# KTH Mechanics

SE-100 44 Stockholm, Sweden

# Activity Report 2009

## Contents

## Preface

This report gives a short overview of the structure and activities at the department of Mechanics, KTH during the year of 2009. More information may be found at the department web site http://www.mech.kth.se.

The teaching activity of the department during 2009 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 five doctoral theses and presentations of fourteen licentiate theses during 2009. The publication list for the department this year consists of 43 publications in archival journals, 45 publications in conference proceedings and 19 internal reports, for a total of 107 publications.

Stockholm in August 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 70 MSEK during the year 2009.

Prof. Dan Henningson is the chairman of the department, with Prof. Anders Eriksson as the vice chairman. 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 is 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 1 300 students, in fluid mechanics with 400 students and in structural and advanced mechanics with 200 students. With a staff including 11 professors and 15 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 2009, five of the graduate students defended their PhD theses and fourteen presented their Licentiate theses.

The department also, together with the Department of Solid Mechanics, 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. Dr. Gunnar Tibert serves as the coordinator of this programme.

Mechanics of solids, 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, electrochemical and pharmaceutical industries, all contributing to the generation of new and challenging research problems. The researchers in the department are divided into eight 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 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 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.

- The research group for *Fluid mechanics of the process industries* (headed by Prof. em. 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 modeling 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 2009*

### *Retirements*

Three highly merited colleagues retired during the year: Fritz Bark, Lars Söderholm and Göran Karlsson.

### *New appointments during 2009*

Luca Brandt, Jens Fransson and Fredrik Lundell were appointed as senior lecturers during the year.

Carolina Eneqvist was recruited into our administration.

Twelve new graduate students started their PhD. education at the department during 2009.

We had several post-docs and guest students at the department during the year.

### *Awards, prizes and funding*

Rune 'Texas' Lindgren was awarded a jubilee doctorate, 52 years after becoming the first PhD. of Mechanics at KTH.

Anders Eriksson was awarded a 'Teacher of the year' award from the KTH S-programme.

The department was successful in obtaining funding from many different sources. In addition to a continued funding from VR, new funding was obtained 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.

The planning for a re-building of our premises at Teknikringen 8 was intense during the year.

The minister for higher education and research visited the department.

A major reorganization of offices was performed in the autumn, trying to gather the research groups tighter.

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

*Common department activities*

The academic year 2008/2009 was ended by a boat trip and a dinner on s/s Stockholm on June, 9. The department also gathered for a Christmas dinner at restaurant Ulla Winblad on December 9.

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

# 2 Personnel

## Professors

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

## Guest Professor

- Lingwood Rebecca, Cambridge University. Appointed in 2009.

## Adjunct professors

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

## Professors emeriti

- Bark Fritz, Ph.D. in applied mechanics, KTH 1974. Prof. of hydromechanics, 1985. Retired in 2009.
- Enflo Bengt, Ph.D. and Docent in theoretical physics, Univ. of Stockholm 1965. 'Biträdande professor' at KTH 1996. Retired in 2000.
- Lesser Martin, Ph.D. in aerospace engineering, Cornell, Docent and Prof. at LTU. Prof. of mechanics at KTH 1987. Retired in 2005.

## Affiliated Professors

- Nagib Hassan, IIT, Chicago, USA.
- Gutmark Ephraim. Univ. Cincinnatti, USA. Appointed in 2009.

## Senior Lecturers

- Apazidis Nicholas, Ph.D. in mechanics, KTH 1985, and Docent at KTH 1994.
- Brandt Luca, Ph.D. in fluid mechanics, KTH 2003, and Docent at KTH 2008. Appointed in 2009.
- Burden Anthony, Ph.D. in applied mathematical physics, CTH 1984. Left for Univ. of Stockholm in 2009.
- Dahlkild Anders, Ph.D. in mechanics, KTH 1988, and Docent at KTH 1992. Director of graduate studies.
- Essén Hanno, Ph.D. in theoretical physics, Univ. of Stockholm 1979, and Docent 1986. Director of undergraduate studies.
- Fransson Jens, Ph.D. in fluid mechanics, KTH 2003, and Docent at KTH 2006. Appointed in 2009.
- Hsieh Richard, Ph.D. in mechanics, KTH 1978, and Docent at KTH 1980.
- Karlsson Arne, TeknL. (50 % at KTH Mechanics). Until 2009.
- Karlsson Göran, Ph.D. in quantum chemistry, Univ. of Uppsala 1970. Retired in 2009.
- Lindborg Erik, Ph.D. in Mechanics, KTH 1996, and Docent at KTH 2001. Director of undergraduate studies in fluid mechanics.
- Nordmark Arne, Ph.D. in mechanics, KTH 1992, and Docent at KTH 1999.
- Nyberg Christer, Ph.D. in mechanics, KTH 1979.
- Söderholm Lars, Ph.D. and Docent in theoretical physics, Univ. of Stockholm, 1970. Retired in 2009
- Thylwe Karl-Erik, Ph.D. in theoretical physics, Univ. of Uppsala 1981, and Docent 1987.

## Lecturers, research associates and researchers

- Brandefelt Jenny, Ph.D. in meteorology, Univ. of Stockholm 2005.
- Brethouwer Geert, Ph.D. in fluid mechanics, TU Delft 2001.
- Do-Quang Mihn, Ph.D. in fluid mechanics, KTH 2004.

- Gutierrez Farewik Elena, Ph.D. in orthopedics, KI 2003, and Docent at KTH 2007.
- Lundell Fredrik, Ph.D. in fluid mechanics, KTH 2003, and Docent at KTH 2008.
- Maxe Gunnar, MSc.
- Prahl Wittberg Lisa, PhD., Lund University 2008.
- Tibert Gunnar, Ph.D. in structural mechanics, KTH 2002, and Docent at KTH 2009.
- Tillmark Nils, Ph.D. in fluid mechanics, KTH 1995. Responsible for the department's lab. facilities.
- Schlatter Philipp, Ph.D. in fluid mechanics, ETH 2005, and Docent at KTH 2009.

## Adjunct Lecturers

- Wallin Stefan, Ph.D. 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*: Prof. Alessandro Talamelli, Univ. of Bologna (3 months).
- *Post-doc*: Dr. Yohann Duguet, Ecole centrale de Lyon, France.
- *Post-doc*: Ilak Milos, Princeton, USA.
- *Post-doc*: Minming Zhu, Polytechnic University, Hong Kong.
- *Visiting doctoral student*: Mr. Shirko Faroughi, Tehran, Iran (October 2008–June 2009).
- *Post-doc*: Xu Yechuan, Polytechnic University, Hong Kong.

## Technical and administrative staff

- Bauer Nina, secretary.
- Ekstrand Pär, MSc., system manager.
- Eneqvist, Carolina, staff manager. Recruited 2009.
- Hornk, Heide, financial manager.
- Karlström Joakim, tool maker.
- Olofsson Anne-Mari, course administrator.
- Rådberg Göran, tool maker.
- Silverhag Hans, head of administration.
- Skult Stefan, administrative assistant.
- Wester Ingunn, human resource manager. Until 2009.

