

Evaluation of Estonian Mathematical Research

Institutes evaluated

- 1. Faculty of Mathematics and Computer Science, Tartu University**
- 2. Department of Mathematics and Informatics, Tallinn Pedagogical University**
- 3. Department of Mathematics, Tallinn Technical University**
- 4. Institute of Cybernetics, Tallinn Technical University**

Evaluation dates

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1. Approach to the evaluation

The evaluators were asked to

- **evaluate the quality of mathematical research in each of the aforementioned institutes;**
- **identify deficiencies in research and facilities;**
- **give recommendations for improvement and development.**

The team had obtained self-evaluation reports of the institutes a couple of weeks in advance. The team was also given the guidelines to the experts, principles and criteria for evaluation and the working schedule.

The team arrived in Tallinn May 20, 2001. After a short briefing the team was transferred to Tartu in the same evening. The Institutes of Pure Mathematics, Applied Mathematics and Mathematical Statistics at the Tartu University were visited on May 21. In the evening the team moved back to Tallinn and the Department of Mathematics at the Tallinn Technical University was visited in the following day. The team visited the Department of Mathematics and Informatics of the Tallinn Pedagogical University May 23 and the Institute of Cybernetics of the Tallinn Technical University May 24. This evaluation report was completed in Tallinn May 25-26.

The team found it necessary to divide some of the Departments/Institutes into subunits in research to which the four point scale (excellent, good, satisfactory, unsatisfactory) on the overall capability, with some finer touches, was applied. On the other hand the evaluators combined similar research projects together. In most cases only the names of the principal

investigators or leaders of the groups are mentioned. The following criteria were used:

1. The quality of research and its international impact; publication record.
2. The novelty of the results and prospects for future developments and breakthroughs.
3. International and national co-operation.
4. The ability of the group to continue and improve their research.
5. Success in educating new PhD's and MSc's.
6. The national importance of the research to other areas of research and development in Estonia.

We also rated the scientific activities of the groups separately using the same grading system. The grades are based on the importance of the results as well as on the publication records.

The recent citation indexes (Compu Math Citation Index, JAN 1996–DEC 2000 and JAN 1997-FEB 2001) are mentioned in connection with those researchers whose citations exceed the limit of ten citations.

The Evaluators found the self-assessment reports very well done. The institutes were also well aware of their strong and weak points.

For future evaluations it is recommended that the evaluators have more time in Tartu. It seems that two days in Tartu and two days in Tallinn would have been more appropriate. In some of the departments the evaluators would have liked to interview the researchers who are moving up in their career but not yet reached the status of a principal investigator.

2. Mathematics in Estonia

Mathematical research has gone through a profound transition period in Estonia. This transition period still continues. The former research connections were very much to the Soviet Union, where many of the Estonian mathematicians had received their candidate and doctor degrees.

The contacts still exist but are much weaker now. The new generation of Estonian mathematicians has found fresh research contacts in the European countries and in USA. Financial difficulties have to a large extent prevented a shorter transition period.

The Evaluators found several examples of mathematical research on a high international level, and some of the mathematicians have a well-developed network of international contacts. However, some groups lag behind in this development.

The separation of teaching and research, which was traditional in the socialist system, has largely ceased to exist. The Institute of Cybernetics remains as the only research institute pursuing mathematical research. It has already been integrated to a certain extent in the Tallinn Technical University but remaining difficulties should be overcome in order to use the research staff of the Institute for teaching purposes.

In a country the size of Estonia it is not possible to find research in all major branches of mathematics. In the Soviet system a country like Estonia could just concentrate on one field of mathematics. In the new situation this does not work. There are clear signs that the mathematical expansion in Estonia is on its way. However, there are a number of mathematicians who still work in fields that are considered obsolete in most parts of the world.

The new degree system, common in most European universities, consists of three year studies for the Bachelor degree and of five year studies for the Master degree. The Evaluators strongly recommend that this system be adopted by the mathematical departments. Also the studies for the PhD degree should be shortened accordingly. There are some difficulties to adapt the teacher-training program into the system but this should be made in a way that confines the study time to five years.

The Evaluators found that during the last five years much effort was devoted producing university level course material in the Estonian language. All departments have joined in this work and it seems that there is a nice teamwork between the institutes to let the best-qualified people prepare the material. This work has had its adverse effect on mathematical research. There is much to recommend that all the basic courses have study material in the mother tongue of the students. However, there is no need to extend this to specialized courses.

