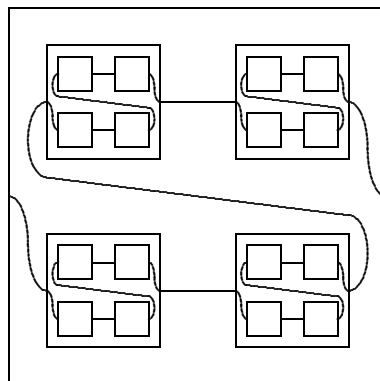


**Department of Mathematics
University of Helsinki
Annual Report 2002**



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Annual Report 2002**

EDITED BY
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1. OVERALL VIEW

The Department of Mathematics of the University of Helsinki is part of the Faculty of Science. It is located in the office building Heimola (Yliopistonkatu 5) in the centre of Helsinki.

In 2002 the teaching faculty comprised a full time staff of 32; this consists of 14 professors, 9 lecturers, 7 assistants, and 2 instructors. Previously the professorships were divided into two categories, professorships and associate professorships; this terminology was changed in 1998. There were about 10–15 teachers on a part-time basis in 2002. The department had 63 docents (in 2002, two new docents were appointed). The department accommodates researchers and foreign visiting scholars funded by the Academy of Finland and other external sources. The administrative, library, and technical staff consists of 7 persons.

The department admits annually around 200 students to major in mathematics. They can choose between four curricula: mathematics, mathematics teacher, applied mathematics, and computer mathematics curriculum. The degrees are the newly reintroduced B.Sc. degree, the M.Sc. degree, the Ph.Lic. degree, and the Ph.D. degree. In the fall term 2002, 1178 students were majoring in mathematics. In addition there were 87 postgraduate students. Of the postgraduate students 58 worked at the department as assistants or as researchers financed by the university, the Academy of Finland, the graduate schools, or a private grant. During the year, 35 students took M.Sc. degree, 6 took Ph.Lic. degree, and 5 took Ph.D. degree. The total amount of credit points awarded to students was 13198.

The department gives ancillary courses in mathematics for students of physics, chemistry, and computer science. Students in many other degree programmes, in all the faculties, take mathematics courses as well. This strong methodological and service character of the department is reflected in the fact that around fifty percent of the yearly credit points are attributed to students minoring in mathematics.

In 2002 the department was participating in three graduate schools: one in mathematical analysis and logic, one in stochastics, and one in inverse problems.

In the teaching of applied mathematics the department has cooperated with Rolf Nevanlinna Institute and some industrial companies. The department has a postgraduate programme in industrial mathematics which is a part of the European programme ECMI.

The main research areas at the department are analysis, mathematical physics, transformation groups, mathematical logic, stochastics, and algebraic geometry. The researchers of the department collaborate with mathematicians from other Finnish universities and more than 40 foreign universities and research institutes. The staff of the department took part in 13 research projects funded by the Academy of Finland and in five network projects funded by the European Union.

During the fall term 1999 an evaluation of research was carried out in the whole University of Helsinki. The Department of Mathematics achieved the highest grade in this evaluation. In the year 2000 an evaluation of research was carried out by the Academy of Finland in all mathematics departments in Finnish universities. In 2001, the Research Unit of Geometric Analysis and Mathematical Physics was selected by the Academy of Finland as a centre of excellence in research for the years 2002–2007.

In 2002 the researchers of the department published 83 refereed papers in journals and conference proceedings. Research to appear soon, or surveyed, was reported

in 28 preprints and 82 communications in mathematical meetings and seminars. The department has a preprint series of its own; in 2002 there appeared numbers 313–339.

The library of the department has a collection of about 45000 bindings. In 2002 the library received 380 titles of periodicals and reports. In addition, many electronic information facilities are available. The library, being the largest mathematical library in Finland, also serves other Finnish universities.

The department has over 100 microcomputers, of which 19 are available to the students in two microcomputer classrooms. The computers are in daily use for text processing, typesetting, communication with foreign research institutions, and running mathematical programs, numerical or symbolical, also in supercomputers via nets.

The international journal *Annales Academiae Scientiarum Fennicae Mathematica* is edited in the department. The Finnish Mathematical Society has its office at the department. Teachers of the department have been responsible for the national activity of the International Mathematical Olympiads (IMO).

The department has representatives in various national organizations, for example the Matriculation Examination Board. There are also many international organizational contacts. The department has a member in the Board of the Mittag-Leffler Institute (Sweden) since 1986. The European Mathematical Society (EMS) is registered in Finland and has its office at the department. The treasurer of the EMS is a professor of the department.

In 2002 four students of the department participated in the SOKRATES/ERASMUS student exchange program, two in the NORDPLUS program, and one in the ISEP program; the department received three foreign students in the SOKRATES/ERASMUS program and one outside the programs.

In 2002 work has also been done to improve the www-homepages of the department. The address is <http://www.math.helsinki.fi>, where also this annual report can be found.

2. STAFF

2.1. REGULAR STAFF

Analysis.

Andersson, Leif, Ph.D., Acting university lecturer
 Astala, Kari, Ph.D., Professor
 Harjulehto, Petteri, Ph.D., Assistant
 Holopainen, Ilkka, Ph.D., Acting professor
 Hurri-Syrjänen, Ritva, Ph.D., University lecturer
 Kankaanpää, Jouni, Ph.D., Instructor
 Koskenoja, Mika, Ph.D., Acting university lecturer
 Kupiainen, Antti, Ph.D., Professor, Academy professor
 Martio, Olli, Ph.D., Professor
 Mickelsson, Jouko, Ph.D., Professor, on leave
 Näätänen, Marjatta, Ph.D., Lecturer
 Partanen, Juha V., Ph.D., Acting university lecturer
 Rickman, Seppo, Ph.D., Emeritus professor
 Seppälä, Mika, Ph.D., Professor

Toppila, Sakari, Ph.D., Professor
 Tukka, Pekka, Ph.D., Professor
 Tylli, Hans-Olav, Ph.D., University lecturer, Academy research fellow
 Väisälä, Jussi, Ph.D., Emeritus professor
 Vuorinen, Matti, Ph.D., Acting professor

Topology.

Elfving, Erik, Ph.D., Acting assistant
 Honkasalo, Hannu, Ph.D., Acting professor
 Illman, Sören, Ph.D., Professor (Swedish)
 Junnila, Heikki, Ph.D., Acting professor
 Kanerva, Okko, Ph.D., Acting university lecturer
 Luukkainen, Jouni, Ph.D., Acting senior assistant

Algebra.

Pihko, Jukka, Ph.D., Instructor
 Suominen, Kalevi, Ph.D., Professor

Mathematical logic.

Huuskonen, Taneli, Ph.D., Acting university lecturer
 Kennedy, Juliette, Ph.D., Acting university lecturer
 Luosto, Kerkko, Ph.D., University lecturer
 Nurmonen, Juha, Ph.D., Acting university lecturer
 Oikkonen, Juha, Ph.D., Research lecturer
 Ruokolainen, Juha, Ph.Lic., Acting assistant
 Väänänen, Jouko, Ph.D., Professor
 Väisänen, Pauli, Ph.D., Doctor-assistant

Stochastics and mathematical statistics.

Mäkeläinen, Timo, D.Pol.Sc., Professor
 Nummelin, Esa, D.Tech., Professor
 Nyrhinen, Harri, Ph.D., Lecturer
 Valkeila, Esko, Ph.D., Acting professor

Applied analysis.

Lahtinen, Aatos, Ph.D., Professor
 Lamberg, Lars, Ph.D., Instructor
 Malmivuori, Markku, Ph.D., Acting assistant

2.2. OTHER TEACHERS AND RESEARCHERS

The following abbreviations are used: AF = Academy of Finland, EU = European union, GS = graduate school, pg = grant from a private foundation, UH = grant from the University of Helsinki.

Alestalo, Pekka, Ph.D., Docent
 Arponen, Heikki, M.Sc., Researcher (AF)
 Blomster, Toni, M.Sc., Researcher (AF)
 De Simone, Emiliano, M.Sc., Researcher (AF)
 Djordjević, Marko, Ph.D., Doctor-researcher

Ekman, Åsa, Teaching assistant
 Eloranta, Kari, Ph.D., Researcher (AF)
 Erkkilä, Paula, M.Sc., Teaching assistant
 Ernvall, Anne-Maria, Teaching assistant
 Falk, Kurt, Ph.D., Researcher (pg)
 Faraco, Daniel, Ph.D., Researcher (AF)
 García-Matos, Marta, M.Sc., Researcher (AF, UH)
 Gasbarra, Dario, Ph.D., Teaching assistant
 Goebel, Roman, M.Sc., Researcher (GS)
 Golińska, Joanna, M.Sc., Researcher (pg, UH)
 Granlund, Seppo, Ph.D., Docent
 Gutlyanskii, Vladimir, Ph.D., Visiting professor
 Haario, Heikki, Ph.D., Docent
 Hakulinen, Ville, Ph.D., Researcher (AF)
 Halko, Aapo, Ph.D., Researcher (AF)
 Hämäri, Severi, Fee-paid teacher
 Hänninen, Teemu, Ph.Lic., Researcher (pg), Teaching assistant
 Hästö, Peter, Ph.Lic., Researcher (GS, AF)
 Heikkala, Ville, Ph.Lic., Researcher (GS)
 Hella, Lauri, Ph.D., Docent
 Hellsten, Alex, Ph.Lic., Doctor-researcher (AF)
 Hohti, Aarno, Ph.D.
 Hyry, Eero, Ph.D., Academy research fellow (AF)
 Hyttinen, Tapani, Ph.D., Academy research fellow (AF)
 Ioanitescu, Oana, M.Sc., Researcher (GS)
 Järvilehto, Tarmo, Ph.Lic., Researcher (AF)
 Järvinen, Matti, Researcher (AF)
 Jost, Céline, Dipl.Math., Researcher (GS, EU)
 Kaila, Rakel, Ph.Lic., Researcher (GS)
 Kaila, Risto, Ph.D., Teaching assistant
 Karttunen, Einar, Civilservice man
 Kauppinen, Risto, Ph.Lic., Researcher (pg), Teaching assistant
 Keith, Stephen, Ph.D., Researcher
 Kinnunen, Juha, Ph.D., Docent
 Kontinen, Juha, M.Sc., Researcher (GS)
 Korppi, Tuomas, Ph.Lic., Teaching assistant
 Koriseva, Eija, M.Sc. (Eng.), Teaching assistant
 Korvola, Timo, M.Sc. (Eng.), Researcher (AF)
 Kuusela, Mikko, Ph.Lic., Researcher (GS)
 Kytölä, Kalle, Researcher (AF)
 Laakso, Tomi, M.Sc., Researcher (GS)
 Lahtinen, Anssi, M.Sc., Researcher (AF)
 Laine, Marko, Ph.Lic., Researcher (AF), Fee-paid teacher
 Laitila, Jussi, M.Sc., Researcher (AF)
 Lehtinen, Matti, Ph.D., Docent
 Lehto, Olli, Ph.D., Academician, Emeritus professor
 Lehto, Pertti, Ph.D., Fee-paid teacher
 Lehto, Saara, Teaching assistant
 Lehtonen, Tapani, Ph.D., Docent

