KTH Mechanics

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Activity Report 2007

Contents

Preface

This report gives a short overview of the structure and activities at the department of Mechanics, KTH during the year of 2007. More information may be found at the department web site http://www.mech.kth.se.

The teaching activity of the mechanics department during the year of 2007 included basic, intermediate, advanced-level as well as graduate courses in mechanics, fluid mechanics and structural mechanics given at various schools at KTH.

The scientific activity of the department resulted in the defence of 3 doctoral and 6 licentiate theses during 2007. The publication list of the staff and graduate students of the mechanics department this year amounted to 51 publications in archival journals, 34 publications in conference proceedings and 9 internal reports.

Stockholm, March 2008

Dan Henningson, department chairman

Nicholas Apazidis, department vice chairman

1 Introduction

Department of Mechanics is one of the 6 departments of the School of Engineering Sciences at KTH. The Department had 99 employees and a turnaround of about 63 MSEK during the year of 2007.

Prof. Dan Henningson is the chairman of the department and docent Nicholas Apazidis is the vice chairman. Docent Hanno Essén is the director of undergraduate studies in mechanics and Docent Erik Lindborg in fluid mechanics. Docent Anders Dahkild is the director of graduate studies. The department is managed by a group consisting of: Henrik Alfredsson, Gustav Amberg, Nicholas Apazidis, Fritz Bark, Anders Eriksson, Hanno Essén, Laszlo Fuchs, Dan Hennigson (chairman), Arne Johansson, Hans Silverhag.

The educational activity at the department for the undergraduate studies offers a comprehensive course selection in basic mechanics attended by 1 500 students, in fluid mechanics with 500 students and in structural and advanced mechanics with 250 students. With about 100 staff, including 11 professors and 15 associate professors the department is large enough to provide an excellent research environment in a wide range of research areas for about 40 graduate students. During the academic year of 2007, 3 of the graduate students defended their PhD thesis and 6 their Licentiate thesis.

The department also serves as one of the hosts, together with the Department of Solid Mechanics of the International Masters Programme in Engineering Mechanics which offers a broad spectrum of higher level courses in solid and fluid mechanics. Dr. Jean-Marc Battini serves as the coordinator of this program at the department.

Mechanics of solids, fluids and gases are fundamental areas within classical physics and plays a pivotal role in the design and analysis in almost every branch of engineering science. Today, this position is enhanced by even larger amount of the areas engulfed by the subject. For instance, chemical and material sciences in combination with fluid mechanics lead to a deeper understanding of various physical phenomena and also leads to new technical innovations. The research methods of mechanics are well established and are successfully used for example in biological sciences with application to human body. Such a cross-scientific approach opens new possibilities for a better understanding of a human body (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, electrochemical and pharmaceutical industries generating new and challenging research problems. The researchers in the department are divided in 7 research groups.

- 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.

- In the *Stability, Transition and Control* group (headed by Prof. Dan Henningson) studies dealing with how and why orderly laminar fluid transitions to chaotic turbulent flow are performed. Often large scale numerical experiments are 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 and Applied Fluid Mechanics Laboratory* (headed by Prof. Henrik Alfredsson and prof. Laszlo Fuchs) is mainly housed in "Flyghuset" at Teknikringen 8 but also partly at Osquars backe 18. Within the laboratory both experimental and computational projects of various fluid dynamical systems are carried out. Six main research areas can be identified 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, heat transfer and reacting flows, internal compressible flows and shock wave research with applications to shock focusing. The computational research utilizes LES based methods for non-reacting and reacting flows as well as single and multiphase flows, whereas 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 and also 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. As of September 1, 2007 prof. Laszlo Fuchs was employed as a full time professor and is now heading his own group in Applied Fluid Mechanics.

- *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), pressure measurements in high Reynolds number flows and measurements in high Reynolds number turbulent boundary layers. Recent developments also include studies of combustion in turbulent flows. 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, that is large scale turbulence strongly affected by the combined effects of rotation and stratification.