Changes in the department personnel in recent years are summarized in the following table

| **Number of employees during 2001-2009** | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Position | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | **2009** |
| Prof./Adj. Prof. | 9 | 11 | 11 | 10 | 10 | 10 | 11 | 11 | **11** |
| Lect./Adj. Lect. | 14 | 15 | 16 | 16 | 16 | 16 | 15 | 14 | **15** |
| Ass. lect./Researcher/Adjunct | 7 | 7 | 9 | 11 | 12 | 12 | 15 | 15 | **10** |
| Technical/adm staff | 9 | 9 | 10 | 10 | 9 | 9 | 9 | 7 | **9** |
| Guest Res./Post-docs | | | 3 | 5 | 5 | 4 | 6 | 5 | **6** |
| Doctoral students | 48 | 45 | 46 | 42 | 38 | 37 | 40 | 36 | **46** |
| External doct. stud. | 14 | 12 | 6 | 11 | 8 | 6 | 5 | 9 | **3** |
| Total | 101 | 99 | 101 | 105 | 98 | 94 | 101 | 97 | **100** |

| Active graduate students at KTH Mechanics during 2009 | | | | | |
|---|---|---|---|---|---|
| Name | Affiliation | Adv. | Start | TeknL | TeknD |
| Ahlberg Charlotte | Mech | DS/FL | 04/2007 | 12/2009 | |
| Amer Malik | Mech | GA | 11/2008 | | |
| Bagheri Shervin | Mech | DH | 04/2006 | 06/2008 | |
| Bellani Gabrielle | Mech | FL/DS | 02/2006 | 10/2008 | |
| Bodin Olle | Mech | LF | 09/2006 | 03/2009 | |
| Carlsson Allan | Mech | DS/FL | 01/2005 | 02/2007 | 03/2009 |
| Carlsson Andreas | Mech | GA | 12/2007 | | |
| Dalilsafaei Seif | Mech | AE/GT | 11/2008 | | |
| Fallenius Bengt | Mech | JF/HAL | 04/2006 | 05/2009 | |
| Fällman Monika | Mech | FB/DS | 04/2003 | 11/2009 | |
| Hellström Fredrik | GM PT | LF | 09/2005 | 03/2008 | |
| Håkansson Karl | Mech | DS/LPW | 11/2009 | | |
| Ivanell Stefan | Mech/HGO | DH | 10/2003 | 05/2005 | 02/2009 |
| Kalpakli Athanasia | Mech | HAL/NT/RÖ | 03/2009 | | |
| Kjellander Malte | Mech | NA/NT | 05/2007 | | |
| 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 | | |
| Kvick Mathias | Mech | DS/FL | 11/2009 | | |
| Laurantzon Fredrik | Mech | HAL/NT | 06/2007 | | |
| Lenaers Peter | Mech | AJ/GB/PS | 02/2009 | | |
| Li Qiang | Mech | DH | 05/2007 | 10/2009 | |
| Ljubimova Darja | Mech | AE | 11/2002 | 12/2005 | 12/2009 |
| Lögdberg Ola | Scania | HAL/JF | 09/2003 | 10/2006 | 01/2009 |
| Manda Krishnagoud | Mech | AE/GT | 10/2008 | | |
| Mellgren Niklas | Mech/FLA | MV | 05/2003 | 09/2009 | |
| Monokrousos Antonios | Mech | DH | 02/2007 | 06/2009 | |
| Muld Tomas | Mech | DH/GE | 04/2007 | | |
| Ohlsson Johan | Mech | DH | 03/2007 | 12/2009 | |
| 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 | | |
| Schrader Lars-Uve | Mech | DH | 04/2006 | 11/2008 | |
| 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 | |
| Tahir Abdul Malik | Mech | GA | 08/2008 | | |
| Tammisola Outi | Mech | DS/FL | 06/2006 | 03/2009 | |
| Tempelmann David | Mech | DH | 03/2007 | 12/2009 | |
| Thysell Lars | FOI | LF | | | |
| Vallgren Andreas | Mech | EL | 02/2007 | | |
| Wang Ruoli | Mech | LGF/AE | 06/2007 | 10/2009 | |
| van Wyk Stevin | Mech | LF/LPW | 08/2009 | | |
| Zhu Lailai | Mech | LB/GA/MDQ | 09/2009 | | |
| Örlü Ramis | Mech | HAL/NT | 02/2004 | 10/2006 | 06/2009 |

# 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 2009 (kr) | GRU | FOFU | Totalt |
|---|---|---|---|
| Gruanslag | 14 545 423 | 0 | 14 545 423 |
| Fofuanslag | 0 | 23 822 542 | 23 822 542 |
| Bidrag fr externa finansiärer | 0 | 30 215 314 | 30 215 314 |
| Övriga intäkter | 219 022 | 605 466 | 824 488 |
| Finansiella intäkter | 0 | 165 970 | 165 970 |
| SUMMA INTÄKTER | 14 764 445 | 54 809 292 | 69 573 737 |
| Personalkostnader | 11 368 001 | 32 716 194 | 44 084 195 |
| Lokalkostnader | 956 632 | 8 175 212 | 9 131 844 |
| Resor och traktamenten | 3 140 | 1 748 678 | 1 751 818 |
| Drift och övrigt | 464 421 | 3 358 894 | 3 823 315 |
| Gemensamma kostnader | 1 753 452 | 7 566 720 | 9 320 172 |
| Avskrivningar | 34 755 | 623 261 | 658 016 |
| Finansiella kostnader | 0 | 0 | 0 |
| SUMMA KOSTNADER | 14 580 401 | 54 188 959 | 68 769 360 |
| ÅRETS KAPITALFÖRÄNDRING | 184 044 | 620 333 | 804 377 |

| RESULTATRÄKNING (kr) | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 |
|---|---|---|---|---|---|---|---|---|---|---|
| Gruanslag | 10 292 988 | 12 324 322 | 14 634 440 | 14 722 646 | 14 519 201 | 16 088 607 | 15 783 902 | 14 779 184 | 15 579 892 | 14 764 445 |
| Fofuanslag | 15 708 352 | 20 753 146 | 20 272 936 | 20 381 213 | 19 070 258 | 20 294 169 | 22 231 335 | 23 354 808 | 25 206 054 | 23 822 542 |
| Externa intäkter | 24 355 272 | 28 464 614 | 30 705 935 | 31 577 133 | 30 276 021 | 26 586 224 | 24 991 127 | 24 593 559 | 35 592 568 | 30 986 749 |
| *SUMMA INTÄKTER* | *50 356 612* | *61 542 082* | *65 613 311* | *66 680 992* | *63 865 480* | *62 969 001* | *63 006 364* | *62 727 551* | *76 378 514* | *69 573 736* |
| *SUMMA KOSTNADER* | *52 922 858* | *57 673 596* | *61 807 300* | *64 157 643* | *65 447 867* | *64 506 333* | *63 266 942* | *63 664 773* | *64 732 651* | *68 769 359* |
| ÅRETS KAPITALFÖRÄNDRING | -2 566 246 | 3 868 486 | 3 806 011 | 2 523 349 | -1 582 387 | -1 537 332 | -260 578 | -937 222 | 11 645 863 | 804 377 |