Li Gongbao, Docent, Visiting professor
 Lindén, Henri, M.Sc., Teaching assistant
 Lounesto, Pertti, D.Tech., Docent
 Lukkarinen, Jani, Ph.D., Researcher (AF)
 Mäkelä, Tuomas, Teaching assistant
 Mäkinen, Jukka, Ph.D., Fee-paid teacher
 Mikkonen, Jari, Fee-paid teacher
 Muratore-Ginanneschi, Paolo, Ph.D., Researcher (AF)
 Natarajan, Deepak, Software engineer
 Nieminen, Pekka, M.Sc., Researcher (AF), Fee-paid teacher
 Niemistö, Hannu, M.Sc., Researcher (UH)
 Nietula, Kalle, Researcher (AF)
 Norros, Ilkka, Ph.D., Docent
 Oinonen, Lotta, Teaching assistant
 Ojala, Lauri, M.Sc., Researcher (AF)
 Päivärinta, Lassi, Ph.D., Docent
 Pankka, Pekka, Ph.Lic., Researcher (AF),
 Pauna, Matti, Ph.Lic., Researcher
 Pere, Mikko, Ph.Lic., Researcher (GS)
 Pitkänen, Matti, M.Sc., Researcher (EU)
 Pitkänen, Timo, M.Sc., Fee-paid teacher
 Poikonen, Vesa, Researcher (AF)
 Rasila, Antti, M.Sc., Researcher (UH, AF), Teaching assistant
 Ravaioli, Elena, M.Sc., Researcher
 Rinkinen, Simo, Teaching assistant
 Saksman, Eero, Ph.D., Docent
 Sanchez, Juan, Teaching assistant
 Saria, Maria, M.Sc., Researcher (pg)
 Schenkel, Alain, Ph.D., Researcher (AF)
 Sottinen, Tommi, M.Sc., Researcher (GS)
 Stenlund, Mikko, M.Sc. (Eng.), Researcher (AF)
 Sugawa, Toshiyuki, Ph.D., Visiting professor
 Tähtinen, Vesa, M.Sc., Researcher (AF)
 Tammi, Olli, Ph.D., Emeritus professor
 Taskinen, Jari, Ph.D., Docent
 Toepfer, Eljas, Researcher (AF)
 Vainio, Juhani, Ph.D., Teaching assistant
 Vesanen, Tiina, M.Sc., Teaching assistant
 Viljanen, Meeri, Teaching assistant
 Vuori, Timo, M.Sc., Teaching assistant
 Wallin, Olli, Fee-paid teacher
 Ylinen, Kari, Ph.D., Docent
 Zhang Yi, Ph.D., Visiting professor

2.3. ADMINISTRATIVE, LIBRARY, AND TECHNICAL STAFF

Kämäri, Seija, M.Sc., Librarian
 Lehtinen, Marketta, Secretary
 Nikunen, Anja, Project secretary

Nikunen, Martti, Ph.D., Laboratory engineer
 Pauninsalo, Raili, Secretary
 Repo, Lea, Project secretary
 Rikkonen, Katriina, M.Sc., Department secretary
 Salonen, Vesajoona, Acting secretary
 Saukkonen, Sisko, M.A., Department secretary
 Ulmanen, Riitta, Librarian secretary

2.4. EDITORIAL STAFF

Mäkeläinen, Tuulikki, M.Sc., Secretary of European Mathematical Society and editorial secretary of *Annales Academiae Scientiarum Fennicae Mathematica*

3. EDUCATION

3.1. STUDENTS

Students majoring in mathematics are admitted in the degree programme of mathematics in two ways, firstly on the basis of matriculation certificate and secondly via entrance examination. The following table contains the numbers of inscribed mathematics majors and the total numbers of mathematics majors in 1993–2002.

| Year | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 |
|------------|------|------|------|------|------|------|------|------|------|------|
| New majors | 205 | 231 | 242 | 257 | 212 | 201 | 180 | 201 | 220 | 211 |
| Majors | 1077 | 1088 | 1199 | 1222 | 1184 | 1135 | 1153 | 1143 | 1168 | 1178 |

In 2002, there were 87 postgraduate students.

In 2002, 24 foreign students were studying at the department having mathematics as their major subject. Of them 20 had the M.Sc. degree as the goal, and four had a postgraduate degree as the goal.

3.2. PROGRAMS OF STUDY

In order to obtain an M.Sc. (Master of Science) degree, a student must earn at least 160 units of academic credit; the minimum requirement for B.Sc. (Bachelor of Science) degree is 120 credits. One credit normally corresponds to roughly one week (40 hours) of study, which may consist of attending lectures, participating in problem solving classes, and independent study. The M.Sc. degree usually demands at least five years of full-time study, while the less extensive B.Sc. degree can be reached in 3–4 years. Beyond these degrees there are two graduate degrees, the Ph.Lic. (Licentiate of Philosophy) degree and the Ph.D. (Doctor of Philosophy) degree, of which the latter has higher quality requirements.

A typical mathematics course consists of 50–60 lectures (a lecture lasts 45 minutes) and 20–30 hours of problem solving classes in small groups. A typical course is worth 5 credits.

A student studying for the M.Sc. in mathematics chooses one of the following four alternative curricula: mathematics curriculum, mathematics teacher curriculum, applied mathematics curriculum, and computer mathematics curriculum. Teacher's curriculum includes some didactic studies which are carried out at the Department of Teacher Education within the Faculty of Education of the university.

The students specializing in computer mathematics are allowed to include more credit units from computer science in their studies than what is possible otherwise. Specialists in this area are in great demand in various branches of software technology and industrial applications, including digital communication, mathematical modelling and scientific computing.

The 160 credits (c for short) needed for the M.Sc. degree in mathematics are subdivided as follows (in each case the indicated number is the minimum requirement):

| | |
|-----------------|-------|
| Mathematics | 93 c |
| Minor subjects | 45 c |
| General studies | 15 c. |

Teacher's curriculum and computer mathematics curriculum require mathematics only 75 c and 76 c, respectively. The student must have at least two secondary subjects; typical choices are computer science, the physical sciences, chemistry, statistics, and theoretical philosophy.

The mathematics studies for the M.Sc. degree in the mathematics and applied mathematics curricula can be subdivided as follows:

| | |
|--------------------------------------|-------|
| Basic courses (cum laude approbatur) | 42 c |
| Advanced courses (laudatur) | 35 c |
| M.Sc. thesis | 16 c, |

adding to 93 c. The required courses depend on the curriculum the student is following. Some courses are taught also in Swedish or English.

For the B.Sc. degree in mathematics, the requirements are as follows:

| | |
|-----------------|-------|
| Mathematics | 55 c |
| Minor subjects | 45 c |
| General studies | 15 c; |

the total must be at least 120 c. Note that only the requirements on mathematics differ from those of the M.Sc. degree. The B.Sc. degree is offered in the mathematics, applied mathematics and teacher's curricula.

In the graduate degrees Ph.Lic. and Ph.D. the major subject can be mathematics, applied mathematics or computer mathematics. For each graduate student, an individual study programme is designed outlining the field of specialization, the topic of the thesis and the contents and schedule of the other required studies. A personal advisor is also assigned to each student.

The requirements for the Ph.Lic. degree are as follows:

1. An M.Sc. degree in one of the above mentioned four curricula
2. Courses and seminars, 40 c
3. Ph.Lic. thesis.

The studies in part 2 normally consist of advanced level courses and seminars in the major subject and some courses in the minor subject(s).

The requirements for the Ph.D. degree are as follows:

1. A Ph.Lic. degree in mathematics or applied mathematics, or parts 1 and 2 of the requirements for Ph.Lic.
2. Ph.D. thesis.

Thus a student aiming directly at the Ph.D. degree need not complete the Ph.Lic. programme. The Ph.D. thesis is required to be based on original research of the student.

3.3. COURSES

The following is a list of all courses and seminars in 2002. The number of credit points for each course is given in parentheses.

INTRODUCTORY COURSE

This course is intended for mathematics minors.

Calculus (5): Differential and integral calculus of one real variable. Introduction to Maple.

BASIC COURSES (CUM LAUDE APPROBATUR)

These courses are intended for both mathematics majors and minors.

Differential and integral calculus I (12): Elementary analysis in one real variable.
Linear algebra I (5): Analytic geometry. Elementary theory of real vector spaces, linear mappings, and matrices.

Algebra I (5): Elements of set theory. Introduction to some algebraic structures such as groups, rings, fields, and polynomial rings.

Topology I (5): Elements of point set topology with emphasis on euclidean and metric spaces.

Differential and integral calculus II (5): Elementary analysis in several variables.

Differential equations (5): Elementary theory of ordinary differential equations.

Probability theory I (5): Introduction to probability theory and mathematical statistics.

Discrete mathematics I (5): Logic and set theory (language of mathematics).

Logic I (5): Introduction to propositional logic and predicate logic.

Linear algebra II (5).

Geometry (5).

Discrete forum.

Mathematical methods for scientists (5): Basic numerical methods using Matlab.

Mathematical typesetting in LateX (2).

ADVANCED COURSES (LAUDATUR)

Measure and integral (3).

Real analysis I (3).

Advanced course in applied analysis (3): Functional analysis, Fourier series, and differentiable mappings.

Advanced course for mathematics teachers (6): Advanced calculus with topology and measure theory organized in a seminar style.

Function theory I (5): Introduction to the theory of functions of a complex variable.

Algebra II (5).

Topology II (5).

Historical introduction to Galois theory.

Advanced course in number theory.

Topological transformation groups I.
 Algebraic topology.
 Modern real analysis.
 Function theory II.
 Kleinian groups.
 Functional analysis (5).
 Introduction to differential geometry.
 C^* -algebras.
 Introduction to mathematical physics.
 Clifford algebras.
 Mathematical logic (Logic II) (5).
 Finite model theory.
 Model theory II.
 Theory of computability.
 Extensions of elementary logic.
 Integral equations (3).
 Partial differential equations.
 Numerical analysis (5).
 Numerical methods and C language.
 Introduction to mathematical projects for industry (4).
 Mathematical projects for industry (7).
 Mathematical methods of digital signal processing.
 Simulation.
 Probability theory.
 Stochastic processes.
 Stochastics of discrete symbol sequences.
 Martingales and stochastic analysis.
 Statistics (5).
 Bayesian statistical methods.
 Asymptotic methods in statistics.
 Life insurance mathematics.
 Risk theory.
 History of mathematics (4).
 Fundamental concepts of mathematics and their introduction by the Varga method.
 Mathematical contents of the school (lukio).

INTENSIVE COURSES (MAINLY FOR THE GRADUATE SCHOOLS)

Complex dynamics.
 Classical inequalities in bad domains.
 Turbulence and stochastic differential equations.
 Non-associative binary systems.
 Queueing theory.

GRADUATE SEMINARS

Pro gradu seminar.
 Mathematical thinking.
 Algebraic topology and algebraic geometry.
 Commutative algebra and algebraic geometry.

Methods of algebraic geometry in coding theory and cryptography.

Transformation groups.

Analysis.

Geometric analysis.

Computational conformal geometry.

Functional analysis.

Mathematical physics.

Mathematical logic.

Finite model theory.

Set theory laboratory.

Stochastics.

Stochastic models.

Insurance mathematics.

Digital communication.

3.4. TEACHING, STUDIES, AND GRADUATES

The total amounts of credit points awarded to the students in 1995–2002 are shown in Table 1.

Table 1. Credit points awarded to students

| Year | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 |
|---------------|-------|-------|-------|-------|-------|-------|-------|-------|
| Credit points | 12247 | 12403 | 11267 | 13331 | 13074 | 14715 | 12778 | 13198 |

The numbers of M.Sc. theses in each curriculum in 1995–2002 are given in Table 2. Concerning the year 1995, the applied mathematics curriculum consisted of the applied analysis curriculum and the stochastics curriculum. The number of graduates is rather low as compared with the student intake. One reason for this is the nature of mathematics, which makes great demands on the students. Another reason for the drop-out is that many students are not intending to graduate in mathematics but rather use the first year mathematics studies as a preparation for admission to other degree programmes or universities.

Table 2. Numbers of M.Sc. theses per curriculum

| Year | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | All |
|----------------|------|------|------|------|------|------|------|------|-----|
| Mathematics | 7 | 4 | 11 | 9 | 17 | 15 | 8 | 9 | 80 |
| Teacher's | 19 | 18 | 30 | 24 | 20 | 26 | 21 | 12 | 170 |
| Applied math. | 9 | 11 | 12 | 4 | 18 | 8 | 4 | 6 | 72 |
| Computer math. | | | | | | | 4 | 2 | 6 |
| All | 35 | 33 | 53 | 37 | 55 | 49 | 37 | 29 | 328 |

Table 3 includes the numbers of postgraduate theses in 1995–2002.