The members of the mathematical community have also written many textbooks for schools. In the countries of the Evaluators this activity is not as widespread among the professors of the universities as in Estonia. This activity is not financially beneficial, but it is important that specialists have taken up this task. This activity should enjoy support from the Ministry of Education.

The Evaluators have a feeling that the facilities (buildings, offices, lecture rooms, access to computers) have greatly improved, the exception being offices and lecture rooms at the Tartu University. Libraries are not up to the European standard.

In spite of the financial difficulties the Evaluators have been impressed by the energy and determination of many of the mathematicians encountered during the visit.

3. Evaluation of mathematical research

3.1. Faculty of Mathematics and Computer Science, Tartu University

The Faculty of Mathematics and Computer Science has three Institutes in mathematics: Pure Mathematics, Applied Mathematics and Mathematical Statistics. These together represent a department of mathematics of a good international size. The division of the chairs is satisfactory and covers the main fields of mathematics. However, the division of associate professors and lecturers under the chairs is obsolete. See our general recommendations.

The Institute of Mathematical Statistics has the best strategy to cope with future problems. There is a lack of motivated students both in pure and in applied mathematics. The education system still partly follows the old Soviet system where a thesis for the MSc degree should contain original results which could be published in a mathematical journal. We recommend that the Faculty insists that the change to the modern 3 + 2 year study system is adopted.

The self-assessment report had made already an impact in the Faculty: Information on the report has been transferred to the WEB-page of the Institutes.

The facilities of the Institutes are poor and lag behind the facilities in other universities of Estonia. They are certainly not up to a European standard. However, the University has a plan to construct a new building and the Faculty is very much looking forward to this. The library of the Faculty is the best in Estonia in mathematical books and journals, but it is certainly not up to the standard found, say, in the Scandinavian universities of similar size. The first thing to improve is to get a connection to the Math Sci Net or to the EMIS database. In this matter the Faculty could cooperate with other Estonian departments of mathematics or to try to find partners abroad.

In many research areas the leading professors are approaching the retirement age. If the structure of the chair system is changed, then the reform of the mathematical research will be more easily achieved.

3.1.1. Institute of Pure Mathematics

The Institute of Pure Mathematics has five chairs, four of which come under this evaluation. Research areas are evaluated separately below.

The Institute has tried to find new methods to recruit motivated students. This is a general problem in most European countries and it is not easy to solve. Mathematicians are needed in the Estonian labour market but students are reluctant to choose rather long and demanding mathematical studies. The degree reform will certainly help here.

The Institute will face a transition period soon since $2/3$ of the staff has reached the age of 55. The Evaluators strongly recommend that our general recommendations be taken into account in order that this period will be passed smoothly and that the Institute will benefit from this transition.

Algebra (M. Kilp, K. Kaarli)

There are two research groups in algebra. The emphasis is in the semi-group theory and universal algebra, with the addition of some ideas from

category theory. These research areas have a long tradition in Estonia. However, the subject is outdated. There are five students at the MSc or PhD level.

These groups have produced a fair number of papers published in international journals, and Prof. Kilp has recently published a monograph. The recent citation indexes (Compu Math Citation Index, JAN 1996–DEC 2000 and JAN 1997-FEB 2001) show that Ass. Prof. Abel, Prof. Kilp and K. Kaarli have reached international mathematical recognition in their fields of research. We rate the research activities of the group as good and the overall capability satisfactory.

Functional Analysis (Eve Oja)

The group deals with problems in approximation and duality of Banach spaces in the area called “Geometry of Banach Spaces”. The problems belong to the hard core in the theory of Banach spaces. Recent nonlinear studies in Banach spaces have shown that the approximation properties play an important role in the geometry of Banach spaces. The recent citation indexes (Compu Math Citation Index, JAN 1996–DEC 2000 and JAN 1997-FEB 2001) show that E. Oja and her group have reached good international mathematical recognition. Papers have been published in good international journals and the records show a very active international co-operation. The group seems to have very good prospects in future.

We judge the research activities of the group as excellent and the overall capability from good to excellent.

Analysis (U. Kangro, T. Leiger, H. Tüرنpu)

The research areas here are differential and integral equations (U. Kangro) and summability, sequence spaces and orthogonal series (T. Leiger, H. Tüرنpu).