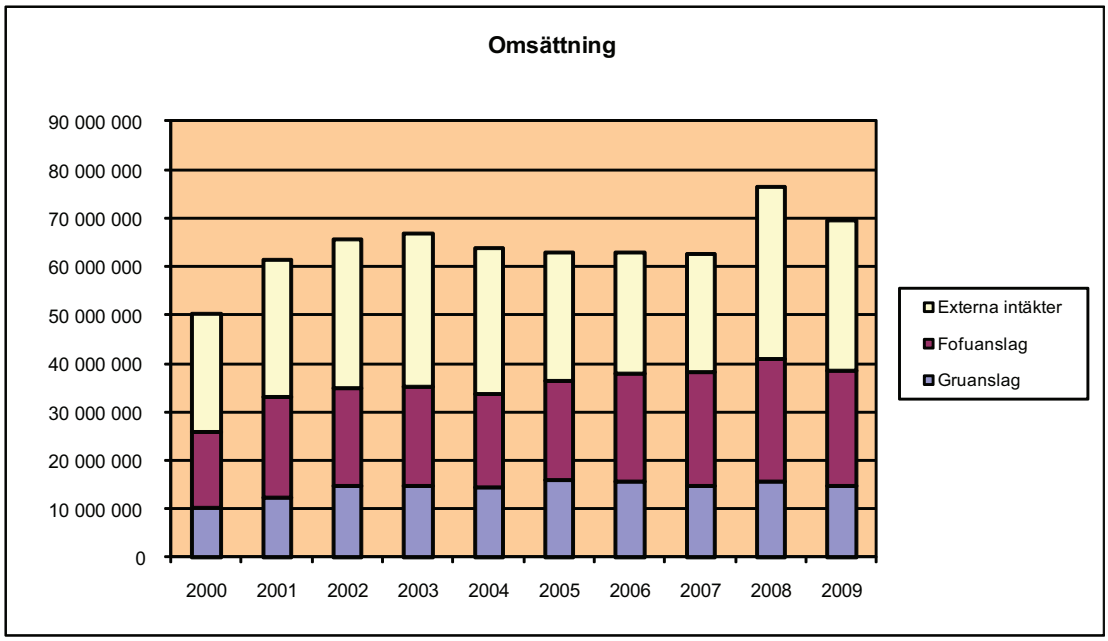


Figure 1: Turnaround in SEK during 2000–2009

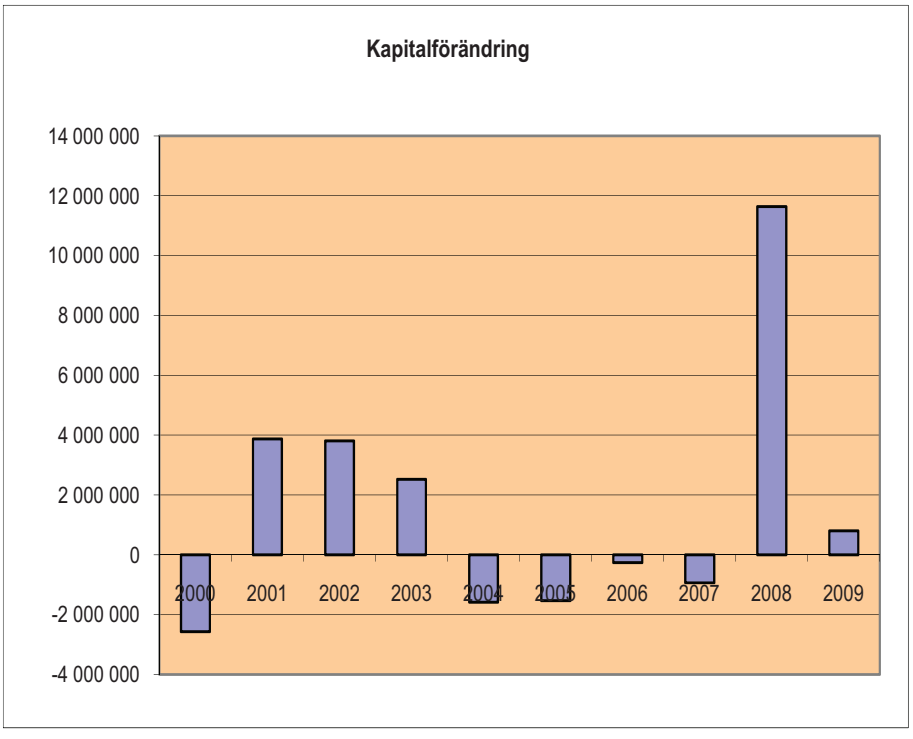


Figure 2: The surplus/deficit in SEK during 2000–2009

# 4 Teaching activities

## 4.1 Undergraduate courses

These data refer to the academic year 2009/2010.

| Progr.: Year | Code | Credit | Name | Responsible |
|---|---|---|---|---|
| **Basic courses mechanics** | | | | |
| 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 | SG2850 | 7,5 | Finite element methods | 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 | 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 2002-2009 are summarized in the following table

| **Number of students during 2002-2009** | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Courses | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | **2009** |
| Basic mechanics | 1744 | 1496 | 1504 | 1442 | 1371 | 1403 | 1232 | **1295** |
| Upper level mechanics courses | 48 | 72 | 96 | 52 | 48 | 42 | 35 | **45** |
| Fluid mechanics | 288 | 408 | 352 | 514 | 425 | 363 | 367 | **439** |
| Structural mechanics | 372 | 317 | 262 | 183 | 146 | 133 | 179 | **159** |

## 4.2 Master's thesis projects

| **Master's theses during 2009** | | |
|---|---|---|
| Name | Title | Advisor |
| Bonnet Guillaume | Modelling the table tennis ball impact over the racket | H. Essén |
| Corengia Francesco | The out-of-plane dimensional stability of paperboard in extremely dry climate | D. Söderberg |
| Deusebio Enrico | Simulations of transition with streaky base flows | P. Schlatter |
| Farina Andrea | A modified burn-out technique for measurement of local filler content in paper | D. Söderberg |
| Grützelius Kim | Analys av vattenkraftaggregats rotordynamiska egenskaper | H. Essén |
| Khavidak Sadegh Seddighi | Turbulent flow in an after-treatment system of an internal combustion engine | L. Fuchs |
| Kvick Mathias | Exploration of OpenFOAM code for flow computation and fluid-structure interaction problems | S. Wallin |
| Larsson Robin | Nonlinear optimal perturbations in plane Couette flow | L. Brandt |
| Laverty Fanny | Determination of the minimum filling ratio of the propellant tanks for horizontal transportation | A. Hanifi |
| Loven Sven Ludvig, Rosengren Per | Design of deep concrete beams using strut-and-tie, stress fields and finite element methods | G. Tibert |
| Löw Marja Liisa | Computational flow modeling of gas-particle separation in an Alfdex centrifuge for crankcase gas cleaning | H. Alfredsson |

| | | |
|---|---|---|
| Malik Amer | Aerodynamic drag reduction on a truck and trailer by modifying the under-body of the truck using computational fluid dynamics | L. Fuchs |
| Mellentien Tobias | Simulation of the receptivity and instability of three-dimensional boundary layers on a swept plate | L. Brandt |
| Merat Clement | Boundary conditions at the wall in lubrication films | L. Brandt |
| Persson Johannes | Simulations of rapid climate changes during the last ice age | E. Lindborg |
| Svensson Johan | Numerical simulation of multispark ignition | E. Lindborg |
| Wu Mingqiu | 3D simulations of fluid-particle interaction by using fictitious domain/finite element method | M. Do-Quang |

## 4.3 Graduate courses

During 2009 the following graduate courses were given. 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)
- SG2221 Wave motions and hydrodynamic stability (Brandt, Fransson)
- SG3128 Vehicle aerodynamics (Talamelli)

# 5 Research activities

## 5.1 Doctoral theses defended 2009

**Ola Lögdberg**

**Thesis title:* Turbulent boundary layer separation and control.
**Date:* January 23, 2009.
**Faculty opponent:* Prof. Guido Buresti, Universita' di Pisa.
**Evaluation committee:* Dr. Andreas Borg, Volvo Aero, Dr. Gunilla Efraimsson, KTH, Prof. Lennart Löfdahl, Chalmers.
**Main advisor:* Prof. Henrik Alfredsson.