- In the group of *Physio-chemical fluid mechanics* (headed by Prof. Gustav Amberg) research dealing with fluid mechanics dominated by effects such as capillarity, phase change, heat and mass transfer, etc, are studied. Examples of application areas are micro fluidics and materials processes.
- *The research group for Fluid Mechanics of the Process Industries* (headed by Prof. Fritz Bark) investigates applied problems, often in combination with other disciplines in the engineering sciences. Examples of research themes are multi-component, multiphase non-isothermal flow in polymer electrolyte fuel cells, electro permutation assisted by ion exchange textiles, multiphase hydrodynamic/electrochemical modelling of pickling of steel and investigations of the mechanics of fiber suspensions.
- 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 2007

New appointments during 2007

Prof. Laszlo Fuchs has been appointed professor in Fluid Mechanics with applications to paper process technology at KTH as of September 1, 2007
Dr. Jenny Brandfelt has been appointed research associate with applications to turbulence and climate modelling as of October 2007.
Mr. Joackim Karlström has been appointed toolmaker as of October 2007.
Dr. Elena Gutierrez-Farewik gave a docent lecture in November 2007 and was appointed docent in mechanics with applications to human locomotion in December 2007.
Dr. Rebecca Lingwood, Oxford University, has been appointed affiliated professor in Fluid mechanics as of December 1, 2007.
Toolmaker Mr. Marcus Gällstedt retired in summer 2007.
Toolmaker Mr. Marcus Landén retired in summer 2007.

During 2007 13 new graduate students started at the department.

Awards and prizes

Bengt Enflo and Hanno Essén, won the KTH Competion in General Education, organized by Henrik Eriksson at NADA.
Elena Gutierrez-Farewik received Göran Gustafsson Foundation's young scientist award with a prize sum of 200 kkr.
Fredrik Laurantzon and Thomas Meurling won a PIEp Engineering Creativity Challenge Masters Thesis competition and were awarded a free visit to Stanford University.
Jean-Marc Battini was nominated as Teacher of the Year by the students of the S programme at KTH.

Nicholas Apazidis received a teaching award from the students of the F programme
Veronica Eliasson, Nils Tillmark and Nicholas Apazidis received an award from the Visualization Society of Japan.

Miscellaneous

Prof. Henrik Alfredsson gave the Folke Odqvist lecture at the Swedish Mechanics Days (SMD) in Luleå. Title: Culinaric fluid mechanics.
Prof. Dan Hennigson has been appointed associate editor of Journal of Fluid Mechanics.

Common department activities

The end of the academic year 2006/2007 was celebrated on June 11 by a boat trip and a dinner on m/s Askungen in the beautiful surroundings of the Stockholm Archipelago.

By the end of the year on December 13 the department gathered for a Christmas dinner at Stallmästaregården.

2 Personnel

Professors

- Alfredsson Henrik, Ph.D. in mechanics, KTH 1983 and Docent there 1985. Prof. of fluid physics 1989. Director of CICERO.
- Amberg Gustav, Ph.D. in fluid mechanics, KTH 1986, Docent at KTH 1990. Prof. of fluid mechanics 1999. Dean of the school of engineering sciences, since December 1, 2004.
- Bark Fritz, Ph.D. in applied mechanics at KTH 1974. Prof. of hydromechanics, 1985.
- Eriksson Anders, Ph.D. in steel structures, KTH 1981 and Docent there 1988. Prof. of structural mechanics 1992. Vice president of KTH, 1999–2007. Acted as president of KTH during August–November 2007.
- Fuchs Laszlo, Ph.D. in gasdynamics 1977, Docent KTH 1980. Prof. of fluid mechanics LTH 1994–2007. Prof. of fluid mechanics KTH 2007.
- Henningson Dan, Ph.D. KTH 1988, Docent KTH 1992. Prof. of fluid mechanics since 1999 . Department chairman since July 2005. Director of Linné Flow Center
- Johansson Arne , Ph.D. in mechanics, KTH 1983 and Docent there 1984. Prof. of mechanics 1991. Appointed secretary general for Natural and Engineering Sciences at the Swedish Research Council (VR) as of July 1, 2004 (75% at VR, 25% at KTH).

Adjunct professors and guest professor

- Hanifi Ardeshir, Ph.D. in fluid mechanics 1995, Docent KTH 2003. Adj. prof. of fluid mechanics 2005 20%, 80% FOI.
- Thomasson Per-Olof , Ph.D. in steel structures 1978, Docent KTH 1978. Employed 20% as Adj. Prof. of applied structural mechanics 2002.

Professors emeriti

- Enflo Bengt, Ph.D. and Docent 1965 in theoretical physics, Univ. of Stockholm. 'Biträdande professor' at KTH 1996. Retired in 2000.
- Lesser Martin, Ph.D. in Aerosp. Eng. at Cornell., Docent and Prof. at LuTH. Professor of mechanics at KTH 1987. Retired in 2005.