The studies in differential and integral equations are devoted to electromagnetic scattering problems. Rate of convergence of the collocation method has been established. These studies continue the basic studies in this area. There is good international co-operation. The group is small, consisting of one researcher only. The research activities of this analysis are rated good.

The group studying summability, sequence spaces and orthogonal series is larger having seven members including one PhD student. This area has been investigated by pure mathematicians in Estonia for a long time. The original problems come from Fourier Analysis. This area is no longer a very active field of international research. It seems that the group has not followed the trend of the mathematical world to study more interesting function spaces. The Evaluators recommend that the group takes up new related topics in the field of real analysis. The research activities of this analysis group are rated satisfactory.

We judge the overall capability of the analysis group satisfactory.

Geometry (M. Rahula)

The research is subdivided into three subsections:

- 1. Differential geometry. The research done by Lumiste (Riemannian geometry) and Rahula (differential equations and their symmetries) is of a very good level, with good international contacts. Our main concern is that the two leaders of the group are above the age of 65, and the future of this research is uncertain.**
- 2. Supersymmetries: The research done by Abramov is of an excellent level, up-to-date, and with a good collaboration abroad. The Institute of Pure Mathematics has an excellent asset here, and PhD students ought to be directed to this field.**
- 3. Topological algebras: The research done by M. Abel here is on a satisfactory level, but in a field of less potential. There are good international contacts.**

We judge the research activities of the geometry group good and the overall capability good..

3.1.2. Institute of Applied Mathematics (IAM)

IAM has three chairs, Differential and Integral Equations, Numerical Methods and Theoretical Mechanics. There are three research projects “Advanced models and methods of applied mathematics and mechanics” (Prof. J. Lellep), “Analysis and optimisation of inelastic structures” (Prof.

J. Lellep), “Numerical solution of differential and integral equations” (Prof. A. Pedas). IAM has obtained several grants closely related to these projects and a postdoctoral fellowship (Ph.D Raul Kangro).

All three research projects have two PhD students. Publication activities of the projects are on the same level and this applies to the overall capability as well. There are rather few practical contacts to the users of applied mathematics; most contacts are to academic institutions. Hence the Evaluators decided to give equal grades to all projects.

Research projects in Applied Mathematics (J. Lellep, A. Pedas, R. Kangro)

The papers show relatively few international contacts, although Prof. Lellep has been involved in international organizations of material studies. The groups have a good publication rate. Some of the problems are old fashioned and there is no clear vision how the group wants to reshape their future studies.

The research activities are rated as good and the overall capability satisfactory.

3.1.3. The Institute of Mathematical Statistics

At present the University of Tartu is the only place which carries out fundamental research in probability and mathematical statistics. However the evaluation team has also encountered research and development work in this area at the Estonian Agricultural University through the Biometrics Group and at the Institute of Cybernetics. There is clearly a need for establishing researchbased teaching in the subjects in the Tallinn area either at the Pedagogical University or the Technical University.

The area in question is important because any organized society needs

- 1. statisticians for collecting, organizing and evaluating data,**
- 2. specialists with a thorough knowledge of probability to be used in economics, financing and insurance,**
- 3. teachers on all levels.**

The institute has a good number of students on every level.

In the area of probability and statistics it is vital to combine fundamental research with applied work. It seems that the group at IMS has been

successful in achieving this. An important component is the attachment of Tõnu Möls to the Institute as 1/2-time Docent while leading the Biometrics Group of the Institute of Zoology and Botany of the EAU. This activity is rated separately in this section.

Fundamental and applied research (T. Kollo, E.-M. Tiit)

The fundamental research at IMS has been supported through target funds for the period

1996-2000 under the leadership of Tõnu Kollo and Ene-Margit Tiit, and for the period 2001-2005

headed by T. Kollo alone. The funds have increased year by year and have more than doubled

from 1996 (EEK 234.100) to 2001 (EEK 564.000).

In addition there has been given research grants from the Estonian Science Foundation to a number of principal investigators: T. Kollo, E. Käärrik, K. Pärna, E.-M. Tiit, I. Traat. As an outcome of the research members of the group have published 53 items in journals having international referee practice. This has been duly noted in the recent citation indexes (Compu Math Citation Index, JAN 1996–DEC 2000 and JAN 1997-FEB 2001). We judge the research activities of the group as excellent.