**Stefan Ivanell**

**Thesis title:* Numerical computations of wind turbine wakes.
**Date:* February 19, 2009.
**Faculty opponent:* Prof. Joachim Peinke, Universität Oldenburg.
**Evaluation committee:* Prof. Arthus Rizzi, KTH, Dr. Helge Madsen, DTU-Risö, Prof. Lars Davidsson, Chalmers.
**Main advisor:* Prof. Dan Henningson.

**Allan Carlsson**

**Thesis title:* Near wall fibre orientation in flowing suspensions.
**Date:* March 27, 2009.
**Faculty opponent:* Prof. Helge Andersson, NTNU.
**Evaluation committee:* Prof. Staffan Toll, Chalmers, Docent Anna-Karin Tornberg, KTH, Dr. Tomas Wikström, Metso Paper.
**Main advisor:* Docent Daniel Söderberg.

**Ramis Örlü**

**Thesis title:* Experimental studies in jet flows and zero pressure-gradient turbulent boundary layers.
**Date:* June 12, 2009.
**Faculty opponent:* Dr. Timothy Nickels, University of Cambridge.
**Evaluation committee:* Prof. Rebecca Lingwood, Oxford University, Dr. Jens Österlund, FOI, Prof. Mats Sandberg, Univ. Coll. Gävle.
**Main advisor:* Prof. Henrik Alfredsson.

**Darja Ljubimova**

**Thesis title:* Biomechanics of the human eye and intraocular pressure measurements.
**Date:* November 26, 2009.
**Faculty opponent:* Docent Anders Eklund, Umeå University.
**Evaluation committee:* Prof. Anders Klarbring, LiU, Prof. Anders Olsson, Växjö University, Docent Rune Brautaset, KI.
**Main advisor:* Prof. Anders Eriksson.

## 5.2 Licentiate theses presented 2009

**Outi Tammisola**

**Thesis title:* Linear stability of plane wakes and liquid jets: global and local approach.
**Date:* April 16, 2009.
**External examiner:* Prof. Luigi di Luca, Univerity of Naples.
**Main advisor:* Docent Daniel Söderberg.

**Olle Bodin**

**Thesis title:* Numerical computations of internal combustion engine related transonic and unsteady flows.
**Date:* March 2, 2009.
**External examiner:* Dr. Daniel Lörstad, Siemens.
**Main advisor:* Prof. Laszlo Fuchs.

**Bengt Fallenius**

**Thesis title:* A new experimental setup for studies on wake flow instability and its control.
**Date:* May 6, 2009.
**External examiner:* Dr. Christoffer Norberg, LTU.
**Main advisor:* Docent Jens H. M. Fransson.

**Robert Pettersson**

**Thesis title:* Human postures and movements analysed through constrained optimization.
**Date:* June 11, 2009.
**External examiner:* Docent Hans Bergh, Karolinska University Hospital.
**Main advisor:* Prof. Anders Eriksson.

**Natalia Kosterina**

**Thesis title:* Muscular force production during non-isometric contractions: Towards numerical muscle modeling.
**Date:* June 11, 2009.
**External examiner:* Docent Ulla Svantesson, Sahlgrenska akademin.
**Main advisor:* Prof. Anders Eriksson.

**Antonios Monokrousos**

**Thesis title:* Optimisation and control of boundary layer flows.
**Date:* June 15, 2009.
**External examiner:* Prof. Per Lötstedt, Uppsala University.
**Main advisor:* Prof. Dan Henningson

**Ruoli Wang**

**Thesis title:* Biomechanical consequences of foot and ankle injury and deformity: kinematics and muscle function.
**Date:* September 24, 2009.
**External examiner:* Docent Toni Arndt, KI.
**Main advisor:* Docent Elena Gutierrez-Farewik.

**Niklas Mellgren**

**Thesis title:* Validated modelling of electrochemical energy storage devices.
**Date:* September 25, 2009.
**External examiner:* Docent Jesper Oppelstrup, KTH.
**Main advisor:* Docent Anders Dahlkild.

**Qiang Li**

**Thesis title:* Simulations of turbulent boundary layers with heat transfer.
**Date:* October 22, 2009.
**External examiner:* Dr. Ulrich Rist, Stuttgart University.
**Main advisor:* Prof. Dan Henningson

**Monika Fällman**

**Thesis title:* Turbulence measurements in fiber suspension flows: experimental method and results.
**Date:* November 11, 2009.
**External examiner:* Dr. Tomas Wikström, Metso Paper.
**Main advisor:* Prof. Fritz Bark.

**Charlotta Ahlberg**

**Thesis title:* An experimental study of fiber suspensions between counter-rotating discs.
**Date:* December 4, 2009.
**External examiner:* Docent Srdjan Sasic, Chalmers.
**Main advisor:* Docent Daniel Söderberg.

**David Tempelmann**

**Thesis title:* Stability and receptivity of three-dimensional boundary layers.
**Date:* December 14, 2009.
**External examiner:* Dr. Stefan Hein, DLR.
**Main advisor:* Prof. Dan Henningson.

**Johan Ohlsson**

**Thesis title:* Spectral-element simulations of separated turbulent internal flows.
**Date:* December 15, 2009.
**External examiner:* Docent Jesper Oppelstrup, KTH.
**Main advisor:* Prof. Dan Henningson.

**Florian von Stillfried**

**Thesis title:* Computational studies of passive vortex generators for flow control.
**Date:* December 16, 2009.
**External examiner:* Docent Sinisa Krajnovic, Chalmers.
**Main advisor:* Prof. Arne Johansson.

## 5.3 Publications 2009

### 5.3.1 Publications in archival journals


1 Ahlman D.A., Velter G.V., Brethouwer G., Johansson A.V., 2009, Direct numerical simulation of non-isothermal turbulent wall-jets, *Phys. Fluids*, **21**, 035101.

2 Bagheri S., Hoepffner J.P.J., Schmid P.J., Henningson D.S., 2009, Input-output analysis and control design applied to a linear model of spatially developing flows, *Appl. Mech. Rev.*, **62**, 020803.

3 Bagheri S., Brandt L., Henningson D.S., 2009, Input-output analysis, model reduction and control of the flat-plate boundary layer, *J. Fluid Mech.*, **620**, 263–298.

4 Bagheri S., Åkervik E.Å., Brandt L., Henningson D.S., 2009, Matrix-free methods for the stability and control of boundary layers, *AIAA J.*, **47**, 1057–1068.

5 Bagheri S., Schlatter P., Schmid P.J., Henningson D.S., 2009, Global stability of a jet in cross-flow, *J. Fluid Mech.*, **624**, 33–44.