Senior Lecturers (in Swedish: lektorer)

- Apazidis Nicholas, Ph.D. in mechanics, KTH 1985, Docent at KTH 1994. Department vice chairman since 2005.

- Burden Anthony, Ph.D. in applied mathematical physics, CTH 1984.
- Dahlkild Anders, Ph.D. in mechanics 1988 and Docent 1992 at KTH. Director of graduate studies.
- Essén Hanno, Ph.D. in theoretical physics Univ. of Stockholm 1979. Docent 1986. Director of undergraduate studies.
- Hsieh Richard, Ph.D. in mechanics 1978, Docent at KTH 1980.
- Karlsson Arne, TeknL. (50 % at KTH Mechanics.)
- Karlsson Göran, Ph.D. in quantum chemistry 1970 Univ. of Uppsala.
- Lindborg Erik, Ph.D. in Mechanics KTH 1996. Docent at KTH 2001. Director of undergraduate studies in fluid mechanics.
- Nordmark Arne, Ph.D. in mechanics 1992. Docent at KTH 1999.
- Nyberg Christer, Ph.D. in mechanics 1979 KTH.
- Söderholm Lars, Ph.D. and Docent 1970 in theoretical physics, Univ. of Stockholm.
- Thor Lars, Ph.D. in mechanics at KTH 1973.
- Thylwe Karl-Erik, Ph.D. 1981 in theoretical physics, Univ. of Uppsala. Docent 1987.

Lecturers, research associates and researchers

- Battini Jean-Marc, Ph.D. in structural mechanics 2002
- Brandefelt Jenny, Ph.D. in meteorology 2005, Univ. of Stockholm.
- Brandt Luca, Ph.D. in fluid mechanics 2003.
- Brethouwer Geert , Ph.D. in fluid mechanics, TU Delft 2001.
- Do-Quang Mihn , Ph.D. in fluid mechanics, KTH 2004.
- Fransson Jens, Ph.D. in fluid mechanics 2003. Docent at KTH 2006
- Gutierrez Farewik Elena, Ph.D. in orthopedics, KI 2003. Docent at KTH 2007
- Lundell Fredrik, Ph.D. in Fluid mechanics 2003.
- Maxe Gunnar, MSc. ('adjunkt').
- Tibert Gunnar, ('forskarassistent'), Ph.D. in structural mechanics 2002.
- Tillmark Nils, Ph.D. in Fluid mechanics 1995. Responsible for the department's lab. facilities.
- Schlatter Philipp , Ph.D. in fluid mechanics, ETH 2005

- Shugai Galina , Ph.D. 2000 at KTH, Researcher, Faxén Laboratory until June 2007.
- Vynnycky Michael, ('förste forskare'), Ph.D. Univ. of Oxford, Docent at KTH 2002. Until September 2007.
- Yakubenko Peter, ('forskare'), Ph.D. in hydraulic engineering 1996. Researcher, Faxén Laboratory until June 2007.

Adjunct Lecturers

- Söderberg Daniel , Ph.D. in fluid mechanics 1999. Docent at KTH 2006. Adjunct lecturer in fluid mechanics with paper manufacturing application (20% at KTH, 80% at STFI/Packforsk).
- Wallin Stefan, Ph.D. in fluid mechanics 2000. Adjunct lecturer in fluid mechanics with turbulence modelling application, (30% at KTH, 70% at FOI).

Guest researchers, post-docs

- *Guest lecturer*: Prof. Alessandro Talamelli, Univ. of Bologna, Italy (3 months)
- *Post-doc*: Dr. Milos Ilak (Sept 2007–Dec 2007)
- *Post-doc*: Dr Takahiro Tsuakahara, Tokyo Science University, (April 2007–April 2008)
- *Visiting doctoral student*: Mr. Antonio Segalini, Universita di Bologna, (October 2007–May 2008)

Technical and administrative staff

- Ekstrand Pär
- Gällstedt Marcus (retired 2007)
- Karlström Joakim
- Landén Ulf (retired 2007)
- Olofsson Anne-Mari
- Silverhag Hans (administrativ chef)
- Skult Stefan
- Wallin Viviana
- Wester Ingunn (chefsadm./personalansvarig)

Changes in the department personnel during the last 7 years are summarized in the following table