Table 3. Numbers of postgraduate theses

| Year | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | All |
|---------|------|------|------|------|------|------|------|------|-----|
| Ph.Lic. | 3 | 3 | 10 | 5 | 4 | 4 | 8 | 6 | 43 |
| Ph.D. | 3 | 6 | 3 | 2 | 1 | 1 | 1 | 6 | 23 |

M.SC. THESES

M.SC. THESES IN MATHEMATICS CURRICULUM

- Jaakko Kangasharju: \mathcal{P} ja \mathcal{NP} suhteellisessa laskettavuudessa.
 Anssi Lahtinen: Hurewiczin isomorfialause.
 Petteri Lemettinen: Jatkuvan funktion approksimoinnista kompleksilukujoukossa.
 Ann-Charlotte Munck: Konforma avbildningars kontinuitet på randen.
 Hannu Niemistö: Ryhmäteorian ratkeavuudesta.
 Kalle Nietula: Newtonin avaruuden funktioiden lattiisiominaisuudet.
 Matti Pitkänen: Szegőn projektio ja harmoninen konjugaatti.
 Kyösti Poutiainen: Kahden muuttujan neliömuodoista.
 Jarno Talponen: Banach-avaruuksien uniformisesta luokittelusta.

M.SC. THESES IN MATHEMATICS TEACHER CURRICULUM

- Ossi Hyyti: WWW-sivut lukion matematiikan opetuksessa.
 Antti Kämppi: WebMathematican käyttö opetuksessa.
 Kim Karesti: Differentiaaliyhtälöt lukion kurssina.
 Sampsa Kurvinen: Derivaatan opetus lukion pitkässä matematiikassa.
 Panu Latva: Lukiokurssi differentiaaliyhtälöistä.
 Marja Martelius: Funktiokäsite koulumaailmassa.
 Jussi Nieminen: Funktion jatkuvuus opetuksen näkökulmasta.
 Milla-Riitta Nordling: Antiikin Kreikan kolme probleemaa ja muita valittuja paloja matematiikan historiasta.
 Sanna Poutanen: Lukujonot ja sarjat koulumatematiikassa.
 Leena Rusanen: Geometria lukion pitkässä matematiikassa ja viime vuosien ylioppilaskirjoituksissa.
 Jenni Taarna: Lukujonot lukiassa — kolmen oppikirjan vertailu koskien luku-
 jonoja lukion pitkässä matematiikassa.
 Eila Tanner: Peruskoulun deduktiivisen geometrian lisäkurssin opettajan mate-
 riaali.

M.SC. THESES IN APPLIED MATHEMATICS CURRICULUM

- Tiina Junkkari: Ammattikorkeakoulun opiskeluprosessin mallintaminen, Case Helia, Tietojenkäsittelyn koulutusohjelma.
 Mira Kauppi: Vahinkojen lukumäärään perustuva tariffointi.
 Heikki Kostiainen: Lineaaristen mallien vararikkoteoriaa.
 Maarit Paakkinen: Fraktiilisuojaus ja tappion riski täydellisessä mallissa.
 Eeva Poutiainen: High speed downlink packet access in WCDMA.
 Matti Taskinen: Sähkömagneettisen sirontaongelman numeerinen malli pintain-
 tegraaliyhtälöllä täysjohtavalle kappaleelle.

M.SC. THESES IN COMPUTER MATHEMATICS CURRICULUM

- Veli Petteri Järvinen: Language independent software communication in dis-
 tributed applications.
 Jarkko Sutela: Tuntemattomien vahinkojen ennustusmenetelmien vertailu.

PH.D. THESES

Peter Hästö: A new relative metric.

Ville Heikkala: Inequalities for conformal capacity, modulus, and conformal invariants.

Rakel Kaila: Harnack's convergence theorem for quasiminimizers on metric measure spaces.

Tuomas Korppi: Equivariant triangulations of C^r -manifolds with a properly discontinuous action.

Pekka Pankka: Globaalinen homeomorfismin lause Riemannin monistoilla.

Sauli Suuntala: Vararikkotodennäköisyyksistä.

PH.D. DISSERTATIONS

Markku Ekonen: Thesis "Generalizations of the Beckenbach–Radó theorem", *Annales Academiae Scientiarum Fennicae Mathematica Dissertationes* 128 (2002), 47 pp.; public examination 14.9.2002; opponent: Ph.D. Visa Latvala (University of Joensuu); Ph.D. degree 18.10.2002.

Daniel Faraco: Thesis "Beltrami operators and microstructure", Department of Mathematics, University of Helsinki, 2002, 15 pp. and three articles, also in electronic form; public examination 5.10.2002; opponent: prof. Bernd Kirchheim (Max-Planck-Institut in Leipzig); Ph.D. degree 22.11.2002.

Ville Hakulinen: Thesis "Passive advection and the degenerate elliptic operators M_n ", Department of Mathematics, University of Helsinki, 2002, 6+88 pp., also in electronic form; public examination 2.3.2002; opponent: prof. Krzysztof Gawędzki (ENS Lyon); Ph.D. degree 21.3.2002.

Petteri Harjulehto: Thesis "Sobolev extension domains", summary in *Reports of the Department of Mathematics, University of Helsinki*, 321 (2002), 4+5 pp., also in electronic form, and three articles; public examination 31.8.2002; opponent: prof. Steve Buckley (National University of Ireland); Ph.D. degree 18.10.2002.

Ville Heikkala: Thesis "Inequalities for conformal capacity, modulus, and conformal invariants", *Annales Academiae Scientiarum Fennicae Mathematica Dissertationes* 132 (2002), 62 pp.; public examination 7.12.2002; opponent: prof. Toshiyuki Sugawa (Hiroshima University); Ph.D. degree 24.1.2003.

Mika Koskenoja: Thesis "Pluripotential theory and capacity inequalities", *Annales Academiae Scientiarum Fennicae Mathematica Dissertationes* 127 (2002), 49 pp., also in electronic form; public examination 17.5.2002; opponent: docent Juha Kinnunen (Helsinki University of Technology); Ph.D. degree 14.6.2002.

3.5. FORMS OF TEACHING

The traditional forms of teaching mathematics are lectures, problem solving classes, and (principally in postgraduate studies) seminars. In 2002 there were around 90 small problem solving groups per term convening once a week. In addition to this traditional line, several pilot programmes have been run in recent years to advance teaching and collaboration between students and teachers at the department. Attempts have been made to develop forms of activity which meet students at all stages of their studies. The following programmes were active in 2002.

Instruction groups. In connection with the main analysis course (Differential and integral calculus I) the students took part in special instruction groups in addition to usual lectures and problem solving classes. In these groups the students worked together with the instructor on problems presented *ex tempore*. This activity was the version of tutoring in use for first year students.

Problem seminar. The leading theme of this elementary seminar was the mathematical problem posed in the course Differential and integral calculus I, but any questions arisen from any course were discussed as well.

Pro gradu seminar. In this seminar different aspects of producing a mathematical document were covered varying from the use of a text processor to the art of mathematical writing. The students also gave talks on their M.Sc. theses and discussed school mathematics.

Study group. In fall 1998 a new kind of learning environment was added. About 30 students started in this programme in fall 2002. These students study together the central portion of the *cum laude* level of mathematics. The work is based on approaching entire courses (or mathematics in general) from general phenomena related to their central and most difficult problems. This form of instruction was directed especially to teacher training.

3.6. EVALUATION OF TEACHING

The department is aware of the importance of regular evaluation of teaching. For some years, the department has carried out evaluation of courses via questionnaires filled in by students.

3.7. EMPLOYMENT PROSPECTS OF GRADUATES

The employment prospects for mathematics graduates have generally been good and they are expected to remain so. Most mathematicians are employed by teaching in schools, technical colleges, and universities. University teachers are usually also researchers; this is in particular the case with the Department of Mathematics. Researchers in applied mathematics often act as consultants in industrial mathematics or participate in research projects of other sciences. Traditionally mathematicians have also worked in insurance companies. There is a growing demand of mathematicians in finance.

4. RESEARCH

4.1. REVIEW

The main research areas at the department are in mathematical analysis—particularly complex analysis, functional analysis, partial differential equations, and potential theory—, mathematical physics with strong connections to analysis, transformation groups, mathematical logic, and stochastics. There are also experts in algebraic geometry and algebraic topology, general and geometric topology, elementary number theory, mathematical statistics, and mathematical modelling. There is also a new group which has started to study mathematics education.

The strategy of the department is to support successful research groups and to help to form new and interdisciplinary groups. The evaluations, see Chapter 4.3.,

show that this policy has been successful: in mathematics the research groups are somewhat smaller than in other sciences and the traditional joint seminars and projects help to promote new interdisciplinary research. The department intends to continue this strategy.

The list below contains most of the research projects in the department although there are many other research groups, which have often organized their own seminars.

4.2. FUNDED RESEARCH GROUPS

The externally funded research groups and projects in 2002 were the following, in alphabetical order of the responsible director (EU = European Union, UH = University of Helsinki, AF = Academy of Finland).

Development of Bayesian methods with applications in geophysics and environmental research. *Responsible director:* Haario. *Funding* (2000–2003): AF.

Irregular domains and Sobolev spaces. *Responsible director:* Hurri-Syrjänen. *Funding* (1999–2002): UH.

Singularities and blow-up algebras. *Responsible director:* Hyry. *Funding* (2001–2005): AF.

Transformation groups. *Responsible director:* Illman. *Funding* (1983–): AF.

Extended dynamical systems. *Responsible director:* Kupiainen. *Funding* (1998–2002): AF.

Stochastic adaptive dynamics of complex systems (STADYCS). *Responsible director:* Kupiainen. *Funding* (2000–2003): AF.

Research unit of geometric analysis and mathematical physics. *Responsible director:* Kupiainen. *Funding* (2002–2004): AF.

Nonlinear analysis and stability. *Responsible director:* Martio. *Funding* (1999–2003): AF.

Nonlinear partial differential equations, variational principles and quasi-conformal analysis. *Responsible director:* Martio. *Funding* (1999–): EU/INTAS.

New trends in complex analysis and potential theory. *Responsible director:* Martio. *Funding* (2000–2002): EU/INTAS.

Mathematics magazine Solmu - research and development project. *Responsible director:* Näätänen. *Funding* (1998–): AF, LUMA-project, Wihuri foundation, Finnish Cultural Foundation.

M-buttons—multilingual mathematics context help. *Responsible director:* Näätänen. *Funding* (2001–): EU

Future internet – traffic handling and performance (FIT). *Responsible director:* Norros. *Funding* (2001–2004): AF.

The theory of large deviations with applications to economics and risk theory. *Responsible director:* Nummelin. *Funding* (1999–2002): AF.

Markov Chain Monte Carlo methods and harmonic analysis. *Responsible director:* Saksman. *Funding* (2001–2002): AF.

Operator theory and applications. *Responsible director:* Tylli. *Funding* (2002–2005): AF.

Logic and its applications. *Responsible director:* Väänänen. *Funding* (1998–2003): AF, UH.

INTAS-99. *Responsible director:* Valkeila. *Funding* (2000–2002): EU/INTAS.

Statistical methods for dynamical stochastic models (DYNSTOC). *Responsible director:* Valkeila. *Funding* (2000–2004): EU.

4.3. EVALUATION OF RESEARCH

During the fall term 1999 an evaluation of research was carried out in the whole University of Helsinki. The assessment was supervised by the Scientific Board of the University. The international panels were appointed by the Rector on the proposal of the Scientific Board.