In the period 1996-2000 the group has educated 2 PhD's and 17 Masters. The group also reports about 10 PhD's and 26 Masters in preparation. Of the latter 13 are in mathematical statistics, 7 in financial mathematics and 6 in applied statistics. It seems that there is a very good balance between the subjects and good potential for further development at the Institute.

As a whole the group at IMS has very good international contacts, they have research partners abroad, they publish in international journals and take part in international conferences.

The overall capability of the IMS is rated as excellent to good.

Estonian Agricultural University, Group of Biometrics (T. Möls)

The head Tõnu Möls of this small unit has received grants in the period 1996-2001 from the Estonian Science Foundation. During this period he

has been involved in 22 publications in diverse areas needing statistical planning and assistance. He has supervised or cosupervised 3 Masters theses and 3 PhD and a Masters theses are under preparation.

The grants are connected to projects important for the future of Estonia (ecology, biology, hydrology...) and the projects as such are scientifically outside the expertise of the present team. However the expertise of the Biometrics Group seems to have played an important role for the success of the projects.

T. Möls has been involved in a substantial amount of projects in the natural sciences, and it seems that the Group of Biometrics needs an enlargement. Considering that T. Möls is born in 1939 one should already begin to think about hiring a younger person who could work together with him in a transition period, and learn from his high experience. For the continuing success of the Biometrics Group it is important that the researcher(s) of the unit are in close contact with the Institute of Mathematical Statistics of Tartu University and take part in the teaching and advising activities of that institution.

The research activities of the Biometrics Group are rated as excellent with a good balance

of papers in Estonian and foreign publications. The overall capability is rated as good.

3.2. Department of Mathematics and Informatics, Tallinn Pedagogical University

Again the Department has been divided according to the chairs of Algebra and Geometry (Prof. Paul Tammela), Mathematical Analysis (Prof. A. Kivinukk) and Informatics (Prof. P. Normak). There are 5 Associate Professors divided among the Chairs. In the Department there is also a professor in didactics but the research in mathematical didactics was not included in the task of the Evaluators.

There is a University Foundation to support research inside university. The Foundation supports usually big projects. There is a separate foundation for co-operation with other universities.

Merging Technical University and Pedagogical University together is not a good choice. Although the courses carry the same name, the content and the emphasis of the courses are different.

The University insists that the master students spend some time in foreign universities (Erasmus program). This provides a good opportunity for students to have an independent view of mathematical research done elsewhere. Now there will be the new degree system, common in most European universities, 3 years for the Bachelor degree and 5 years for the Master degree. Bachelor degree plus 2 years of educational training would likely suffice to the level of a high school teacher.

The Pedagogical University is not allowed to grant PhD degrees. The students aiming to this degree are formally sent to the Technical University but in practice supervised by the staff of TPU. Pure mathematics on the PhD level is only present at the Tartu University.

The Pedagogical University has been very successful in training teachers in mathematics. Most of the schoolbooks have been produced by the members of the Department of Mathematics in the Pedagogical University.

The Department of Mathematics seems to have the best access in Estonia to motivated students in mathematics.

Analysis (A. Kivinukk)

The work of this group (Prof. Kivinukk, Assoc. Prof. Aasma, Monakov, Tali and Ass. Prof. Porn) is in close connection with the analysis group in the Tartu University. The areas are summability theory, Fourier analysis and approximation problems, topology and liftings. The same comments as to the Tartu group apply here. The main drawback is that most studies lack connections to modern analysis. New areas of research, like wavelets and pricing of options, have been introduced recently, and the staff is encouraged to continue such new trends. Compared to the related Tartu group more Master theses have been completed.

The research activities of the research group are rated from good to satisfactory and the overall capability as satisfactory.

Algebraic structures and discrete mathematics (P. Normak, P. Tammela)

There are two groups. The first group, Prof. Normak and Assoc. Prof. Redi, deals with problems of universal algebra; this area is closely connected to model theory in logic. They are both active in their research, but do not have students. The subject, which belongs to the tradition of semi-groups (extensively cultivated in Estonia) is somewhat old-fashioned. In this research area Prof. Normak has successfully departed from this classical field and he is duly noted by his achievements in the recent citation indexes (Compu Math Citation Index, JAN 1996–DEC 2000 and JAN 1997-FEB 2001).

In the second group Prof. Tammela continues his research about quadratic forms, with two young collaborators. They have expanded the scope of their research to include cryptology. International co-operation is relatively limited.

The research activities of the research group are rated good and the overall capability as satisfactory.