Number of employees during 2001-2007							
Position	2001	2002	2003	2004	2005	2006	2007
Prof./Adj. Prof.	9	11	11	10	10	10	11
Lect./Adj. Lect.	14	15	16	16	16	16	15
Ass. lect./Researcher/Adjunct	7	7	9	11	12	12	15
Technical/adm staff	9	9	10	10	9	9	9
Guest Res./Post-docs			3	5	5	4	6
Doctoral students	48	45	46	42	38	37	40
External doct. stud.	14	12	6	11	8	6	5
Total	101	99	101	105	98	94	101

Active graduate students at KTH Mechanics during 2007					
Name	Affiliation	Adv.	Start	TeknL	TeknD
Ahlman Daniel	Mech	AJ/GB	07/2002	04/2006	12/2007
Andrén Peter	Mech	AE	01/1996	05/2006	
Bagheri Shevrin	Mech	DH	04/2006		
Bellani Gabrielle	Mech	HAL/FL	02/2006		
Bodin Olle	Mech	LF	09/2006		
Byström Martin	Mech	DH	02/2005	06/2007	
Carlsson Allan	Mech	DS/FL	01/2005	02/2007	
Carlsson Andreas	Mech	GA	12/2007		
Eliasson Veronica	Mech	NA/NT	02/2003	12/2005	09/2007
Fallenius Bengt	Mech	JF/HAL	04/2006		
Fällman Monika	Mech	FB/DS	04/2003		
Gärdsback Mattias	Mech	AE/GT	03/2004	02/2007	
Hellström Fredrik	GM PT	LF	09/2005		
Hyensjö Marko	Metso	AD	09/2001	04/2005	
Ivanell Stefan	Mech/HGO	DH	10/2003	05/2005	
Kaphle Manindra	Mech	AE	01/2005	12/2007	
Kjellander Malte	Mech	NA/NT	05/2007		
Kosterina Natalia	Mech	AE	11/2006		
Kurian Thomas	Mech	HAL/JF	08/2005		
Laurantzon Fredrik	Mech	HAL/NT	06/2007		
Li Qiang	Mech	DH	05/2007		
Lin Yuan	Mech	GA	01/2004	06/2006	
Ljubimova Darja	Mech	AE	11/2002	12/2005	
Lu Lina	Mech	GA	06/2007		
Lögdberg Ola	Scania	HAL/JF	09/2003	10/2006	
Marstorp Linus	Mech	AJ/GB	02/2004	04/2006	
Mellgren Niklas	Mech/FLA	MV	05/2003		
Monokrousos Antonios	Mech	DH	02/2007		
Muld Tomas	Mech	DH/GE	04/2007		
Nurhussen Filli	Mech	AE	09/2003	01/2007	
Ohlsson Johan	Mech	DH	03/2007		
Pettersson Robert	Mech	AE	09/2006		
Schrader Lars-Uve	Mech	DH	04/2006		
Tempelmann David	Mech	DH	03/2007		
Strömgren Tobias	Mech	GA/AJ	04/2005		
Svärd Anna	GM PT	HAL/NT	09/2005		
Tammisola Outi	Mech	DS/FL	06/2006		
Unckel Carl-Gustav	Mech	DH	10/2004		
Vallgren Andreas	Mech	EL	02/2007		
Villanueva Walter	Mech	GA	02/2003		06/2007
von Stillfried Florian	Mech	AJ/SW	09/2007		
Wang Raouli	Mech	AE/LGF	06/2007		
Åkervik Espen	Mech	DH	03/2004	03/2007	
Örlü Ramis	Mech	HAL/NT	02/2004	10/2006	

3 Economy

The financial state of the department is summarized in the table and diagrams shown below.

KTH Mekanik, resultat

Resultaträkning 2007 (kr)	GRU	FOFU	Totalt
Gruanslag	14 549 306	0	14 549 306
Fofuanslag	0	23 354 808	23 354 808
Bidrag fr externa finansiärer	0	22 886 355	22 886 355
Övriga intäkter	229 878	1 272 231	1 502 109
Finansiella intäkter	0	434 972	434 972
Summa intäkter	14 779 184	47 948 366	62 727 550
Personalkostnader	11 318 873	28 327 858	39 646 731
Lokalkostnader	2 183 230	6 350 527	8 533 757
Resor och traktamenten	10 392	1 453 048	1 463 440
Drift och övrigt	569 080	2 381 976	2 951 056
Gemensamma kostnader	1 838 808	7 587 028	9 425 836
Avskrivningar	53 457	1 574 861	1 628 318
Finansiella kostnader	0	15 636	15 636
Summa kostnader	15 937 840	47 690 934	63 664 774
Årets kapitalförändring	-1 194 656	257 432	-937 224