The Department of Mathematics achieved the highest grade in this evaluation. From the assessment report:

”Summing up, the department of mathematics is in the enviable position of having several world class research groups, with leading experts in their respective fields as members. Virtually all submitted publications are published in top class or very good journals, monographs of international acclaim are written, international contacts and cooperations are excellent, many of the researchers take an active part in the mathematical research world as editors, referees, committee members etc., the ratio of Ph.D. students to faculty is acceptable, and the number of Ph.D. exams on the rise. There is no doubt that the department deserves the highest grade in this evaluation. ..., the strength of the department lies to a considerable degree in its coherence and unity of purpose, its strong leadership, and vigorous pursuance of new technical methods.”

In the year 2000 an evaluation of research was carried out by the Academy of Finland in all mathematics departments in Finnish universities. The following is a quotation from the report of the evaluation panel:

”The University of Helsinki is clearly the leading Finnish center of research in pure mathematics, due to its overall size and the presence of several strong groups. By far the strongest and largest of these groups are the analysts, who can count a commanding presence in areas relating to quasiconformal mapping. Here Martio leads a distinguished group in partial differential equations. The geometry of quasiconformal maps is represented by a deep and excellent group that includes a world leader in Tukia. The analysts also have a good presence in function spaces and functional analysis. Kupiainen is probably Finland’s most famous mathematician at the moment. He is to be congratulated for a rapidly developing and extremely active and internationally recognized group in mathematical physics. This has brought an entirely new field to Finland. Väänänen leads a rather large group of logicians. This group is of very high quality and has managed to develop strong international contacts and collaborations. Illman leads a small but highly respected team in transformation groups.”

In 2001, the Research Unit of Geometric Analysis and Mathematical Physics was selected by the Academy of Finland as a centre of excellence in research for the years 2002–2007. The unit is a joint venture with the Department of Mathematics and Statistics at the University of Jyväskylä.

4.4. CONFERENCES AND WORKSHOPS

The following conferences and workshops were organized by members of the department at the University of Helsinki in 2002.

IV Number Theory Days, Helsinki, 23.–24.5.

Stochastics in Finland (workshop), Helsinki, 9.–10.1.

5. PUBLICATIONS

All printed research publications (items 1–71), articles in conference proceedings (72–83), preprints (84–111), publications of general interest (112–133), and printed teaching material (134–140) in 2002 due to the personnel (and to a few other persons affiliated to the department) are listed below in alphabetic order in Sections 5.1–5.5, respectively. For technical reasons the coverage of the publications does not exactly fit with the calendar year 2002. All numbers (but number 321, a Ph.D. thesis summary) of the preprint series of the department that appeared in 2002 are listed in Section 5.3. Section 5.6 contains a list of all authors belonging to the personnel (or some to the guests), with references to the items authored by these persons. This list of publications does not include Ph.D. theses; they are listed separately in Section 3.4.

5.1. PRINTED RESEARCH PUBLICATIONS

1. Sergey Antonyan, Erik Elfving, and Armando Mata-Romero, *Adjunction spaces and unions of G -ANE's*, *Topology Proceedings* **26** (2001–2002), 1–28.
2. Kari Astala, Mario Bonk, and Juha Heinonen, *Quasiconformal mappings with Sobolev boundary values*, *Annali della Scuola Normale Superiore di Pisa. Scienze Fisiche e Matematiche. Serie V* **1** (2002), 687–731.
3. Guillaume van Baalen, Alain Schenkel, and Peter Wittwer, *Asymptotics of solutions in $nA + nB \rightarrow C$ reaction-diffusion systems*, *Communications in Mathematical Physics* **210** (2000), 145–176, also in electronic form.
4. R. Balasubramanian, S. Naik, Saminathan Ponnusamy, and Matti Vuorinen, *Elliott's identity and hypergeometric functions*, *Journal of Mathematical Analysis and Applications* **271** (2002), 232–256, also in electronic form.
5. R. Balasubramanian, Saminathan Ponnusamy, and Matti Vuorinen, *On hypergeometric functions and function spaces*, *Journal of Computational and Applied Mathematics* **139** (2002), 299–322, also in electronic form.
6. Zoltán M. Balogh, Ilkka Holopainen, and Jeremy T. Tyson, *Singular solutions, homogeneous norms, and quasiconformal mappings in Carnot groups*, *Mathematische Annalen* **324** (2002), 159–186, also in electronic form.
7. Jean Bricmont, Antti-Jukka Kupiainen, and Raphael Lefevere, *Probabilistic estimates for the twodimensional stochastic Navier–Stokes equations*, *Journal of Statistical Physics* **100** (2000), 743–756, also in electronic form.
8. Jean Bricmont, Antti-Jukka Kupiainen, and Raphael Lefevere, *Exponential mixing of the 2D stochastic Navier–Stokes dynamics*, *Communications in Mathematical Physics* **230** (2002), 87–132, also in electronic form.
9. Peter Buser and Mika Seppälä, *Short homology bases and partitions of Riemann surfaces*, *Topology* **41** (2002), 863–871, also in electronic form.

10. Thierry Coulhon, Ilkka Holopainen, and Laurent Saloff-Coste, *Harnack inequality and hyperbolicity for subelliptic p -Laplacians with applications to Picard type theorems*, Geometric and Functional Analysis **11** (2001), 1139–1191, also in electronic form.
11. Thierry Coulhon, Ilkka Holopainen, and Laurent Saloff-Coste, *Erratum to: “Harnack inequality and hyperbolicity for subelliptic p -Laplacians with applications to Picard type theorems”*, in Geometric and Functional Analysis **11** (2001), 1139–1191; Geometric and Functional Analysis **12** (2002), 217, also in electronic form.
12. Freddy Delbaen, Yuri M. Kabanov, and Esko Valkeila, *Hedging under transaction costs in currence markets: a discrete-time model*, Mathematical Finance **12** (2002), 45–61, also in electronic form.
13. Kacha Dzhaparidze, Peter Spreij, and Esko Valkeila, *Information concepts in filtered experiments*, Teoriya Ėmovirnostei ta Matematichna Statistika **67** (2002), 38–56.
14. Tadeusz Figiel, Peter Šemrl, and Jussi Väisälä, *Isometries of normed spaces*, Colloquium Mathematicum **92** (2002), 153–154.
15. D. Franke, Olli Martio, Vladimir M. Miklyukov, Matti Vuorinen, and R. Wisk, *Quasiregular mappings and WT -classes of differential forms on Riemannian manifolds*, Pacific Journal of Mathematics **202** (2002), 73–92, also in electronic form.
16. V. Ya. Gutlyanskiĭ, Olli Martio, and Matti Vuorinen, *On Hölder continuity of quasiconformal maps with VMO dilatation*, Complex Variables **47** (2002), 495–505, also in electronic form.
17. V. Ya. Gutlyanskiĭ and Toshiyuki Sugawa, *On Lipschitz continuity of quasiconformal mappings*, Report. University of Jyväskylä Department of Mathematics and Statistics **83** (2001), 91–108, also in electronic form.
18. Petteri Harjulehto, *Sobolev extension domains on metric spaces of homogeneous type*, Real Analysis Exchange **27** (2001–2002), 583–597.
19. Petteri Harjulehto, *Maximal inequality in (s, m) -uniform domains*, Annales Academiae Scientiarum Fennicae Mathematica **27** (2002), 291–306, also in electronic form.
20. Peter A. Hästö, *On descents in standard Young tableaux*, The Electronic Journal of Combinatorics **7** (2000), Research paper 59, 13 pp., in electronic form.
21. Peter A. Hästö, *A new weighted metric: the relative metric. I*, Journal of Mathematical Analysis and Applications **274** (2002), 38–58, also in electronic form.
22. Peter A. Hästö, *A monotonicity property of ratios of symmetric homogeneous means*, Journal of Inequalities in Pure and Applied Mathematics **3** (2002), Article 71, 54 pp., in electronic form.
23. Peter A. Hästö, *The packing density of other layered permutations*, The Electronic Journal of Combinatorics **9(2)** (2002–2003), Research paper 1, 16 pp., in electronic form.
24. Juha Heinonen and Seppo Rickman, *Geometric branched covers between generalized manifolds*, Duke Mathematical Journal **113** (2002), 465–529, also in electronic form.
25. Alex Hellsten, Tapani Hyttinen, and Saharon Shelah, *Potential isomorphism and semi-proper trees*, Fundamenta Mathematicae **175** (2002), 127–142.
26. Aarno Hohti, M. Hušek, and J. Pelant, *The locally fine coreflection and normal covers in the products of partition-complete spaces*, Topology and its Applications **126** (2002), 187–205, also in electronic form.
27. Ilkka Holopainen, *Asymptotic Dirichlet problem for the p -Laplacian on Cartan-Hadamard manifolds*, Proceedings of the American Mathematical Society **130** (2002), 3393–3400, also in electronic form.
28. Ilkka Holopainen and Nageswari Shanmugalingam, *Singular functions on metric measure spaces*, Collectanea Mathematica **53** (2002), 313–332.
29. Taneli Huuskonen and Jussi Väisälä, *Hyers–Ulam constants of Hilbert spaces*, Studia Mathematica **153** (2002), 31–40.
30. Tapani Hyttinen, *A remark on weakly compact cardinals*, Mathematical Logic Quarterly **48** (2002), 397–402, also in electronic form.
31. Tapani Hyttinen, *Canonical finite diagrams and quantifier elimination*, Mathematical Logic Quarterly **48** (2002), 533–554, also in electronic form.
32. Tapani Hyttinen, *Väärä todistus*, Arkhimedes **2002**, no. 2, 16–18. (Finnish)
33. Tapani Hyttinen and Olivier Lessmann, *A rank for the class of elementary submodels of a superstable homogeneous model*, The Journal of Symbolic Logic **67** (2002), 1469–1482.
34. Tapani Hyttinen and Saharon Shelah, *Forcing a Boolean algebra with predesigned automorphism group*, Proceedings of the American Mathematical Society **130** (2002), 2837–2843,