3.3. Department of Mathematics, Tallinn Technical University

The Department of Mathematics is a structural unit within the Faculty of Mathematics and Physics. The research has been supported by target funds for the years 1996-2000 under the theme "Application methods of algebra and mathematical analysis". In addition there has been given research grants from the Estonian Science Foundation to a number of principal investigators: J. Janno, L. Kluge, E. Paal, P. Puusemp, I. Tammeraid, O. Vaarmann.

The research directions are algebra, geometry, mathematical analysis and applied mathematics. There is a good beginning of leaving the chair system in the sense that two professors now are together under the heading Algebra and Geometry since the research in geometry has many algebraic aspects.

The Department aims at creating a new professorship in probability and statistics, but lacks a suitable candidate. As remarked elsewhere in the

report, there is a need for research in this subject, which is represented only in Tartu University.

It is of great concern that there seems to be a lack of students for the Masters degree. Only 4 Masters theses were defended in the period 1996-2000. For the moment 5 PhD students are formally attached to the department, partly supervised by the staff at Tallinn Pedagogical University. Also the age profile of the department gives rise to concern, but it is not easy to see any solution in the near future.

The staff has put a lot of effort in making course material available in Estonian language for the basic courses. This is important in a technical university where plenty of service teaching is given to engineering students. This activity has certainly left less time for research. After this transition period to Estonian language based courses, the department shall try to broaden its research profile and make plans for the future development. From 2002/2003 it has been decided to enlarge the mathematics curriculum to include the engineering bachelor degree.

Algebra and Geometry (P. Puusemp, E. Paal)

The research of E. Puusemp is in the tradition of semigroup theory, initiated by Kurosh and Gluskin, and cultivated for a long time in Estonia. He applies these ideas to the characterization of some groups. This research is on a satisfactory level, but subject to our general remarks about semigroups.

E. Paal received his education in the Institute of Physics in Tartu. In the scientific tradition of Gusev, he studied nonassociative algebras in physics (Moufang loops, Maltsev algebras). This line of research is no more a hot subject, but Paal has been able to change his focus. With a help of his very gifted student L. Kluge, he is now studying Gerstenhaber algebras and operads; this subject has experienced important recent developments, especially in France and USA. This opens a possibility of collaboration with French mathematicians (J.-L. Loday, Fr. Chapoton, P. Cartier) in coming years.

The research activities of the Algebra and Geometry group are rated good and overall capability satisfactory.

Analysis (I. Tammeraid, O. Vaarmann)

There are three main research areas, “Summability Theory”, “Formation and Solution of Mathematical Models Using Differential Equations” and “Regularization and Inverse Problems of Integro-Differential Type”. Since there is a very similar project to the last research area in the Institute of Cybernetics headed by J. Janno, the Evaluators rate this area in the section devoted to that institute.

What has been said previously about summability methods applies also to this research in TTU. In general there are very few international contacts.

The research activities of the Analysis group are rated satisfactory and overall capability satisfactory.

3.4. Institute of Cybernetics, Tallinn Technical University

This institute is the only research institute employing mathematicians. It is economically independent although it is connected to the Tallinn Technical University. It has employed 25 mathematicians in the past. After the institute was merged with the Tallinn Technical University some of the mathematicians joined the Department of Mathematics and some proceeded to the open market. The merge with the Tallinn Technical University was not entirely successful: Some of the mathematicians came back to the Institute. It was also found that mathematicians are very much needed in the Institute to help researchers in other projects. Presently the Institute employs six mathematicians. There are 30-40 researchers at the Institute.

The researchers have five-year temporary positions like professors in the universities. The Institute is able to practice a much more flexible financial policy for its staff than the universities in spite of similar general circumstances. Researchers in mathematics are appreciated by the directors of the Institute. Working conditions and facilities (except library) are up to a good European standard. Compared to the other sections in the Institute the mathematical section has a very good record of papers published in international journals.

The main drawback of the mathematical section of the Institute is that it has no teaching duties and hence its educational impact is severely restricted. Educational connections to the universities in Estonia should be improved. The obvious targets are the Department of Mathematics and Informatics in Tallinn Pedagogical University and the Department of Mathematics at the Tallinn Technical University. Indeed, J. Janno has a half time job at the Department of Mathematics. However, since most of the advanced courses in mathematics are taught in the Tartu University, educational relations to Tartu should be improved. In the beginning this could be financed by a two-three year educational target project.