6 Brandefelt J., Otto-Bliesner L., 2009, Equilibration and variability in a last glacial maximum climate simulation with CCSM3, *Geophys. Res. Letters*, **36**, L19712, doi:10.1029/2009GL040364.

7 Brethouwer G., Lindborg E., 2009, Numerical study of vertical dispersion by stratified turbulence, *J. Fluid Mech.*, **631**, 149–163.

8 Carlson A.C., Do-Quang M., Amberg G., 2009, Modeling of dynamic wetting far from equilibrium, *Phys. Fluids*, **21**, 121701.

9 Danielsson C., Dahlkild A. A., Velin A, Behm M, 2009, A model for the enhanced water dissociation on monopolar membranes, *Electrochimica Acta*, **54**, 2983–2991.

10 Do-Quang M., Amberg G., 2009, The splash of a solid sphere impacting on a liquid surface: Numerical simulation of the influence of wetting, *Phys. Fluids*, **21**, 022102.

11 Duguet Y., Schlatter P., Henningson D.S., 2009, Localized edge states in plane Couette flow, *Phys. Fluids*, **21**, 111701.

12 Essén H., Apazidis N., 2009, Turning points of the spherical pendulum and the golden ratio, *Eur. J. Phys.*, **30**, 427 – 432.

13 Essén H., 2009, From least action in electrodynamics to magnetomechanical energy — a review, *Eur. J. Phys.*, **30**, 515 – 539.

14 Gärdsback M., Tibert G., 2009, Deployment control of spinning space webs, *J. Guidance, Contr. Dyn.*, **32**, 40–50.

15 Hellsten, A., Wallin, S., 2009, Explicit algebraic Reynolds stress and non-linear eddy-viscosity models, *Int. J. Comp. Fluid Dyn.*, **23**, 349–361.

16 Jakusjina Linnæus, I., Thylwe, K.–E., 2009, Doubly uniform semiclassical quantization formula for resonances, *Eur. Phys. J. D*, **53**, 283–288.

17 Kosterina N., Westerblad H., Eriksson A., 2009, Mechanical work as predictor of force enhancement and force depression, *J. Biomech.*, **42**, 1628–1634.

18 Kurian T., Fransson J. H. M., 2009, Grid generated turbulence revisited, *Fluid Dyn. Res.*, **41**, 021403.

19 Li, Q., Schlatter, P., Brandt, L., Henningson, D.S., 2009, DNS of a spatially developing turbulent boundary layer with passive scalar transport, *International J. Heat Fluid Flow*, **30**, 916–929.

20 Lin Y., Shiomi J., Amberg G., 2009, Numerical calculation of the dielectrophoretic force on a slender body, *J. Electrophoresis*, **30**, 831–838.

21 Lin, Y., Shiomi, J., Maruyama, S., Amberg, G., 2009, Dielectric relaxation of water inside a single-walled carbon nanotube, *Phys. Rev. B – Condensed Matter and Materials Physics*, **80**.

22 Lindborg E., 2009, Comment on "Turbulent-condensate interactions in two dimensions", *Phys. Rev. Letters*, **102**, 149401.

23 Lindborg E., 2009, Two comments on the surface quasigeostrophic model for the atmospheric energy spectrum, *J. Atmos. Sci.*, **66**, 1069–1072.

24 Lindborg, E., Tung, K.K., Nastrom, G.D., Cho, J.Y.N., Gage, K.S., 2009, Comment on "Reinterpreting aircraft measurements in anisotropic scaling turbulence" by Lovejoy et al. (2009), *Atm. Chem. and Phys. Disc.*, **9**, 22331–22336.

25 Lindborg, E., Fedina, E., 2009, Vertical turbulent diffusion in stably stratified flows, *Geophys. Res. Letters*, **36**.

26 Lögdberg O., Fransson J. H. M., Alfredsson P.H., 2009, Streamwise evolution of longitudinal vortices in a turbulent boundary layer, *J. Fluid Mech.*, **623**, 27–58.

27 Marstorp L.M., Brethouwer G., Grundestam O., Johansson A.V., 2009, Explicit algebraic subgrid stress models with application to rotating channel flow, *J. Fluid Mech.*, **639**, 403–432.

28 Marxen, O., Lang, M., Rist, U., Levin, O., Henningson, D.S., 2009, Mechanisms for spatial steady three-dimensional disturbance growth in a non-parallel and separating boundary layer, *J. Fluid Mech.*, **634**, 165–189.

29 Nordmark A., Piiroinen P T, 2009, Simulation and stability analysis of impacting systems with complete chattering, *Nonlin. Dyn.*, **58**, 85–106.

30 Nordmark, A., Dankowicz, H., Champneys, A., 2009, Discontinuity-induced bifurcations in systems with impacts and friction: Discontinuities in the impact law, *Int. J. Non-Lin. Mech.*, **44**, 1011–1023.

31 Parsheh M., Dahlkild A. A., 2009, Mixing layers in sink flow: effect of length of flight on mixing in a channel downstream, *Flow, Turbulence and Combustion*, **82**, 407.

32 Parsheh M., Dahlkild A. A., 2009, Evolution of flat plate wakes in sink flow, *J. Fluid Mech.*, **626**, 241–262.

33 Prahl Wittberg L., Jadoon A., Revstedt J., 2009, Interaction between two spheres placed in tandem arrangement in steady and pulsating flow, *Int. J. Multiphase Flow*, **35**, 963–969.

34 Pringle C.T., Duguet Y., Kerswell R., 2009, Highly symmetric travelling waves in pipe flow, *Phil. Trans R. Soc. London A*, **367**, 457–472.

35 Rowley, C.W., Mezi, I., Bagheri, S., Schlatter, P., Henningson, D.S., 2009, Spectral analysis of nonlinear flows, *J. Fluid Mech.*, **641**, 115–127.

36 Schlatter P., Örlü R., Li Q., Fransson J. H. M., Johansson A.V., Alfredsson P.H., Henningson D.S., 2009, Turbulent boundary layers up to $\mathrm{Re}_\theta = 2500$ studied through simulation and experiment, *Phys. Fluids*, **21**, 051702.

37 Schrader L.–U., Brandt L., Henningson D.S., 2009, Receptivity mechanisms in three-dimensional boundary-layer flows, *J. Fluid Mech.*, **618**, 209–241.

38 Talamelli A., Persiani F., Fransson J. H. M., Alfredsson P.H., Johansson A.V., Nagib H.M., Ruedi J. D., Sreenivasan K. R., Monkewitz P. A., 2009, CICLoPE – a response to the need for high Reynolds number experiments, *Fluid Dyn. Res.*, **41**, 021407.

39 Thylwe,K.–E., 2009, Bound Dirac states, different Lorentz-type couplings of central potentials and the non-relativistic limit, *Eur. Phys. J. D*, **54**, 591–596.

40 Törnblom O., Lindgren B., Johansson A.V., 2009, The separating flow in a plane asymmetric diffuser with 8.5° opening angle: mean flow and turbulence statistics, temporal behaviour and flow structures., *J. Fluid Mech.*, **636**, 337–370.

41 Villanueva, W., Boettinger, W.J., Warren, J.A., Amberg, G., 2009, Effect of phase change and solute diffusion on spreading on a dissolving substrate, *Acta Materialia*, **57**, 6022–6036.