- also in electronic form.
35. Tapani Hyttinen, Saharon Shelah, and Jouko Väänänen, *More on the Ehrenfeucht–Fraïssé game of length ω_1* , *Fundamenta Mathematicae* **175** (2002), 79–96.
 36. Sören Illman, *Hilbert’s fifth problem: Review*, *Journal of Mathematical Sciences* **105** (2001), 1843–1847, also in electronic form; transl. from *Itogi Nauki i Tekhniki, Seriya Sovremennaya Matematika i Ee Prilozheniya. Tematicheskie Obzory* **68** (1999), 55–64 (Russian).
 37. Heikki Junnila, Hans-Peter A. Kunzi, and Stephen Watson, *On a class of hereditarily paracompact spaces*, *Topology Proceedings* **25** (2000), Summer, 271–289.
 38. Heikki Junnila and Yun Ziqiu, *On Nagata spaces*, *Topology Proceedings* **25** (2000), Summer, 553–561.
 39. Risto Kaila, *Convergence laws for very sparse random structures with generalized quantifiers*, *Mathematical Logic Quarterly* **48** (2002), 301–320, also in electronic form.
 40. Sari Kallunki and Olli Martio, *ACL homeomorphisms and linear dilatation*, *Proceedings of the American Mathematical Society* **130** (2002), 1073–1078, also in electronic form.
 41. Juliette Kennedy and Shelah Saharon, *On regular reduced products*, *The Journal of Symbolic Logic* **67** (2002), 1169–1177.
 42. Yong Chang Kim and Toshiyuki Sugawa, *Growth and coefficient estimates for uniformly locally univalent functions on the unit disk*, *Rocky Mountain Journal of Mathematics* **32** (2002), 179–200, also in electronic form.
 43. Yu. Kozachenko, Tommi Sottinen, and O. Vasylyk, *Self-similar processes with stationary increments in the spaces $S\text{Sub}_\varphi(\Omega)$* , *Teoriya Ėmovirnostei ta Matematichna Statistika* **65** (2001), 67–78 (Ukrainian); English transl. in *Theory of Probability and Mathematical Statistics* **65** (2002), 77–88.
 44. Yu. Kozachenko, Tommi Sottinen, and O. Vasylyk, *Path space large deviations of a large buffer with Gaussian input traffic*, *Queueing Systems. Theory and Applications* **42** (2002), 113–129, also in electronic form.
 45. Tomi J. Laakso, *Plane with A_∞ -weighted metric not bilipschitz embeddable to \mathbf{R}^n* , *Bulletin of the London Mathematical Society* **34** (2002), 667–676, also in electronic form.
 46. Tomi J. Laakso, *Erratum to “Ahlfors Q -regular spaces with arbitrary $Q > 1$ admitting weak Poincaré inequality”*, in *Geometric and Functional Analysis* **10** (2000), 111–123; *Geometric and Functional Analysis* **12** (2002), 650, also in electronic form.
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 49. Olli Martio, Vladimir M. Miklyukov, Saminathan Ponnusamy, and Matti Vuorinen, *On some properties of quasiplanes*, *Results in Mathematics* **42** (2002), 107–113.
 50. Olli Martio and Vladimir I. Ryazanov, *Suspensions of generalized spheres and the triangulation theory*, *Siberian Advances in Mathematics* **12** (2002), no. 3, 41–61.
 51. Yulia S. Mishura and Esko Valkeila, *The absence of arbitrage in a mixed Brownian-fractional Brownian model*, *Trudy Matematicheskogo Instituta imeni V. A. Steklova* **237** (2002), 224–233 (Russian); English transl. in *Proceedings of the Steklov Institute of Mathematics* **237** (2002), 215–224.
 52. Esa Nummelin, *MC’s for MCMC’ists*, *International Statistical Review* **70** (2002), 215–240.
 53. Alain Schenkel, Jan Wehr, and Peter Wittwer, *Computer-assisted proofs for fixed point problems in Sobolev spaces*, *Mathematical Physics Electronic Journal* **6** (2000), Paper 3, 67 pp., in electronic form.
 54. Saharon Shelah and Pauli Väisänen, *On equivalence relations second order definable over $H(\kappa)$* , *Fundamenta Mathematicae* **174** (2002), 1–21.
 55. Saharon Shelah and Pauli Väisänen, *The number of $L_{\infty\kappa}$ -equivalent nonisomorphic models for κ weakly compact*, *Fundamenta Mathematicae* **174** (2002), 97–126.
 56. Saharon Shelah and Pauli Väisänen, *Almost free groups and Ehrenfeucht–Fraïssé games for successors of singular cardinals*, *Annals of Pure and Applied Logic* **118** (2002), 147–173, also in electronic form.
 57. A. N. Shiryaev, Esko Valkeila, and L. Vostrikova, *On lower and upper functions for square integrable martingales*, *Trudy Matematicheskogo Instituta imeni V. A. Steklova* **237** (2002),

- 290–301 (Russian); English transl. in Proceedings of the Steklov Institute of Mathematics **237** (2002), 281–292.
58. Mikko Stenlund, *On the tangent lines of a parabola*, The College Mathematics Journal **32** (2001), 194–196.
59. Toshiyuki Sugawa, *An explicit bound for uniform perfectness of the Julia sets of rational maps*, Mathematische Zeitschrift **238** (2001), 317–333, also in electronic form.
60. Toshiyuki Sugawa, *Uniform perfectness of the limit sets of Kleinian groups*, Transactions of the American Mathematical Society **353** (2001), 3603–3615, also in electronic form.
61. Toshiyuki Sugawa, *Uniformly perfect sets—their analytical and geometrical aspects*, Sūgaku **53** (2001), 387–402. (Japanese)
62. Toshiyuki Sugawa, *A remark on the Ahlfors–Lehto univalence criterion*, Annales Academiae Scientiarum Fennicae Mathematica **27** (2002), 151–161, also in electronic form.
63. Toshiyuki Sugawa, *Estimates of hyperbolic metric with applications to Teichmüller spaces*, Kyungpook Mathematical Journal **42** (2002), 51–60, also in electronic form.
64. Kalevi Suominen, *Birchin ja Swinnerton-Dyerin otaksuma*, Arkhimedes. **2002**, no. 4, 10–14. (Finnish)
65. Olli Tammi, *On the first postwar contacts between Polish and Finnish mathematicians*, Bulletin de la Société des Sciences et des Lettres de Łódź **51** (2001); Recherches sur les Déformations **34**, 15–20.
66. Pekka Tukia and Xiantao Wang, *Discreteness of subgroups of $SL(2, \mathbf{C})$ containing elliptic elements*, Mathematica Scandinavica **91** (2002), 214–220.
67. Jouko Väänänen, *On the semantics of informational independence*, Logic Journal of the IGPL **10** (2002), 339–352, also in electronic form.
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71. Jussi Väisälä, *Isometric approximation property in euclidean spaces*, Israel Journal of Mathematics **128** (2002), 1–27.

5.2. CONFERENCE PROCEEDINGS

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73. Tapani Hyttinen, *Groups acting on geometries*, Logic and algebra (Istanbul Bilgi University 1999/2000 and 2000/2001), Contemporary Mathematics 302, American Mathematical Society, Providence, RI, 2002, pp. 221–233.
74. Sören Illman, *Hilbert’s fifth problem and proper actions of Lie groups*, Current trends in transformation groups. Dedicated to the memory of Professor Katsuo Kawakubo, K-Monographs in Mathematics 7, Kluwer, Dordrecht, 2002, pp. 1–23.
75. Antti-Jukka Kupiainen, *Lessons for turbulence*, Visions in mathematics – Towards 2000. Proceedings of the meeting held at Tel Aviv University (Tel Aviv, August 25–September 3, 1999), Geometric and Functional Analysis, Special Volume, Part I, Birkhäuser, Basel, 2000, pp. 316–333.
76. Olli Martio, *Olli Lehto, Suomalaisen Tiedeakatemian kunniajäsen 2001*, Vuosikirja 2001, Suomalainen Tiedeakatemia, Helsinki, 2002, pp. 23–25. (Finnish)
77. Olli Martio, Vladimir M. Miklyukov, and Matti Vuorinen, *On the geometric structure of quasiplanes*, Twenty years of mathematical analysis and function theory (Proceedings of the Department of Mathematical Analysis and Function Theory, Volgograd State University, Volgograd 2002), Volgograd, 2002, pp. 21–31. (Russian)
78. Marjatta Näätänen, *Five years experiences with the Finnish mathematics web magazine Solmu*, Proceedings of the International Conference on the Humanistic Renaissance in Mathematics Education (Hotel Città del Mare, Terrasini, Palermo, Italy, September 20–25, 2002), The Mathematics Education into the 21st Century Project, Palermo, 2002, pp. 283–284.

79. Mika Seppälä and Jouko Väinänen, *Semantics of mathematics on the Web*, Semantic web kick-off in Finland, Helsinki Institute for Information Technology, Helsinki, 2002, pp. 265–275.
80. Jonathan Stavi and Jouko Väinänen, *Reflection principles for the continuum*, Logic and algebra (Istanbul Bilgi University 1999/2000 and 2000/2001), Contemporary Mathematics 302, American Mathematical Society, Providence, RI, 2002, pp. 59–84.
81. Toshiyuki Sugawa, *Unified approach to conformally invariant metrics on Riemann surfaces*, Proceedings of the Second ISAAC Congress, Vol. 2 (Fukuoka, 1999), Kluwer, Dordrecht, 2000, pp. 1117–1127.
82. Matti Vuorinen, *Quasi-regular mapping*, Encyclopaedia of Mathematics, Supplement III, Kluwer, Dordrecht, 2001, p. 320.
83. Matti Vuorinen, *Zorich theorem*, Encyclopaedia of Mathematics, Supplement III, Kluwer, Dordrecht, 2001, p. 465.

5.3. PREPRINTS

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85. David R. Adams and Ritva Hurri-Syrjänen, *Besov functions and vanishing exponential integrability*, Research report/University of Kentucky, Department of Mathematics **4** (2002), 13 pp.
86. Daniel Faraco, *Tartar conjecture and Beltrami operators*, Reports of the Department of Mathematics, University of Helsinki **323** (2002), 23 pp, also in electronic form.
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90. Aarno Hohti, *Recursive synthesis and the foundations of mathematics*, Reports of the Department of Mathematics, University of Helsinki **325** (2002), 20 pp., also in electronic form.
91. Ilkka Holopainen and Pekka Pankka, *Mappings of finite distortion: global homeomorphism theorem*, Reports of the Department of Mathematics, University of Helsinki **339** (2002), 22 pp., also in electronic form.
92. A. Ignat'ev and V. Ryazanov, *Finite mean oscillation in the mapping theory*, Reports of the Department of Mathematics, University of Helsinki **332** (2002), 17 pp, also in electronic form.
93. Juha Kinnunen and Olli Martio, *Sobolev space properties of superharmonic functions on metric spaces*, Reports of the Department of Mathematics, University of Helsinki **333** (2002), 12 pp., also in electronic form.
94. Juha Kinnunen and Nageswari Shanmugalingam, *Polar sets on metric spaces*, Reports of the Department of Mathematics, University of Helsinki **334** (2002), 25 pp, also in electronic form.
95. Yu. Kozachenko, Tommi Sottinen, and O. Vasylyk, *Weakly self-similar stationary increment processes from the space $S\text{Sub}_\varphi(\Omega)$* , Reports of the Department of Mathematics, University of Helsinki **317** (2002), 14 pp., also in electronic form.
96. Tomi J. Laakso, *Look-down equivalence without BPI equivalence*, Reports of the Department of Mathematics, University of Helsinki **320** (2002), 11 pp., also in electronic form.
97. Mikael Lindström, Eero Saksman, and Hans-Olav Tylli, *Strictly singular and cosingular multiplications*, Reports of the Department of Mathematics, University of Helsinki **327** (2002), 27 pp.
98. Yurii N. Lin'kov, *Large deviations in testing of models with fractional Brownian motion*, Reports of the Department of Mathematics, University of Helsinki **313** (2002), 14 pp, also in electronic form.
99. Olli Martio, Vladimir Miklyukov, and Matti Vuorinen, *Generalized Wiman and Arima theorems for n -subharmonic functions on cones*, Reports of the Department of Mathematics, University of Helsinki **315** (2002), 29 pp., also in electronic form.

100. Olli Martio, Vladimir Miklyukov, and Matti Vuorinen, *Relative distance and boundary properties of nonparametric surfaces with finite area*, Reports of the Department of Mathematics, University of Helsinki **316** (2002), 18 pp., also in electronic form.
101. Olli Martio, Vladimir Miklyukov, and Matti Vuorinen, *Some remarks on an existence problem for degenerate elliptic systems*, Reports of the Department of Mathematics, University of Helsinki **329** (2002), 9 pp., also in electronic form.
102. Olli Martio, Vladimir Miklyukov, and Matti Vuorinen, *Functions monotone close to boundary*, Reports of the Department of Mathematics, University of Helsinki **330** (2002), 20 pp., also in electronic form.
103. Olli Martio, Vladimir Ryazanov, Uri Srebro, and E. Yakubov, *On boundary behavior of Q -homeomorphisms*, Reports of the Department of Mathematics, University of Helsinki **318** (2002), 12 pp., also in electronic form.
104. Olli Martio, Vladimir Ryazanov, Uri Srebro, and E. Yakubov, *Mappings of finite length distortion*, Reports of the Department of Mathematics, University of Helsinki **322** (2002), 20 pp., also in electronic form.
105. Yuliya Mishura, *Fractional stochastic integration and Black–Scholes equation for fractional Brownian model with stochastic volatility*, Reports of the Department of Mathematics, University of Helsinki **337** (2002), 19 pp.
106. Pekka J. Nieminen and Eero Saksman, *On compactness of the difference of composition operators*, Preprint/University of Jyväskylä, Department of Mathematics and Statistics **267** (2002), 5 pp.
107. Pekka J. Nieminen and Eero Saksman, *Boundary correspondence of Nevanlinna counting functions for self-maps of the unit disc*, Reports of the Department of Mathematics, University of Helsinki **326** (2002), 20 pp.
108. Tommi Sottinen, *On Gaussian processes equivalent in law to fractional Brownian motion*, Reports of the Department of Mathematics, University of Helsinki **328** (2002), 17 pp., also in electronic form.
109. Tommi Sottinen and Esko Valkeila, *On arbitrage and replication in the fractional Black–Scholes pricing model*, Reports of the Department of Mathematics, University of Helsinki **335** (2002), 13 pp., also in electronic form.
110. Toshiyuki Sugawa and Matti Vuorinen, *Some inequalities for the Poincaré metric of plane domains*, Reports of the Department of Mathematics, University of Helsinki **314** (2002), 20 pp., also in electronic form.
111. Jussi Väisälä, *Locally bilipschitz maps of roughly dense sets*, Reports of the Department of Mathematics, University of Helsinki **319** (2002), 16 pp., also in electronic form.