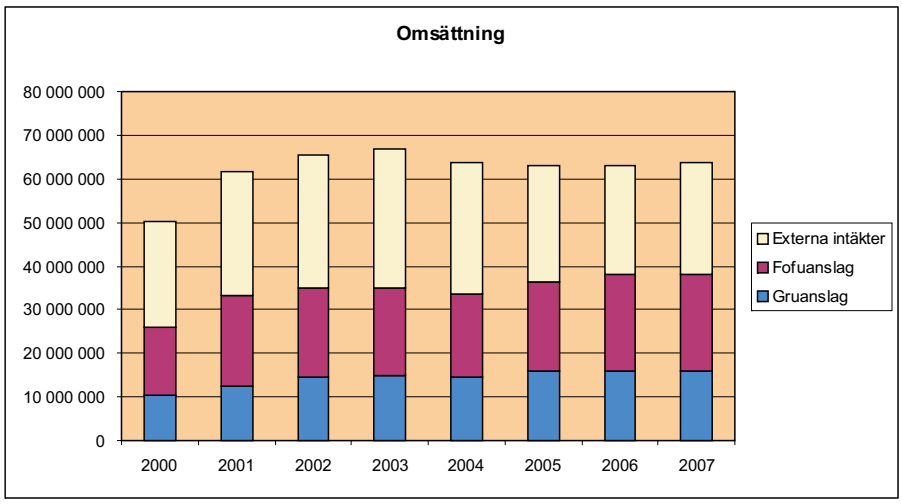

Figure 1: Turnaround in SEK during 2000–2007

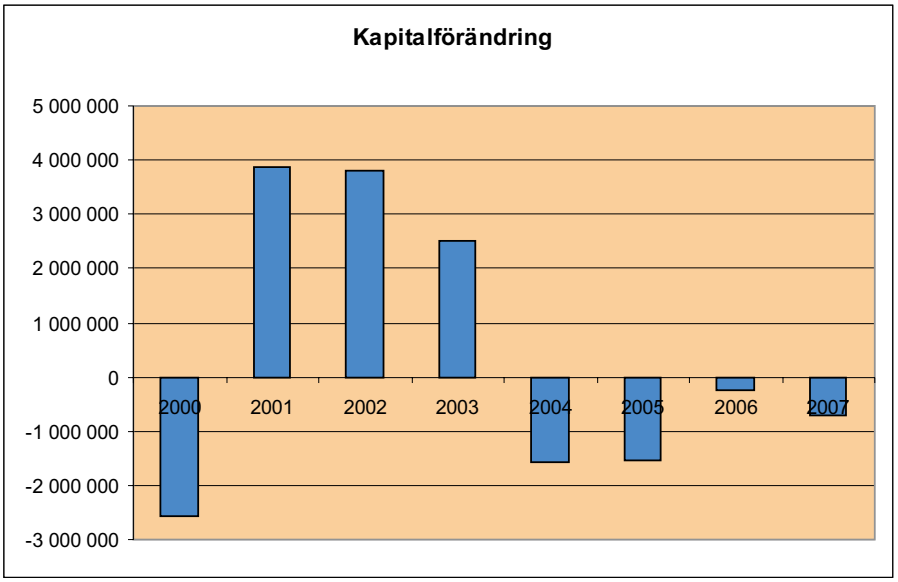

Figure 2: The surplus/deficit in SEK during 2000–2007

4 Teaching activities

4.1 Undergraduate courses

Basic courses mechanics					
Program	Year	Course code	Credit	Name	Responsible
K, Bio	1	SG1102	6,0	Mechanics, Smaller course	Lindborg
OPEN	1	SG1102	6,0	Mechanics, Smaller course	Lundell
F	1	SG1130	9,0	Mechanics I	Apazidis
CL	2	SG1130	9,0	Mechanics I	Apazidis
I	1	SG1109	8,0	Mechanics for I	Essén
ME	1	SG1108	7,5	Applied Physics, Mechanics	G. Karlsson
S	2	SG1107	7,5	Mechanics	Thylwe
F	2	SG1113	6,0	Mechanics, Continuation course	Apazidis
BD	1	SG1130	9,0	Mechanics I	Nyberg
M	1	SG1130	9,0	Mechanics I	Nyberg
T	1	SG1130	9,0	Mechanics I	Nyberg
P	1	SG1130	9,0	Mechanics I	Tibert
M	2	SG1140	6,0	Mechanics II	Thylwe
T	2	SG1140	6,0	Mechanics II	Nyberg
P	2	SG1130	6,0	Mechanics II	Bark
Advanced courses					
All	4	SG2122	6,0	Continuum mechanics	Söderholm
All	4	SG2123	6,0	Math. methods of mechanics	Söderholm
All	3	SG2150	7,5	Rigid body dynamics	Essén
All	4	SG2151	8,0	Multibody dynamics	Thylwe
All	4	SG2126	7,5	Nonlinear dynamics	Nordmark
Advanced courses structural mechanics					
S	3	SG1801	7,5	Structural mechanics, basic course	Battini
S	4	SG2802	7,5	Membranes, plates and FEM	Tibert
All	3	SG2803	7,5	Numerical modelling and simulation	Eriksson
All	2	SG2850	7,5	Finite element methods	Eriksson
All	4	SG2860	7,5	Finite element modelling	Battini
Basic courses fluid mechanics					
T	2	SG1216	6,0	Thermodynamics	Burden
T	2	SG1217	6,0	Fluid mechanics	A. Karlsson
M, P	3	SG1220	6,0	Fluid mechanics for engineers	A. Karlsson
Advanced courses fluid mechanics					
All	4	SG2211	6,0	Vehicle aerodynamics	Talamelli
All	4	SG3114	7,5	Computational fluid dynamics	Henningson