42 Villanueva, W., Grönhagen, K., Amberg, G., Ågren, J., 2009, Multicomponent and multiphase simulation of liquid-phase sintering, *Comp. Mat. Sci.*, **47**, 512–520.

43 Vynnycky, M., Shugai, G., Yakubenko, P., Mellgren, N., 2009, Asymptotic reduction for numerical modeling of polymer electrolyte fuel cells, *SIAM J. Appl. Math.*, **70**, 455–487.

### 5.3.2 Other publications

44 Ahlberg C.A., Lundell F., Söderberg D., 2009, Self-organization of fibers in a suspension between two counter-rotating discs, *In proc. of: "FEDSM2009, ASME Fluids Engineering Division Summer Meeting", August 2009, Vail, CO.*

45 Ahlman D, Brethouwer G., Johansson A.V., 2009, Direct numerical simulations of non-isothermal and reacting wall-jets. *In Proc. TSFP6 (pp 947-952), Seoul June 22-25, 2009.*

46 Alfredsson P.H., Örlü R., Kurian T., Fransson J. H. M., Segalini A. S., Ruedi J. D., Talamelli A., 2009, The diagnostic plot: a new way for appraisal of turbulent boundary layer data, *Advances in Turbulence XII, Proc. 12th EUROMECH ETC, Sept. 7-10, 2009, Marburg, Germany*, 609-612.

47 Bellani G., Imagawa, Higuchi H., Lundell F., Hayase, 2009, Measurement-integrated simulations applied to the case f a planar co-flowing jet: results and experimental validation, *4th Symposium on Integrating CFD and Experiments in Aerodynamics, September 2009, Rhode-Saint-Genes, Belgium.*

48 Bellani G., Imagawa, Higuchi H., Lundell F., Hayase, 2009, Experimental evaluation of a CFD-based flow observer applied to the case of a turbulent jet in a co-flowing stream.

49 Brethouwer G., Lindborg E., 2009, Investigation of fluid particle dispersion in stably stratified turbulence, *Turbulence and Shear Flow Phenomena - 6*, 1160-1165.

50 Brethouwer G., Lindborg E., 2009, Numerical simulations of particle dispersion in stratified flows, *Advances in Turbulence XII, Proc. 12th EUROMECH ETC, Sept. 7-10, 2009, Marburg, Germany*, **12**, 51-54.

51 Duguet Y., Schlatter P., Henningson D.S, 2009, Stripy patterns in low-Re turbulent plane Couette flow, *Proc. Seventh IUTAM Symposium on Laminar-Turbulent Transition, Stockholm, Sweden, 2009*, 159-164.

52 Duguet Y., Schlatter P., 2009, Large-scale pattern formation in transitional Couette flow, *Advances in Turbulence XII, Proc. 12th EUROMECH ETC, Sept. 7-10, 2009, Marburg, Germany*, 93-96.

53 Fransson J. H. M., Hutchins N., Örlü R., Chong M., 2009, Turbulence measurements with hot wires in high reynolds number boundary layers, *Bulletin of the American Physical Society, 62nd Annual Meeting of the APS Division of Fluid Dynamics, Volume 54, Number 19, November 22–24, 2009, Minneapolis, Minnesota.*

54 Hanifi A., Amoignon O., Pralits J. O., Chevalier M., 2009, A gradient-based optimization method for natural laminar flow, *Proc. of the Seventh IUTAM Symposium on Laminar-Turbulent Transition, Stockholm, Sweden, 2009*, 3-10.

55 Hein S., Schulein E., Hanifi A., Sousa J., Arnal D., 2009, Laminar flow control by suction at Mach 2, *Proc. of the Seventh IUTAM Symposium on Laminar-Turbulent Transition, Stockholm, Sweden, 2009*, 189-194.

56 Hellstrom, F., Fuchs, L., 2009, Numerical computation of the pulsatile flow in a turbocharger with realistic inflow conditions from an exhaust manifold, *Proc. ASME Turbo Expo*, **7, PART B**, 1317–1329.

57 Imayama S.I., Yamamoto Y.Y., Tsuji Y.T., 2009, Coherent structures and their contribution to energy transfer in turbulent channel flow, *The Sixth International Symposium on Turbulence and Shear Flow Phenomena, June 22 - 24, 2009, Seoul National University, Seoul, Korea*, **1**, 165-168.

58 Kurian T., Fransson J. H. M., 2009, New results on grid-generated turbulence, *Advances in Turbulence XII, Proc. 12th EUROMECH ETC, Sept. 7-10, 2009, Marburg, Germany.*

59 Kurian T., Fransson J. H. M., Alfredsson P.H., 2009, Evolution of traveling crossflow modes over a swept flat plate, *Proc. of the Seventh IUTAM Symposium on Laminar-Turbulent Transition, Stockholm, Sweden, 2009*, **18**.

60 Li Q., Schlatter P., Henningson D.S, 2009, Simulations of heat transfer in a boundary layer subject to free-stream turbulence, *Turbulence and Shear Flow Phenomena - 6*, **I**.

61 Lundell F., Monokrousos A M, Brandt L., 2009, Feedback control of boundary layer bypass transition: experimental and numerical progress, *47th AIAA Aerospace Sciences Meeting, Orlando, FL.*

62 Lundell F., Bellani G., Söderberg D., 2009, Exploring the secrets of forming: particle image velocimetry in a scaled and index-of-refraction matched fibre suspension, *Papermaking Research Symposium, June 2009, Kuopio, Finland.*

63 Lundell F., Monokrousos A M, Brandt L., 2009, Experimental and numerical flow control of bypass transition, *6th International Conference on Flow Dynamics, November 2009, Sendai, Japan.*

64 Mylavarapu G., Mihaescu M., Gutmark E., Murugappan S., Prahl Wittberg L., Fuchs L., Papatziamos G., 2009, Importance of paranasal sinuses in computational modeling of nasal air flow, *47th AIAA Aerospace Sciences Meeting and Exhibit, Jan 5-8, 2009, Orlando, Florida, USA.*

65 Pouransari Z. P., Velter G.V., Ahlman D.A., Brethouwer G., Johansson A.V., 2009, Direct numerical simulationis of non-isothermal and reacting wall-jets, *Turbulence and Shear Flow Phenomena - 6*, 947-952.

66 Rehill B., Walsh E J, Schlatter P., Brandt L., Nolan K., Henningson D.S, Mc Eligot D M, 2009, Entropy generation rate in turbulent spots in a boundary layer subject to free stream turbulence, *Proc. Seventh IUTAM Symposium on Laminar-Turbulent Transition, Stockholm, Sweden, 2009*, 557-560.

67 Rowley W., Mezic, Bagheri S., Schlatter P., Henningson D.S., 2009, Reduced-order models for flow control: balanced models and Koopman modes, *Proc. Seventh IUTAM Symposium on Laminar-Turbulent Transition, Stockholm, Sweden, 2009*, 43-50.

68 Rüedi J.D., Duncan R.D., Imayama S.I., Chauhan K.C., 2009, Accurate and independent measurements of wall-shear stress in turbulent flows, *Bulletin of the American Physical Society, 62nd Annual Meeting of the APS Division of Fluid Dynamics, Volume 54, Number 19, November 22–24, 2009, Minneapxxxx olis, Minnesota.*

69 Schlatter P., Li Q., Brethouwer G., Johansson A.V., Henningson D.S, 2009, Towards large-eddy simulations of high-Reynolds number turbulent boundary layers, *Turbulence and Shear Flow Phenomena - 6*, 271-276.