5.4. PUBLICATIONS OF GENERAL INTEREST

112. Erik Elfving (ed.), *Annual Report 2001, Department of Mathematics, University of Helsinki*, Helsinki, 2002, 28 pp.
113. Mika Koskenoja, *Sattuman matematiikka I — klassinen todennäköisyys*, Solmu **2002**, no. 2, 6–12, also in electronic form.
114. Antti-Jukka Kupiainen, *Pääsevätkö kaikki leijonat taivaaseen?*, Arkhimedes **2002**, no. 2, 5.
115. Antti-Jukka Kupiainen, *Voiko kahvikuppi räjähtää?*, Arkhimedes **2002**, no. 3, 9–12.
116. Antti-Jukka Kupiainen, *Ydinkysymyksiä*, Arkhimedes **2002**, no. 4, 9.
117. Antti-Jukka Kupiainen, *Huijauksia*, Arkhimedes **2002**, no. 6, 7.
118. Aatos Lahtinen, *Matematiikan ylioppilaskirjoitus keväällä 2002*, Dimensio **66** (2002), no. 6, 14–29.
119. Aatos Lahtinen, *Alkusanat*, Sivistyksen portti, Otava, Helsinki, 2002, p. 8.
120. Aatos Lahtinen, *Matematiikkaa ylioppilastutkinnossa*, Luma-projekti tiedottaa, Opetushallitus, Helsinki, 2002, pp. 19–23.
121. Marjatta Näätänen and Juha Haataja, *Tarvitaanko matematiikkaa tietokoneiden aikana?*, Tieto ja tekniikka, Tekniikan akateemisten liitto, Helsinki, 2002, pp. 32–37.
122. Marjatta Näätänen, Juha Haataja, and Erja Väyrynen, *Käyttäjä kunniaan*, Tieto ja tekniikka, Tekniikan akateemisten liitto, Helsinki, 2002, pp. 216–225.
123. Marjatta Näätänen and Matti Lehtinen, *Matematiikasta ja sen menetelmistä*, Solmu **2002**, no. 1, 16–22, also in electronic form.
124. Martti Nikunen, *Matemaattisen tekstin kirjoittamisesta*, Solmu **2002**, no. 1, 12–13, also in electronic form.

125. Juha Nurmonen, $P \stackrel{?}{=} NP$ Kysymys ratkaisun keksimisestä ja sen tarkistaminen, *Arkhimedes* **2001**, no. 6 / **2002**, no. 1, 8–11.
126. Juha Oikkonen, *Sen seitsemän sortin ääretön: alkupalat*, *Dimensio* **66** (2002), no. 1, 23.
127. Juha Oikkonen, *Äärettömän monta: kardinaalilukujen ihmeellinen maailma (Sen seitsemän sortin ääretön)*, *Dimensio* **66** (2002), no. 2, 41–43.
128. Juha Oikkonen, *Sen seitsemän sortin ääretön: reaalitylukujen ääretön*, *Dimensio* **66** (2002), no. 3, 46.
129. Juha Oikkonen, *Sen seitsemän sortin ääretön: kompleksitason ääretön*, *Dimensio* **66** (2002), no. 4, 22.
130. Juha Oikkonen, *Sen seitsemän sortin ääretön: luettelot ja äärettömät järjestyksluvut*, *Dimensio* **66** (2002), no. 5, 30–31.
131. Pekka Pankka, *Matematiikan kansainvälinen vierailijaohjelma*, *Arkhimedes* **2002**, no. 3, 6.
132. Kirsi Peltonen, *Tarina Poincarén konjektuurista jatkuu*, *Arkhimedes* **2001**, no. 6 / **2002**, no. 1, 18–23.
133. Tibor Szalontai and Marjatta Näätänen, *Muutamia ajatuksia matematiikan opetuksesta*, *Solmu* **2002**, no. 3, 13–16, also in electronic form.

5.5. TEACHING MATERIAL

134. Pekka Kontkanen, Jukka Lehtonen, Kerkko Luosto, Juha Nurmi, Riikka Nurmiainen, and Sisko Savolainen, *Pyramidi: matematiikan tietokirja 3*, Tammi, Helsinki, 2002, 328 pp.
135. Pekka Kontkanen, Jukka Lehtonen, Kerkko Luosto, Juha Nurmi, Riikka Nurmiainen, and Sisko Savolainen, *Pyramidi: matematiikan harjoituskirja 3*, Tammi, Helsinki, 2002, 140 pp.
136. Aatos Lahtinen and Lauri Myrberg, *Matematiikan ylioppilastehtävät ratkaisuihin: pitkä oppimäärä*, MFKA-Kustannus, Helsinki, 2002, 284 pp.
137. Aatos Lahtinen and Lauri Myrberg, *Matematiikan ylioppilastehtävät ratkaisuihin: lyhyt oppimäärä*, MFKA-Kustannus, Helsinki, 2002, 264 pp.
138. Olli Martio, *Modern tools in the theory of quasiconformal maps*, *Textos de matemática/ Departamento de Matemática, Faculdade de Ciências e Tecnologia da Universidade de Coimbra. Série B* **27** (2000), 43 pp.
139. Evsey Morozov, *Elements of queueing theory, with applications to communication networks*, *Graduate texts in mathematics 3*, Department of Mathematics, University of Helsinki, Helsinki, 2002, 63 pp.
140. Jussi Väisälä, *Topologi I*, Limes, 2002, 144 pp. (Swedish; translation by Leif Andersson)

5.6. AUTHORS

This section contains a list of all researchers either belonging to the personnel or more loosely affiliated to the Department of Mathematics who have published papers in Sections 5.1–5.5. The numbers following the names indicate the items in the reference lists authored by these persons.

Leif Andersson 140; Kari Astala 2; Zoltán Balogh 6; Jean Bricmont 7–8; Oleksiy Dovgoshey 84; Erik Elfving 1, 112; Daniel Faraco 86; D. Franke 15; Roman Goebel 87; Vladimir Gutlyanskii 16–17, 88; Petteri Harjulehto 18–19, 89; Peter Hästö 20–23, 89; Juha Heinonen 2, 24; Alex Hellsten 25; Aarno Hohti 26, 90; Ilkka Holopainen 6, 10–11, 27–28, 91; Ritva Hurri-Syrjänen 85; Taneli Huuskonen 29; Tapani Hyttinen 25, 30–35, 73; Sören Illman 36, 74; Heikki Junnila 37–38; Yuri Kabanov 12; Risto Kaila 39; Juliette Kennedy 41; Juha Kinnunen 93–94; Mika Koskenoja 89, 113; Yuriy Kozachenko 43–44, 95; Antti Kupiainen 7–8, 75, 114–117; Tomi Laakso 45–46, 96; Aatos Lahtinen 118–120, 136–137; Raphael Lefevre 7–8; Matti Lehtinen 123; Li Gongbao 47–48; Yurii Lin'kov 98; Kerkko Luosto 134–135; Olli Martio 15–16, 40, 47–50, 76–77, 88, 93, 99–104, 138; Vladimir Miklyukov 15, 49, 77, 99–102; Yuliya Mishura 51, 105; Evsey Morozov 139; Marjatta Näätänen 78, 121–123, 133; Pekka Nieminen 106–107; Martti Nikunen 124; Esa Nummelin 52; Juha Nurmonen 125; Juha Oikkonen 126–130; Pekka Pankka 91, 131; Kirsi Peltonen 132;

Saminathan Ponnusamy 4–5, 49; Seppo Rickman 24; Vladimir Ryazanov 50, 92, 103–104; Eero Saksman 97, 106–107; Alain Schenkel 3, 53; Mika Seppälä 9, 79; Nageswari Shanmugalingam 28, 94; Tommi Sottinen 43–44, 95, 108–109; Uri Srebro 103–104; Mikko Stenlund 58; Toshiyuki Sugawa 17, 42, 59–63, 81, 110; Kalevi Suominen 64; Tibor Szalontai 133; Olli Tammi 65; Pekka Tukia 66; Hans-Olav Tylli 97; Jeremy Tyson 6; Jouko Väänänen 35, 67–68, 79–80; Jussi Väisälä 14, 29, 69–71, 111, 140; Pauli Väisänen 54–56; Esko Valkeila 12–13, 51, 57, 109; Susanna Varonen 89; Olga Vasylyk 43–44, 95; L. Vostrikova 57; Matti Vuorinen 4–5, 15–16, 49, 77, 82–83, 99–102, 110; Xiantao Wang 66; Yi Zhang 72; Yun Ziqiu 38.

6. OTHER ACTIVITIES

6.1. COMMUNICATIONS IN MATHEMATICAL MEETINGS

The following are the numbers of communications in mathematical conferences and other scientific meetings (in parentheses the numbers of talks given in seminars abroad) delivered by the personnel of the department in 2002: Kari Astala 2, Ville Heikkala 2, Ilkka Holopainen 1 (3), Tapani Hyttinen 1, Sören Illman 2 (3), Céline Jost 1, Heikki Junnila 1, Juliette Kennedy 3 (1), Juha Kontinen 1, Mika Koskenoja 4 (1), Antti Kupiainen 4, Mikko Kuusela 1, Marko Laine 2, Kerkko Luosto 1, Olli Martio 5 (3), Marjatta Näätänen 1, Esa Nummelin 1, Harri Nyrhinen 3, Antti Rasila 1, Alain Schenkel 1, Mika Seppälä 2 (1), Tommi Sottinen 3, Hans-Olav Tylli 2 (4), Jouko Väänänen 3 (4), Esko Valkeila 5 (7), Matti Vuorinen 1 (1).

These communications total 54 (28). Of the communications 31 (15) were invited talks.

6.2. VISITS ABROAD

The following are the visits of the personnel for working abroad for at least two weeks in 2002.

Kari Astala: Mittag-Leffler Institute, Sweden, 15.1.–17.2. and 1.–31.5.; University of Auckland, New Zealand, 20.11.–20.12.

Ilkka Holopainen: Institut Henri Poincaré, France, 27.5.–30.6.

Sören Illman: University of Cambridge, Great Britain, 1.1.–18.7.

Juliette Kennedy: UCLA, USA, 30 days in May; Gödel Archive, Firestone Library, Princeton, USA, 30 days in July; Mittag-Leffler Institute, Sweden, 7.–23.6.

Antti Kupiainen: Institute for Advanced Study, Princeton, USA, 1.–20.3.; Erwin Schrödinger Institute, Vienna, Austria, 15.5.–30.6.

Olli Martio: Mittag-Leffler Institute, Sweden, 14.1.–1.2.

Esa Nummelin: Cornell University, ORIE Institute, USA, 6.2.–7.4.

Mika Seppälä: Florida State University, USA, 1.9.–31.12.

Tommi Sottinen: University of Aarhus, Denmark, 1.1.–30.6.

Hans-Olav Tylli: University of Texas at Austin, USA, 15.–20.10. and 27.10.–14.12.

Jouko Väänänen: CALTECH, USA, 1.–30.4.; Mittag-Leffler Institute, Sweden, 7.–23.6.; City University of New York, USA, 1.–31.7.