All	4	SG1213	3,0	Applied computational fluid dynamics	Wallin
All	3	SG2214	7,5	Fluid mechanics, General course	Dahlkild
All	4	SG1215	7,5	Compressible flow	Alfredsson
All	4	SG3112	9,0	Turbulence	Burden
All	4	SG2221	7,5	Wave motion and stability	Fransson
All	4	SG2219	7,5	Advanced compressible flows	HA, NA, AD, NT
All	4	KF2050	6,0	Paper process technology	Lundell

The number of students based on hås/håp: 8*(hås+håp)/2 during the years 2002-2007 is summarized in the following table

Number of students during 2002-2007						
Students	2002	2003	2004	2005	2006	2007
Basic mechanics	1744	1496	1504	1442	1371	1403
Upper level mechanics courses	48	72	96	52	48	42
Fluid mechanics	288	408	352	514	425	363
Structural mechanics	372	317	262	183	146	133

4.2 Master's thesis projects

Master's theses during 2007		
Name	Title	Advisor
Alenius E.	CFD Simulation of the flow in a water turbine spiral casing	H. Alfredsson
Beloki Perurena J.	Experimental investigations of a liquid jet injection into a crossing hypersonic flow	H. Alfredsson
Chen M.	A study on optimizing strain sensing for large bearings	J-M. Battini
Eslami S.M.	Computation of the optimal velocity disturbances of the low Reynolds number flow past a circular cylinder using a stabilized finite element method	L. Brandt
Farkas R.	Helical flow: theory, conservation laws and invariant solutions using Lie symmetries	H. Alfredsson
Fjellgren J.	Fibre orientation in shear flows	F. Lundell
Forsell, C.	On the analysis of human body movements using a minimum set of reflective markers	K-E. Thylwe
Gao X.	Comparison of gas dispersion simulation with Kameleon FireEx and fire dynamic simulator	S. Wallin
Hagström T., Johansson M.	Analysis of inflatable structures using Abaqus/Explicit	G. Tibert
Kjellander M.	Tailoring converging shock fronts by distributed objects	N. Apazidis