70 Schlatter P., Deusebio E.D., Brandt L., De Lange H. C., 2009, Interaction of noise disturbances and streamwise streaks, *Proc. Seventh IUTAM Symposium on Laminar-Turbulent Transition, Stockholm, Sweden, 2009*, 355-360.

71 Schlatter P., Brandt L., De Lange H. C., 2009, Interaction of noise disturbances and streamwise streaks, *Advances in Turbulence XII, Proc. 12th EUROMECH ETC, Sept. 7-10, 2009, Marburg, Germany*, 151-154.

72 Schrader L.-U., Brandt L., Mavriplis C, Henningson D.S, 2009, Flow past a plate with elliptic leading edge: layer response to free-stream vorticity, *Proc. of the Seventh IUTAM Symposium on Laminar-Turbulent Transition, Stockholm, Sweden, 2009*, 565-568.

73 Segalini A. S., Örlü R., Talamelli A., Alfredsson P.H., 2009, The effect of oblique waves on jet turbulence, *Progress in Turbulence III, Proc. iTi Conference in Turbulence 2008*, 231-234.

74 von Stillfried F., Lögdberg O., Wallin S., Johansson A.V., 2009, Statistical modeling of the influence of turbulent flow separation control devices, *47th AIAA Aerospace Sciences Meeting, Orlando, FL*, **AIAA-2009-1501**.

75 von Stillfried F., Wallin S., Johansson A.V., 2009, Application of a statistical vortex generator model approach on the short-chord flap of a three-element airfoil, *KATnet II conference on Key Aerodynamic Technologies, Bremen, Germany, 2009.*

76 von Stillfried F., Wallin S., Johansson A.V., 2009, Statistical modeling of vortex generators in pressure gradient boundary layers, *The Sixth International Symposium on Turbulence and Shear Flow Phenomena, June 22 - 24, 2009, Seoul National University, Seoul, Korea.*

77 Strömgren T., Brethouwer G., Amberg G., Johansson A.V., 2009, A study of particle feedback in turbulent gas-particle flows, *7th World Conference on Experimental Heat Transfer, Fluid Mechanics and Thermodynamics, June 28 – July 3, 2009, Krakow, Poland*, 1633-1640.

78 Strömgren T., Brethouwer G., Amberg G., Johansson A.V., 2009, A modelling study of evolving particle-laden turbulent pipe-flow, *Turbulence, Heat and Mass Transfer 6, Rome, Sept. 2009*, 713-716.

79 Summerer, L., Purcell, O., Vasile, M., Tibert, G., Kaya, N., 2009, Making the first steps towards solar power from space — Microgravity experiments testing the deployment of large antennas, *60th Int. Astronautical Congress 2009, IAC 2009*, **8**, 6133–6140.

80 Söderholm, L.H., 2009, On the relation between the Hilbert and Chapman-Enskog expansions, *AIP Conf. Proc.*, **1084**, 81–86.

81 Tammisola O., Lundell F., Söderberg D., 2009, Effect of confinement on wake instability: comparison of local, global linear and nonlinear methods, *6th International Conference on Flow Dynamics, November 2009, Sendai, Japan.*

82 Tammisola O., Lundell F., Söderberg D., 2009, Global stability of a plane liquid jet surrounded by gas, *Proc. Seventh IUTAM Symposium on Laminar-Turbulent Transition, Stockholm, Sweden, 2009.*

83 Tempelmann D.T., Hanifi A., Henningson D.S, 2009, Spatial optimal disturbances in three-dimensional boundary layers, *Proc. Seventh IUTAM Symposium on Laminar-Turbulent Transition, Stockholm, Sweden, 2009*, 589-592.

84 Wallin S., Grundestam O.G., Johansson A.V., 2009, Stabililty and laminarisation of turbulent rotating channel Flow, *Advances in Turbulence XII, Proc. 12th EUROMECH ETC, Sept. 7-10, 2009, Marburg, Germany*, **12**, 177-178.

85 Wang R.L., Gutierrez-Farewik E.M., 2009, The effect of excessive subtalar inversion/eversion on the dynamic function of the soleus and gastrocneumius during the stance phase.

86 Örlü R., Segalini A. S., Alfredsson P.H., Talamelli A., 2009, Turbulence enhancement in coaxial jet flows by means of vortex shedding, *Progress in Turbulence III, Proc. iTi Conference in Turbulence 2008*, 235-238.

87 Örlü R., Fransson J. H. M., Alfredsson P.H., 2009, On imperfect hot-wire resolution issues and their effect on mean quantities, *Advances in Turbulence XII, Proc. 12th EUROMECH ETC, Sept. 7-10, 2009, Marburg, Germany*, 605-608.

88 Örlü R., Hutchins N., Kurian T., Talamelli A., 2009, Challenges in hot wire measurements in wall-bounded turbulent flows, *Bulletin of the American Physical Society, 62nd Annual Meeting of the APS Division of Fluid Dynamics, Volume 54, Number 19, November 22–24, 2009, Minneapolis, Minnesota.*

### 5.3.3 Technical reports (TRITA)

89 Ahlberg C.A., 2009, An experimental study of fiber suspensions between counter-rotating discs, *Licentiate thesis*, KTH/MEK/TR–09/16–SE.

90 Bodin O., 2009, Numerical computations of internal combustion engine related transonic and unsteady flows, *Licentiate thesis*, KTH/MEK/TR–09/02–SE.

91 Carlsson A., 2009, Near wall fibre orientation in flowing suspensions, *Doctoral thesis*, KTH/MEK/TR–09/03–SE.

92 Fallenius B.E.G., 2009, A new experimental setup for studies on wake flow instability and its control, *Licentiate thesis*, KTH/MEK/TR–09/05–SE.

93 Fällman M., 2009, Turbulence measurements in fiber suspension flows: experimental method and results, *Licentiate thesis*, KTH/MEK/TR–15–SE.

94 Ivanell S., 2009, Numerical computations of wind turbine wakes, *Doctoral thesis*, KTH/MEK/TR–09/01–SE.

95 Kosterina N., 2009, Muscular force production during non-isometric contractions: Towards numerical muscle modeling, *Licentiate thesis*, KTH/MEK/TR–09/07–SE.

96 Li Q., 2009, Simulations of turbulent boundary layers with heat transfer, *Licentiate thesis*, KTH/MEK/TR–09/14–SE.

97 Ljubimova D., 2009, Biomechanics of the human eye and intraocular pressure measurements, *Doctoral thesis*, KTH/MEK/TR–09/10–SE.

98 Mellgren N., 2009, Validated modelling of electrochemical energy storage devices, *Licentiate thesis*, KTH/MEK/TR–09/12–SE.

99 Monokrousos A.M., 2009, Optimisation and control of boundary layer flows, *Licentiate thesis*, KTH/MEK/TR–09/09–SE.

100 Ohlsson J.O., 2009, Spectral-element simulations of separated turbulent internal flows, *Licentiate thesis*, KTH/MEK/TR–09/13–SE.

101 Pettersson R., 2009, Human postures and movements analysed through constrained optimization, *Licentiate thesis*, KTH/MEK/TR–09/06–SE.

102 von Stillfried F., 2009, Computational studies of passive vortex generators for flow control, *Licentiate thesis*, KTH/MEK/TR–09/18–SE.