6.3. EDITING JOURNALS

Kari Astala: Conformal Geometry and Dynamics (USA), editor.

Ilkka Holopainen: Reports of the Department of Mathematics, University of Helsinki (a preprint series), editor.

Heikki Junnila: Encyclopedia of General Topology (reference work), subeditor.

Juliette Kennedy: Synthese (Netherlands), editor.

Mika Koskenoja: Arkhimedes (Finland), member of the editorial board.

Antti Kupiainen: Communications in Mathematical Physics (USA), member of the editorial board; Electronic Journal of Mathematical Physics (USA), member of the editorial board; Grundlehren der Mathematik (Germany), member of the editorial board; Journal of Statistical Physics (USA), member of the editorial board; Reviews in Mathematical Physics (USA), member of the editorial board.

Aatos Lahtinen: Dimensio (Finland), member of the advisory board.

Kerkko Luosto: Reports of the Department of Mathematics, University of Helsinki (a preprint series), editor.

Olli Martio: Annales Academiae Scientiarum Fennicae Mathematica (Helsinki), chief editor; Discrete and Continuous Dynamical Systems Series B (USA), member of the editorial board; Journal of Function Spaces and Applications (Sweden), member of the editorial board; Bulletin de la Société des Sciences et des Lettres de Łódź, Serie: Recherches sur les Déformations (Poland), member of the editorial board.

Esa Nummelin: Annals of Probability, member of the editorial board.

Harri Nyrhinen: Scandinavian Actuarial Journal, editor.

Seppo Rickman: Annales Academiae Scientiarum Fennicae Mathematica (Helsinki), member of the editorial board.

Pekka Tukia: Annales Academiae Scientiarum Fennicae Mathematica (Helsinki), member of the editorial board.

Esko Valkeila: Statistical Inference for Stochastic Processes, Netherlands, member of the editorial board.

Matti Vuorinen: Computational Methods and Function Theory, member of the editorial board.

6.4. REFEREEING FOR JOURNALS

The following are the numbers of appointments to a referee for a mathematical journal (or, respectively, to a reviewer for an abstract or review journal): Aapo Halko 1, Petteri Harjulehto 1, Ilkka Holopainen 3, Sören Illman 2, Heikki Junnila 2, Juliette Kennedy 1, Aatos Lahtinen 1, Olli Martio 3 (26), Marjatta Näätänen 1, Alain Schenkel 2, Mika Seppälä 5, Pekka Tukia 1, Hans-Olav Tylli 6 (5), Jouko Väänänen 4, Esko Valkeila 5 (6), Matti Vuorinen 7 (13).

These refereeing total 45 (50).

6.5. MANAGERIAL DUTIES IN SCIENTIFIC AND PROFESSIONAL ORGANIZATIONS

Kari Astala: Finnish Mathematical Society, president; The 12th Jyväskylä Summer School, organizer (mathematics).

Sören Illman: Rolf Nevanlinna Institute, vice member of the board; Federation of Finnish Learned Societies, substitute member of the board.

Juliette Kennedy: Association of Symbolic Logic (USA), expert member.

Antti Kupiainen: Rolf Nevanlinna Institute, member of the board; Niilo Helander foundation, member of the board; Helsinki Institute of Physics, member of

the board; Erwin Schrödinger Institute (Austria); member of the scientific advisory board.

Aatos Lahtinen: European Mathematical Society (Helsinki), member of the council; Federation of Finnish Learned Societies, member of the board; Rolf Nevanlinna Institute, member of the scientific board; Academy of Finland, member of the panel of experts.

Jouni Luukkainen: The association HYT of the scientists of the University of Helsinki, appointed representative.

Olli Martio: Publication Committee of the Finnish Academy of Science and Letters, vice chairman; European Mathematical Society, Finland, member of the executive committee, treasurer; European Mathematical Fund, Switzerland, member of the board, treasurer; National Committee of Mathematics (IMU), chairman; National Committee of Finland for mathematical education, chairman; Mittag-Leffler Institute, Sweden, member of the board; Banach Center, Poland, member of the board; FinEst Math 2002, chairman of the organizing committee; International Mathematical Union, IMU Council Shanghai, China, representative of Finland; Conference on Complex Analysis, Shanghai, member of the scientific board; Norges Forskningsråd, Norway, expert.

Marjatta Näätänen: Finnish Mathematical Society, member of the board; The association of the lecturers of the University of Helsinki, member of the board; National Committee for Mathematics, member; EU project Women IT, expert; Conformal Geometry, Discrete Groups and Surfaces, member of the scientific board of the conference; Hungarian afternoon in Finnish Mathematics Days, organizer and chairman.

Esa Nummelin: Rolf Nevanlinna Institute, member of the board.

Pekka Pankka: Finnish Mathematical Society, member of the board, secretary.

Juha Partanen: Consultative committee for subject teacher education at the University of Helsinki, member.

Jukka Pihko: IV Number Theory Days, Helsinki, member of the organizing committee.

Mika Seppälä: Finnish Graduate School in Mathematical Analysis and Its Applications (2003–2006), director; OpenMath Society, Finland, secretary; OpenMath Thematic Network, EU project (2002–2004); Helsinki Learning System project, leader; Advanced Learning Systems project, leader.

Hans-Olav Tylli: European Commission pilot project Tuning Educational Structures in Europe, expert (Mathematics group); FinEst Math 2002, member of the organizing committee; Finnish Graduate School in Mathematical Analysis and Its Applications, member of the board; Arkhimedes, member of the board.

Riitta Ulmanen: European Women in Mathematics, Helsinki, secretary.

Jouko Väänänen: Rolf Nevanlinna Institute, support foundation, chairman of the board of directors; Logic Colloquium 2003, Helsinki, chairman of the organizing committee and member of the program committee; WOLLIC 2003, member of the program committee; Helsinki Learning System project, leader; Advanced Learning Systems project, leader; Matematiikkaa multimedialla avulla project, leader; MALJA Graduate School in Mathematical Logic (2003–2006), member of the board.

Esko Valkeila: Stochastics in Finland (workshop), Helsinki, organizer (with Antti Kupiainen); Miniworkshop in stochastic analysis and finance, Jyväskylä, organizer (with Stefan Geiss).

Matti Vuorinen: Graduate School in Mathematical Analysis and Logic, chairman; Subcontract ordered by Nokia Research Center from Department of Mathematics, University of Helsinki, director.

6.6. ASSESSMENTS FOR APPOINTMENTS

The following are the numbers of assessments for appointments to a professorship or docentship: Ilkka Holopainen 1, Taneli Huuskonen 1, Antti Kupiainen 3, Kerkko Luosto 1, Olli Martio 4, Mika Seppälä 1, Kalevi Suominen 1, Jouko Väänänen 1, Matti Vuorinen 3.

6.7. REFEREEING PH.D. THESES

Ilkka Holopainen has acted once as an opponent.

6.8. ACTIVITIES IN THE SOCIETY

Mika Koskenoja was a member of the editorial board of the mathematics magazine *Solmu*. He was interviewed twice in the newspapers and once in a student bulletin.

Aatos Lahtinen, as president of the Matriculation Examination Board, was interviewed several times on radio, television, and in the newspapers. He has also delivered several talks concerning the matriculation examination. He acted as chairman in a committee for developing the matriculation examination. He has been a member of the follow-up group for the structure experiment of the matriculation examination. He has also been a member of a committee for developing high school education and a member of the follow-up group for the LUMA project. He was an expert for adjustment of the examination of the second national language. He was heard as an expert by the Education and Culture Committee of the Parliament of Finland.

Kerkko Luosto is a member of the training group of the Finnish Mathematical Society for high school students and a member of the competition committee of the MAOL association. He was the director of the Finnish group in the International Mathematical Olympiad IMO2003. He delivered a talk on high school mathematics teaching.

Jouni Luukkainen tried to improve the proposed new law for liberty of religion.

Olli Martio delivered a talk on grading the mathematics exam in the matriculation examination.

Marjatta Näätänen has been a member of the follow-up group for the LUMA project. She was a member of the editorial board of the mathematics magazine *Solmu*. She has been responsible for the Finnish part of the EU project “M-buttons”, a multilingual mathematics dictionary for the school level in the internet. She has initiated and leads an experimental project of primary teaching of mathematics in the Hungarian way (Varga method) in several schools in Finland.

Juha Partanen delivered two talks on grading the mathematics exam in the matriculation examination. He has been a member of the school board for Helsingin II Normaalikoulu.

Jouko Väänänen delivered an introductory talk for students.

Since 1996 a scrapbook containing information about the department and articles of public interest written by persons in the department is maintained in the library.

7. GUESTS

The following is a list of the foreign guests of the department in 2002.

- Knut Aase, NHH, Bergen, Norway, 6.–12.5.
 Mark van Atten, Catholic University of Leuven, Belgium, 10.–23.5., 14.–20.12.
 Zoltán Balogh, University of Bern, Switzerland, 7.–10.10.
 Thomas Bartsch, University of Giessen, Germany, 27.11.–1.12.
 Michael Bildhauer, University of Saarland, Saarbrücken, Germany, 29.11.–4.12.
 Anders Björn, Linköping University, Sweden, 13.–24.5.
 Jana Björn, Lund University, Sweden, 13.–24.5.
 Andrei Bovykin, Istanbul Bilgi University, Turkey, 1.2.–30.6.
 Jean Bricmont, UCL, Louvain-la-Neuve, Belgium, 22.–30.1., 27.9.–4.10.
 Steve Buckley, National University of Ireland, Maynooth, Ireland, 27.8.–1.9.
 Dimitri Burago, Pennsylvania State University, University Park, USA, 8.5.
 Jeff Cheeger, Courant Institute, New York, USA, 11.1.
 Ed Chiang, University of Hong Kong, China, 16.10.
 Jeffrey Collamore, ETH, Zürich, Switzerland, 13.–25.1., 4.–11.8.
 Michael Detlefsen, University of Notre Dame, USA, 14.–28.5.
 Oleksiy Dovgoshey, NAS of Ukraine, Donetsk, Ukraine, 1.–21.10., 13.11.–12.12.
 Aleš Drápal, Charles University, Prague, Czech Republic, 23.–28.5.
 Mirna Džamonja, University of East Anglia, Norwich, UK, 12.5.–6.6.
 Ludwig Fadeev, Steklov Institute of Mathematics, St. Petersburg, Russia, 2.–5.10.
 Beata Falda, Catholic University of Lublin, Poland, 12.–16.10.
 Kurt Falk, University of Fribourg, Switzerland, 4.9.–31.12.–
 Larry Fialkow, SUNY at New Paltz, USA, 19.–24.3.
 Magnus Fontes, Lund University, Sweden, 26.5.–2.6.
 Bent Fuglede, Lungby, Denmark, 27.–30.4.
 Marc Gaetano, University of Nice Sophia Antipolis, France, 2 days in August
 Thierry Gallay, University of Grenoble, France, 4.–11.5.
 Krzysztof Gawędzki, ENS Lyon, France, 1.–6.3.
 Fred Gehring, University of Michigan, Ann Arbor, USA, 27.10.–4.11.
 Hagen Gilsing, Humboldt University Berlin, Germany, 23.8.–3.10.
 Yuri Gurevich, Microsoft, 12.–17.11.
 Alexander Gushchin, Steklov Institute of Mathematics, Moscow, Russia, 6.5.
 Vladimir Gutlyanskiĭ, NAS of Ukraine, Donetsk, Ukraine, 1.7.–6.12.
 Lars-Inge Hedberg, Linköping University, Sweden, 12.–15.4.
 Juha Heinonen, University of Michigan, Ann Arbor, USA, 16.–19.6.
 Paweł Hitczenko, Drexel University, Philadelphia, USA, 7.10.
 Hu Yijun, Wuhan University, China, 5.–20.10.
 Per-Anders Ivert, Lund University, Sweden, 18.3.
 Leonid Kalachev, University of Montana, Missoula, USA, 20.9.–20.10.
 Wojciech Kawa, Catholic University of Lublin, Poland, 12.–16.10.
 Stephen Keith, Australian National University, Canberra, Australia, 15.7.–15.12.
 Bernd Kirchheim, Max-Planck Institute, Leipzig, Germany, 3.–6.10.
 Vladimir Klyachin, Volgograd State University, Russia, 14.–20.12.
 Kim Knudsen, Aalborg University, Denmark, 11.4.
 Yuriy Kozachenko, Kiev State University, Ukraine, 11.11.
 Saul Kripke, USA, 7.–14.5.
 Yaroslav Kurylev, Loughborough University, UK, 26.9.