Although the Institute is directed towards applications there are rather few joint mathematical projects with private enterprises.

Recently the Institute has employed PhD S. Tupailo, who works in the field of mathematical logic. This is a new opening and offers interesting possibilities in co-operation with computer science.

Nonlinear Mathematical Modelling (J. Janno)

Two of the reserchers in this area, R. Lepp and O. Vaarmann, are professors at TTU. The work of O. Vaarmann is discussed under that heading.

This research topic represents the best applied mathematical analysis research in Estonia. The recent citation indexes (Compu Math Citation Index, JAN 1996–DEC 2000 and JAN 1997-FEB 2001) show that J. Janno has reached international mathematical recognition. There are many joint papers with foreign mathematicians and rather many of the papers are published in good international journals. The Evaluators rate the research activities of this topic excellent. We rate the overall capability as good.

Applied research (I. Petersen)

I. Petersen has developed probabilistic and statistical methods to estimate motor insurance premiums in connection with new law requirements. There is an obvious need for research in applied probability and for attaching young people to the group. Collaboration with the Institute of Mathematical Statistics at the Tartu University is highly recommended.

4. General recommendations

- 1. The old system of chairs in universities is outdated. The research fields of professors should be well-defined (Analysis, Algebra, Applied Analysis etc) but the division of Associate Professors and Lecturers according to the chairs is old-fashioned. They should be directly under the Head of the Department. In this system teaching could be better organized according to the needs.**
- 2. The change of the fields of full professorships should be made easier. In small departments there is a tendency to favour the research done by the members of the department. Hence the method to change a field should receive a proper attention.**
- 3. The sabbatical system needs improvements. Although the university teachers have a year free of teaching in every five years, the universities or the Estonian Science Foundation offer few financial possibilities to visit foreign institutions. The Estonian Science Foundation should create a grant that helps university teachers spend a semester abroad.**
- 4. During the transition period of the Estonian educational system the five-year temporary positions in the universities served their role. Since this period is largely over, a more stable system could be adapted. To begin this change, full professorships could be first changed into tenure positions.**
- 5. The university financing in education is based on the number of students. The system would be more target effective if it would be partly based on the number of BSc's, MSc's and PhD's who have taken their final examination in the Department. Since the departments of mathematics give a lot of service teaching, this should also be taken into account.**

5. Recommendations to improve the quality of mathematical research

- 6. It is important to send young promising students for PhD-studies abroad although there is a possibility of no return. However, a visit of one or two semesters could already considerably enlarge the mathematical world of a PhD-student. The neighbouring countries provide a good target. To finance such an exchange good personal contacts and research in closely related fields are more important than contracts between countries and universities. The aforementioned improvement for the sabbatical system will greatly help in this matter.**
- 7. The universities lack a good system to invite foreign mathematicians to lecture in Estonia. Although rather many conferences have been organized, the financial constraints have prevented invitations for mathematicians to give a series of lectures, say, during a period of two weeks. The lectures should be directed to undergraduate and graduate students. The Evaluators feel that this is not only a financial problem but the mathematical community lacks contacts to the neighbouring countries which are able to finance this type of exchange.**
- 8. Estonia should be able to establish a good international mathematical journal. The Tartu Mathematical Journal, established already in 1893 under a different name, provides a natural starting point. The journal is technically already up to a very good international standard. The Editorial Board of the journal has recently been enlarged to contain mathematicians outside Estonia. More foreign mathematicians and mathematicians from other universities in Estonia could be included. For a good international journal two volumes annually are needed; at present there is one volume only. There are several international publishing houses, like the new Publishing House of the European Mathematical Society, which can be consulted in order to improve the circulation of the journal. The Estonian Science Foundation should provide a target grant for this purpose. The Tartu Mathematical Journal should find a slot of its own in the publishing market. This should be different from the Proceedings of the Estonian Academy of Sciences, Physics and Mathematics, which has also been able to establish its position with four annual volumes. Negotiations between the editors of these two journals are strongly recommended.**
- 9. Mathematical libraries in the Estonian universities are not up to the European standard. Taking into account the financial constraints**

and the size of the departments Estonian mathematicians should join to create one mathematical library of decent size with good electronic access from other institutes. It is important to have access to one of the review journals, Math. Reviews or Zentralblatt, in electronic form.

Tallinn May 26, 2001

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