphasic articular cartilages with localized metal implants, *Licentiate thesis*, KTH/MEK/TR–10/10–SE.

109 Muld T, 2010, Analysis of flow structures in wake flows for train aerodynamics, *Licentiate thesis*, KTH/MEK/TR–10/04–SE.

110 Schrader L.-U., 2010, Receptivity of boundary-layer flows over flat and curved walls, *Doctoral thesis*, KTH/MEK/TR–10/08–SE.

111 Strömgren T., 2010, Model predictions of turbulent gas-particle shear flows, *Doctoral thesis*, KTH/MEK/TR–10/02–SE.

112 Tysell L., 2010, Hybrid grid generation for viscous flow computations around complex geometries, *Doctoral thesis*, KTH/MEK/TR–09/17–SE.

113 Vallgren A., 2010, Statistical characteristics of two-dimensional and quasigeostrophic turbulence, *Licentiate thesis*, KTH/MEK/TR–10/05–SE.

114 Vallgren A., 2010, Dynamic properties of two-dimensional and quasigeostrophic turbulence, *Doctoral thesis*, KTH/MEK/TR–10/06–SE.

5.4 Seminars at KTH Mechanics

January 14 Minh Do-Quang, KTH Mechanics
Fluid dynamic behavior of dispensing small droplets through a thin liquid film.

January 28 Walter Villanueva, KTH Nuclear Power Safety
Modeling and Simulation of Reactive Wetting with Intermetallic Formation.

February 4 Milos Ilak, KTH Mechanics
Model Reduction and Feedback Control of Transitional Channel Flow.

February 9 Rene Oliemans, Multiphase Flow B.V.
Best practice guidelines for computational fluid dynamics of dispersed multiphase flows.

February 11 Alessandro Bottaro, Universitá di Genova
The optimal and near optimal wavepacket in a boundary layer and its ensuing turbulent spot.

February 12 Shervin Bagheri, KTH Mechanics
Analysis and control of transitional shear flows using global modes.

February 18 Dhrubaditya Mitra, Nordita, Stockholm
Dissipation reduction by addition of polymers additives in direct numerical simulation of homogeneous, isotropic turbulence.

February 19 Lars Tysell, FOI, Stockholm
Hybrid grid generation for viscous flow computations around complex geometries.

February 25 Philipp Schlatter, KTH Mechanics
The strucutre of a turbulent boundary layer: Simulations at high Reynolds number.

March 4 Onofrio Semeraro, KTH Mechanics
Feedback control of three dimensional linear optimal disturbances.

March 11 Amin Rasam, KTH Mechanics
Large eddy simulations of high-Reynolds number channel flow.

March 25 Hans Kuerten, Eindhoven University of Technology
DNS of particle motion in rotating pipe flow.

March 29 Tobias Strömgren, KTH Mechanics
Model predictions of turbulent gas-particle shear flows.

March 30 Martin Sommerfeld, Martin-Luther-University, Halle-Wittenberg
Analysis of collision effects in particle-laden flows using the discrete particle method.

April 15 Gabi Ben-Dor, Ben-Gurion University of the Negev
Hysteresis phenomena in the interaction of shock waves in steady flows.

April 16 Malte Kjellander, KTH Mechanics
On dynamics and thermal radiation of imploding shock waves.

April 16 Javier Jimenez, Universita Politecnica, Madrid
Simulation results on wall-bounded turbulence.

April 23 Hassan Nagib, KTH Mechanics
High Reynolds number wall-bounded turbulence: approach to asymptotic state, universality and ICET.

May 3 Lawrence Cheung, Imperial College, London
The behavior of nonlinear instability waves in free shear flows.

May 20 Victor Yakhot, Boston University
Small parameter in turbulence theory. Mixing and skin friction in wall flows.

May 24 Hugh Blackburn, Monash University, **city**
Floquet instabilities of wakes and related systems.

May 26 Fredrik Hellström, KTH Mechanics
Numerical computations of the unsteady flow in turbochargers.

June 9 Simone Camarri, University of Pisa

An adjoint-based analysis of the secondary instability in the wake of a circular cylinder.

June 10 Edward White, Texas A&M University
Transient Growth: Receptivity, Realizability and Realistic Roughness.

June 11 Thomas Kurian, KTH Mechanics
An experimental investigation of disturbance growth in boundary layer flows.

June 14 Andreas Vallgren, KTH Mechanics
Statistical characteristics of two-dimensional and quasigeostrophic turbulence.

August 31 Junichiro Shiomi, University of Tokyo
Heat conduction in carbon nanotube system.

September 16 Magnus Björkman, KTH Mechanics
Numerical simulations of flow in a refiner.

September 30 Oscar Flores, University of Washington, Seattle
Analysis of stratification effects in the atmospheric surface layer using DNS.

October 7 Ramis Örlü and Philipp Schlatter, KTH Mechanics (joint seminar)
Turbulent boundary layers: experiment and simulation at KTH.

October 13 Wim-Paul van Breugem, Delft University of Technology
A combined soft-sphere/immersed boundary method for resolved simulations of particulate flows.

October 14 Cyrus Aidun, Georgia Institute of Technology, Atlanta
DNS of noncolloidal particles, deformable capsules and fibres suspended in liquid.

October 15 S.J. Garrett, University of Leicester
Distinct transition mechanisms on slender vs broad cones.

October 21 Larry Mahrt, Oregon State University
Stratified atmospheric boundary layers.

October 28 Robert F. Mikkelsen, DTU, Copenhagen
Distributed momentum sources in CFD applied to rotor aerodynamic flows.

November 4 Michiel Kreutzer, Delft University of Technology
Instabilities in segmented flows - bubble formation and partial wetting.

November 11 Gregoire Casalis, ONERA, Toulouse
Investigations on the receptivity induced by micron-sized roughness elements placed on a swept cylinder in a uniform flow.

November 12 Lars-Uve Schrader, KTH Mechanics
Receptivity of boundary-layer flows over flat and curved walls.

November 18 Peter Ditlevsen, Niels Bohr Institute, Copenhagen
The Dansgaard-Oechger events, could they be predicted?.

November 19 Andreas Vallgren, KTH Mechanics
Dynamic properties of two-dimensional and quasi-geostrophic turbulence.

November 25 Mireia Altimira, KTH Mechanics
Analysis of atomization systems through mathematical modeling and experimentation: application to industrial fan-spray atomizers.

December 9 Fabrizio Ponti, University of Bologna
Crankshaft torsional models for ICE Torque management and combustion positioning control.

December 9 Eri Tatsumi, Kyoto University
Gas flow through a curved micro channel: application of kinetic gas theory.

December 16 Krishnagoud Manda, KTH Mechanics
Finite element simulations of biphasic articular cartilages with localized metal implants.

December 17 Fredrik Laurantzon, KTH Mechanics
Flow measuring techniques in steady and pulsating compressible flows.

December 20 Calle Finnström, KTH Mechanics
Numerical investigation of secondary flows in a compressor cascade.