Lê Tuân Hoa, Institute of Mathematics, Hanoi, Vietnam, 2.5.–28.6.
 Raphael Lefeveré, RIMS, Kyoto, Japan, 23.–29.1., 13.–19.2.
 István Lénart, ELTE, Hungary, 19.11.
 Bernhard Lewerich, Skills On Line, Germany, 2 days in August
 Li Gongbao, Academia Sinica, Wuhan, China, 9.9.–7.12.
 Mikhail Lifshits, St. Petersburg State University, Russia, 4.11.
 Mukul Majumdar, Cornell University, Ithaca, USA, 20.8.
 Vladimir Maz'ya, Linköping University, Sweden, 9.–13.12.
 Tatyana Maz'ya-Shaposhnikova, Linköping University, Sweden, 9.–13.12.
 Michel Mendès-France, University of Bordeaux I, France, 22.–26.5.
 Vladimir M. Miklyukov, Volgograd State University, Russia, 3.–13.3., 1.–15.10.
 Yuliya Mishura, Kiev State University, Ukraine, 8.–14.4., 15.–25.11.
 Evsei Morozov, University of Petrozavodsk, Russia, 1.–19.2.
 Ragnar Norberg, University of London, UK, 7.–8.6.
 Eve Oja, Tartu State University, Estonia, 10.–14.11.
 Vera Oláh, The mathematics magazine *KöMal*, Hungary, 7.–13.1.
 Krzysztof Oleszkiewicz, University of Warsaw, Poland, 7.–8.3.
 Vladimir Potyemkin, NAS of Ukraine, Donetsk, Ukraine, 1.–21.5.
 István Prause, Eötvös Loránd University, Budapest, Hungary, 25.11.–9.12.
 Qun Chen, Max-Planck Institute, Leipzig, Germany, 14.–17.11.
 Gerhard Rosenberger, University of Dortmund, Germany, 1.7.
 Vladimir Ryazanov, NAS of Ukraine, Donetsk, Ukraine, 1.3.–30.4., 1.–31.10.
 Rolf Schroll, Skills On Line, Germany, 2 days in August
 Kristian Seip, NTNU, Trondheim, Norway, 9.–13.1.
 Peter Šemrl, University of Ljubljana, Slovenia, 19.–26.1.
 Karen Smith, University of Michigan, Ann Arbor, USA, 2.–10.7.
 Virge Soomer, Tartu State University, Estonia, 10.–14.11.
 Uri Srebro, Technion, Haifa, Israel, 1.7.–30.9.
 Viggo Stoltenberg-Hansen, Uppsala University, Sweden, 6.–8.2.
 Bernd Stratmann, University of St. Andrews, UK, 12.11.–20.12.
 Toshiyuki Sugawa, Hiroshima University, Japan, 1.1.–15.4., 1.–9.12.
 Tibor Szalontai, College of Nyíregyháza, Hungary, 12.–25.5.
 Andrzej Szulkin, University of Stockholm, Sweden, 19.–22.10.
 Kazuo Tomoyasu, Miyakonojo National College of Technology, Japan, 16.–28.8.
 Tibor Toró, University of Timișoara, Romania, 21.10.
 Hans Triebel, Friedrich-Schiller-University, Jena, Germany, 2.9.
 Jean-Marc Vanden-Broeck, University of East Anglia, Norwich, UK, 25.–31.5.
 Kari Vilonen, Northwestern University, Evanston, USA, 13.–19.9.
 Angelo Vulpiani, University of Rome “La Sapienza”, Italy, 26.1.–2.2.
 Yun Ziqiu, Suzhou University, China, 12.7.–4.9.
 Józef Zajac, Catholic University of Lublin, Poland, 12.–16.10.
 Michel Zinsmeister, University of Orléans, France, 4.–7.6.

Of these 88 guests 14, namely Bovykin, Dovgoshey, Falk, Gilsing, Gutlyanskiĭ, Kalachev, Keith, Le Tuan Hoa, Li Gongbao, Ryazanov, Srebro, Stratmann, Sugawa, and Yun Ziqiu, stayed at least one month.

8. LIBRARY

At the beginning of March 2001 the Library of the Department of Mathematics was incorporated with other libraries of the exact sciences in the faculty to form the Kumpula Science Library. The Library of Mathematics stays in Heimola with the department until they together move to Kumpula in 2004.

The collection of mathematics is the only one containing advanced mathematical literature at the University of Helsinki. This collection covers a wide range in the fields of mathematics. It is considered to be of a very high international standard (especially the journals). In 2002 the library obtained some funds from the faculty for acquisitions, but otherwise the library was exclusively funded by the department.

The collection of the library consists of about 45 000 bindings on almost 2000 shelf meters. In 2002 the accumulation of new books was 527, from which 392 were bought, and the library received 380 titles of periodicals and reports, from which 161 were bought. The majority of series (65 %) is received only in printed form, about 35 % both in printed and digital form (e.g. Academic Press, AMS, Elsevier, Springer-Verlag). Six to ten journals were received only electronically. The number of journals which are available through FinELib (a national electronic database) is growing. The most important reference databases in mathematics are the “MathSciNet” and the “STN International Math”, which are available as online-versions on each PC computer at the department.

The book and journal catalogues are part of the electronic HELKA- and LINDA-databases. Because the books have been catalogued into HELKA-database, they can be borrowed automatically with HELKA- or Unicard. The serials check-in has been carried out manually. In 2001 the library system was converted from VTLS to Voyager, whose new features were still added in 2002.

The ARTO database is being upkept in the library. ARTO contains information on articles either published by Finnish authors or published in Finnish journals. Also the databases of the University of Helsinki ASTI (Expert database), JULKI (Publication database), MUTI (Academic activities), TUHTI (Research Projects) and YHTI (Non-academic activities of social significance) are updated by the library.

The core customers consists of teachers and researchers at the department, as well as of graduate students and advanced undergraduate students, and of the mathematical departments of other Finnish universities. Since September, the opening hours have been 8.30–17.30 during the semesters and 8.30–15.30 off semesters, Monday through Friday. In July the library was closed four weeks. The staff of the department has round-the-clock access to the library.

9. COMPUTING FACILITIES

The department has about 100 PC computers and 6 Macintosh computers, which are all connected to the university network. For output there are 18 laser printers. The computers are mainly used for word processing, typesetting, and communication by electronic mail, but some mathematical and statistical programs are used as well. The laboratory engineer of the department supports the equipment and consults the staff in automatic data processing. Students can use two microcomputer classrooms, which have altogether 19 PC computers and one laser printer. The students and the staff of the department have about 830 accounts on the UNIX machines and about 770 accounts on the Novell networks of the university.

10. ADMINISTRATION

The administrative posts on the university, faculty, or department level held by members of the department in 2002 were the following. If a name is followed by a name in parentheses, the latter person had been elected to replace the first person when needed.

Faculty Council. Member in the quota of professors was Olli Martio (Sören Illman). Jouko Väänänen was a deputy member. Hans-Olav Tylli (Hannu Honkasalo) was a member in the quota of the other teachers and researchers and the other personnel.

Faculty Planning Board. Olli Martio was a member.

Faculty Entrance Board. Hannu Honkasalo and Kalevi Suominen were members. Åsa Ekman was a student member.

Subject-teacher student entrance board in the Faculty of Education. Juha Partanen (Olli Martio) was a member.

Teaching development board in the faculty. Juha Oikkonen was a member. Hanna Jäntti was a student member.

Chairman. The chairman of the department was Olli Martio (Jouko Väänänen).

Department Board. The two members of the department board from the quota of professors were Olli Martio (Kalevi Suominen) and Jouko Väänänen (Esa Nummelin). The two members from the quota of other personnel were Mika Koskenoja (Pauli Väisänen) and Hans-Olav Tylli (Juha Oikkonen). The two members from the quota of students were Åsa Ekman (Marika Koivunen) and Jarkko Sutela (Timo Laitinen). The board was chaired by the chairman of the department.

Faculty library board. Kalevi Suominen (Jouko Väänänen) was a member. Mika Koskenoja and Riitta Ulmanen were deputy members representing the researchers and the library personnel, respectively. Kalevi Suominen was also responsible for library acquisitions of the department.

Subject-teacher student evaluation board in mathematics. The members were Sakari Toppila and Kalevi Suominen.

Workgroup for planning the new Faculty of Science. Jouko Väänänen was a member.

Committee for implementing the fusion of Department of Mathematics, Department of Statistics, and Rolf Nevanlinna Institute. Jouko Väänänen was the chairman and Olli Martio a member.

Study records rectifying board of the university. Jouko Väänänen was an additional member.

11. ECONOMY

The expenses covered directly by the department can be divided into the following nine parts:

- The salaries of the regular staff. (Until 1997 the salaries of the regular staff were paid by the university, from 1998 on they are paid from the budget of the department.)

- The salaries of the graduate school students.
- The activities of the Centre of Excellence.
- Teaching fee allocation (the salaries of the instructors and the teaching assistants).
- The acquisitions of the library: books, periodicals, and CD-ROMs.
- Research: reports (until 1997 this included some scholarships).
- Travels and scholarships.
- Computers: microcomputers, printers, computer software etc.
- Mixed expenditure (this includes, e.g., mailing, telephone, telefax, photocopy paper).

The following table gives these costs in thousands of euros in the last eight years.

| Year | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 |
|---------------|------|------|------|------|------|------|------|------|
| Salaries | | | | 1668 | 1559 | 1543 | 1610 | 1719 |
| Gr. schools | | | | | | | 135 | 280 |
| Centre of Ex. | | | | | | | | 123 |
| Teaching | 187 | 224 | 273 | 289 | 372 | 322 | 216 | 233 |
| Library | 91 | 93 | 146 | 86 | 137 | 153 | 81 | 130 |
| Research | 16 | 7 | 5 | 5 | 4 | 3 | 5 | 5 |
| Travels | 7 | 9 | 12 | 13 | 2 | 10 | 12 | 20 |
| Computers | 16 | 27 | 19 | 16 | 38 | 27 | 30 | 75 |
| Mixed | 12 | 18 | 20 | 23 | 24 | 61 | 26 | 40 |
| Total | 329 | 378 | 477 | 2100 | 2136 | 2119 | 2115 | 2625 |

The salaries of the regular staff, paid then by the university, were about 1.6 million euros in 1997, and about 1.7 million euros in 1996. In 2002 and 2001 the external research funding amounted to approximately 1.51 million euros and 1.48 million euros, respectively. These amounts do not include the Graduate Schools. In 2000 the external research funding amounted to approximately 1.44 million euros, of which 0.17 million euros were due to the Graduate School. In 1999 these sums were 1.28 million euros and 0.16 million euros, respectively, and in 1998 they were 0.73 million euros and 0.16 million euros, respectively.

12. PREMISES

The premises of the department are located in four floors (4.–7.) of the office building Heimola (Yliopistonkatu 5) in the centre of Helsinki. There are 51 offices, 4 seminar rooms, a departmental library, and 2 microcomputer rooms, altogether 1561 m². In addition, in the office building Vuorikatu 6 there are 4 office rooms, altogether 79 m², and in the office building Vuorikatu 20 there are 4 seminar rooms, altogether 156 m². A large part of the lectures and all exams are held in big lecture halls outside Heimola.