Krantz, M.	Generation of strut-and tie models for structural concrete using topology optimization methods	G. Tibert
Krzysztof Tomaszewski , P.	FEM simulations of single particle electro-hydro-dynamic mobility	G. Amberg
Laurantzon, F. Meurling, T.	Measuring methods applied to internal compressible flows	H. Alfredsson
Li, Q.	Direct numerical simulation of a turbulent boundary layer with passive scalar transport	P. Schlatter
Mojab, S. M.	Estimation and control of bypass transition in the Blasius boundary layer	L. Brandt
Monokrousos, A.	Estimation and control of bypass transition in the Blasius boundary layer	L. Brandt
Muld, T.	CFD simulations on air curtains. A comparison between horizontal and vertical Air Curtains	S. Wallin
Nesic, I.	Response of cold wire measurements of fluctuating temperature in a heated jet	H. Alfredsson
Palaniyappan, M.	Mechanical design of Mega-watt offshore wind generators using the finite element method	J-M. Battini
Schreyer, A.-M.	Experimental flow studies on separation and reattachment around sharp, wedge shaped leading edges for low Reynolds numbers	H. Alfredsson
Wang, R.	Analysis of foot kinematics during gait in adults	E. Gutierrez Farewik

4.3 Graduate courses

During 2006 the following graduate courses ('forskarutbildningskurser') were given. In addition several reading courses were also given.

- SG3105 Fluid mechanics for graduate students (Lindborg)
- SG3112 Turbulence (Burden)
- SG3113 Advanced compressible flow (Alfredsson, Apazidis, Dahlkild, Tillmark)
- SG3114 Numerical methods in fluid mechanics (Henningson)
- SG2221 Wave motions and hydrodynamic stability (Brandt, Fransson)

5 Research activities

5.1 Doctoral theses defended 2007

Walter Villanueva

Thesis title: Diffuse-interface simulations of capillary phenomena
Date: June 8, 2007
Faculty opponent: Prof. Steffen Hardt, University of Hannover
Evaluation committee: Dr. Bo Jansson, Seco Tools, Prof. Stig Larsson, CTH, Prof. Seshadri Seetharaman, KTH
Main advisor: Prof. Gustav Amberg

Veronica Eliasson

Thesis title: On focusing of shock waves
Date: September 21, 2007
Faculty opponent: Dr. John Dear, Imperial College, London
Evaluation committee: Prof. Mats Åbom, KTH, Univ.Lekt. Marie Finnström, LTU, Prof. Nils-Erik Molin, LTU
Main advisor: Docent Nicholas Apazidis

Daniel Ahlman

Thesis title: Numerical studies of turbulent wall-jets for mixing and combustion applications
Date: December 14, 2007
Faculty opponent: Prof. Michael Manhart, Technische Universität München
Evaluation committee: Prof. Xue-Song Bai, LTH, Prof. Lars-Erik Eriksson, Volvo Flygmotor AB, Trollhättan, Dr. Christer Fureby, FOI
Main advisor: Prof. Arne Johansson

5.2 Licentiate theses presented 2007

Filli Nurhussen

Thesis title: Experimental studies on mouse slow and fast twitch muscles
Date: January 10, 2007
External examiner: Docent Ulla Svantesson, Sahlgrenska akademin
Main advisor: Prof. Anders Eriksson

Mattias Gärdsback

Thesis title: Rotation-Free Shell Elements for Thin-Film Structures and Simulations of Centrifugally Deployed Space Webs
Date: February 23, 2007
External examiner: Dr. Andrew Lennon, ABL Engineering Ltd
Main advisor: Prof. Anders Eriksson

Allan Carlsson

Thesis title: Orientation of fibres in suspensions flowing over a solid surface
Date: February 23, 2007
External examiner: Prof. Staffan Toll, CTH
Main advisor: Docent Daniel Söderberg

Espen Åkervik

Thesis title: Feedback Control of Spatially Evolving Flows
Date: March 8, 2007
External examiner: Univ.Lekt. Martin Berggren, Tdb, Uppsala
Main advisor: Prof. Dan Henningson

Byström Martin

Thesis title: Optimal disturbances in boundary layer flows
Date: June 12, 2007
External examiner: Dr. Stefan Hein, DLR, Göttingen, Germany
Main advisor: Prof. Dan Henningson

Manindra Kaphle

Thesis title: Simulations of human movements through temporal discretization and optimization
Date: December 13, 2007
External examiner: Docent Kjartan Halvorsen, GIH
Main advisor: Prof. Anders Eriksson

5.3 Publications 2007

5.3.1 Publications in archival journals

1 Ahlman D.A., Brethouwer G., Johansson A.V., 2007, Direct numerical simulation of a plane turbulent wall-jet including scalar mixing, *Phys. Fluids A*, **19**, 065102.

2 Åkervik E.Å., Hoepffner J.P.J., Ehrenstein U, Henningson D.S, 2007, Optimal growth, model reduction and control in a separated boundary-layer flow using global eigenmodes, *J. Fluid Mech.*, **579**, 305-314.