103 Tammisola O., 2009, Linear stability of plane wakes and liquid jets: global and local approach, *Licentiate thesis*, KTH/MEK/TR–09/04–SE.

104 Tempelmann D.T., 2009, Stability and Receptivity of Three-Dimensional Boundary Layers, *Licentiate thesis*, KTH/MEK/TR–09/19–SE.

105 Tysell L., 2009, Hybrid grid generation for viscous flow computations around complex geometries *Doctoral thesis*, KTH/MEK/TR–09/17–SE.

106 Wang R.L., 2009, Biomechanical consequences of foot and ankle injury and deformity: kinematics and muscle function, *Licentiate thesis*, KTH/MEK/TR–09/11–SE.

107 Örlü R., 2009, Experimental studies in jet flows and zero pressure-gradient turbulent boundary layers, *Doctoral thesis*, KTH/MEK/TR–09/08–SE.

## 5.4 Seminars at the department

**Seminars given at KTH**

*January 22* Guido Buresti, Universita' di Pisa
Flow fluctuations and vorticity dynamics in the near wake of triangular prisms in cross-flow.

*January 23* Ola Lögdberg, KTH Mechanics
Turbulent boundary layer separation and control.

*February 5* Outi Tammisola, KTH Mechanics
Global modes in plane wakes and liquid sheets.

*February 12* Denis Sipp, Onera
Open loop control of wake flows with adjoint methods.

*February 18* Joachim Peinke, Oldenburg University
Impact of turbulence on the wind energy conversion.

*February 19* Stefan Ivanell, KTH Mechanics
Numerical computations of wind turbine wakes.

*February 26* Thorsten Mauritsen, Stockholm University
Causes for recent Arctic climate change.

*March 5* Antonios Monokrousos, KTH Mechanics
Global optimal disturbances in the Blasius flow using time-steppers.

*March 12* Philippe Meliga, Ecole Polytechnique
Global modes for the dynamics and control of afterbody flows.

*March 19* Christoph Bruecker, TU Freiberg
Near wall flow and wall shear measurements in turbulent boundary layer flows.

*March 27* Allan Carlsson, KTH Mechanics
Near wall fibre orientation in flowing suspensions.

*April 2* Malte Kjellander, KTH Mechanics
Temperature measurements of light emission in imploding polygonal shock.

*April 8* Yohann Duguet, KTH Mechanics
Localised patterns in transitional shear flows: pipe flow and plane Couette flows.

*April 16* Outi Tammisola, KTH Mechanics
Linear stability of plane wakes and liquid jets: global and local approach.

*April 21* Predrag Cvitanovic, Georgia Tech
Invariant solutions and state-space dynamics in wall-bounded flows.

*April 30* Qiang Li, KTH Mechanics
Numerical simulation of the heat transfer in a turbulent boundary layer.

*May 5* Hiroshi Higuchi, Syracuse University
Separated flow control and bluff-body wake.

*May 6* Bengt Fallenius, KTH Mechanics
A new experimental setup for studies on wake flow instability and its control.

*May 8* Luciano Mariella, Ferrari F1 GeS
The role of CFD in the aerodynamic design of a Ferrari Formula 1 car.

*May 11* Zhensu She, Peking University
Universal hierarchical symmetry for turbulence and general multi-scale fluctuation systems.

*May 12* Nils van Hinsberg, TU Darmstadt
Spray and drop impact onto films of finite thickness: dynamics of the crater and the fluctuating film.

*May 14* Carlo Cossu, Ecole Polytechnique
Spherical cap bubbles with a toroidal bubbly wake.

*May 20* Jens H. M. Fransson, KTH Mechanics
Turbulent patch evolution in spatially steady boundary layers.

*May 26* Karl Bolin, KTH MWL
Wind turbine noise and natural sounds - masking, propagation and modelling.

*May 27* Gunnar Tibert, KTH Mechanics
Centrifugalkraftsutfällning av en flexibel rymdstruktur.

*May 28* Ramis Örlü, KTH Mechanics
Wall-bounded turbulent flows - revisited.

*June 3* Yves Auregon, Université du Maine
Aeroacoustic instability in a channel with a compliant and locally reacting wall.

*June 4* David Tempelmann, KTH Mechanics
Spatial optimal growth in three-dimensional boundary layers.

*June 11* Timothy Nickels, University of Cambridge
New developments in turbulent boundary layer research.

*June 12* Ramis Örlü, KTH Mechanics
Experimental studies in jet flows and zero pressure-gradient turbulent boundary layers.

*June 12* Kunihiko Taira, Princeton University
Simulation and control of flows around low-aspect-ratio wings.

*June 25* Timothy Barth, NASA Ames
Recent experiences in space-time FEM error representation in time for compressible flow.

*August 17* Pinhas Bar-Yoseph, Technion
Biomechanics review seminar on novel computational methods for simulation of wound healing and analysis of arterial and metabolic disease.

*September 3* Lisa Prahl Wittberg, KTH Mechanics
Hydrodynamical interaction among spherical particles.

*September 15* Oliver Paschereit, TU-Berlin
Recent progress in combustion and flow control.

*September 17* Toshiyuki Oyama, University of Tokyo
Surface tension effect on a single bubble bouncing on a free surface with a front-tracking method.

*September 24* Erich Becker, Leibniz-Institut für Atmosphärenphysik
Hydrodynamic conservation laws and turbulent friction in atmospheric circulation models.

*September 25* Niklas Mellgren, KTH Mechanics
Validated modelling of electrochemical energy storage devices.

*October 1* Tobias Strömgren, KTH Mechanics
Modelling of turbulent gas-particle flow.

*October 8* Florian von Stillfried, KTH Mechanics
Evaluation of a vortex generator model in adverse pressure gradient boundary layers.

*October 22* Qiang Li, KTH Mechanics
Simulations of turbulent boundary layers with heat transfer.

*October 23* Ulrich Rist, University of Stuttgart
Interaction of vortices and shear layers in viscous fluid flows.

*November 5* Pavel Kudinov, KTH Nuclear Power Safety
Particle-based methods for fluid dynamics, or can validation be an obstacle for scientific progress?.

*November 11* Monika Fällman, KTH Mechanics
Turbulence measurements in fiber suspension flows: experimental methods and results.

*November 12* Daniel Bodony, University of Illinois at Urbana-Champaign
Aeroacoustic predictions in complex geometries.

*November 19* Andreas Vallgren, KTH Mechanics
Numerical simulations of two-dimensional turbulence.

*November 26* Axel Kierkegaard, Aero
Prediction of acoustic wave propagation and whistling potentiality in Low Mach

number flow ducts.

*December 3* Peter Davidson, University of Cambridge
Structure formation in rotating turbulence.

*December 4* Charlotte Ahlberg, KTH Mechanics
An experimental study of fibre-suspensions between counter rotating discs.

*December 14* David Tempelmann, KTH Mechanics
Stability and receptivity of three-dimensional boundary layers.

*December 15* Johan Ohlsson, KTH Mechanics
Spectral-element simulations of separated turbulent internal flows.

*December 16* Florian von Stillfried, KTH Mechanics
Computational studies of passive vortex generators for flow control.

*December 17* John Fitzpatrick, Trinity College Dublin
Measurement and analysis of turbulent length scales in jet flows.