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5.3.3 Technical reports (TRITA)

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5.4 Seminars

Seminars given at KTH

January 16 Kjell Rosquist, Fysikum, Stockholms universitet
Electric antigravity.

January 25 Axel Brandenburg, Nordita, Stockholm
Turbulence research at Nordita.

February 1 Jeroen Mans, TU Eindhoven
Streak development and breakdown during bypass transition.

February 8 Walter Villanueva, KTH, Mekanik
Phase-field modeling and simulation of multphase microflows.

March 1 Josue Sznitman, ETH Zurich
Insight into respiratory fluid dynamics in the pulmonary acinus.

March 8 Yohji Seki, Tokyo University of Science
Prandtl number Effect on Turbulence Quantities through High Spatial Resolution DNS of Turbulent Heat Transfer in a Channel Flow.

March 15 Linus Marstorp, KTH Mekanik
Subgrid scale modelling for LES including scalar mixing.

March 22 Clarence Rowley, Princeton
Model reduction for control of fluids, using balanced truncation.

April 12 Shilpa Khatri, Courant Institute, NYU
A Numerical Method for Soluble Surfactants on Moving Interfaces.

April 19 Alessandro Talamelli, KTH, Mekanik & Univ. Bologna
Experimental investigations of coaxial jets and development of a passive technique for mixing control.

April 26 Axel Kirkegaard, Marcus Wallenberg Lab, KTH
Computational Low Mach Number Internal Aeroacoustics.

May 3 Anders Ynnerman, Linköping University
Dealing with large and complex data in visualization.

May 4 Paul Billant, LadHyX, Ecole Polytechnique, France
Physical mechanism of the zigzag instability of stratified flows.

May 10 Élisabeth Guazzelli, Polytech Marseille
Sedimentation of small particles.

May 21 Peter Schmid, LadHyX, Ecole Polytechnique, France
Stability of swept Hiemenz flow and variable-density jets.

May 24 Mats Åbom, Marcus Wallenberg Lab, KTH
Aeroacoustics of flow duct singularities at Low Mach Numbers.

May 29 Peter Ditlevsen, Nils Bohr Institute, Copenhagen
Theory of Ice-ages and the problem of predicting them.

June 7 Steffen Hardt, University of Hannover
Heat and mass transfer in interfacial microflows.

June 14 Paul Fischer, Argonne National Laboratory
Accurate, Stable, and Scalable Algorithms for Convection-Dominated Flows.

August 23 Yvan Maciel, Université Laval, Canada
Near-field dynamics of a turbulent round jet with moderate swirl.

September 6 Veronica Eliasson, KTH, Mekanik
Numerical simulations of converging shock waves.

September 6 Hajime Fujita, College of Science and Technology Nihon University
The Characteristics of the Aeolian Tone Generated from Two-Dimensional Cylinders.

September 13 Josu Beloki Perurena, KTH Mechanics
Experimental investigation of liquid jet injection into Mach 6 hypersonic flow.

September 13 Laszlo Fuchs, KTH, Mekanik
Swirling jet instability and its role in flame holding.

September 20 John Dear, Imperial College, London
Acceleration of Brittle Failure in Polyolefins and composite structures for wind turbine blades.

September 27 Milos Ilak, Princeton University
Modeling of transitional channel flow using balanced proper orthogonal decomposition.

October 4 Erik Lindborg, KTH, Mekanik
Vertical eddy diffusion by stratified turbulence.

October 18 Gabriele Bellani, KTH Mekanik
PIV study on fiber suspension flow: the formation of a fiber network.

October 25 Catherine Mavriplis, University of Oklahoma
High Order Adaptive Methods for Fluid Flow.

November 1 Philipp Schlatter, KTH, Mekanik
LES of the interaction between TS-waves and finite amplitude streaks.

November 6 Mats Wallin, Theoretical Physics KTH
Monte Carlo simulation of phase transitions.

November 12 Jonathan Freund, University of Illinois at Urbana-Champaign
A quiet free shear flow.

November 15 Tamer Zaki, Imperial College London
The many routes to boundary layer turbulence in adverse pressure gradient.

November 29 Hans Bodén, MWL, KTH
The effect of flow and high acoustic excitation levels on the acoustic properties of perforates.

November 29 Lanie Gutierrez-Farewik, KTH Mechanics
Mechanics of Walking.