

# АККОРК

Агентство  
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Approved by

Chairman of the Advisory Council

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## REPORT

on the results of an independent evaluation of the main professional educational  
programs of higher education

### **"Comprehensive analysis" of the Siberian Federal University (Krasnoyarsk)**

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Moscow – 2016

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## **REPORT ON THE RESULTS OF AN INDEPENDENT EVALUATION OF THE MAIN EDUCATIONAL PROGRAM**

The basic educational program "Complex analysis" is implemented within the 01.04.01 "Mathematics" direction by the department of theory of functions of the Institute of Mathematics and Fundamental Informatics and leads to the award of the master qualification. The program is run by the director of the Institute of Mathematics and Fundamental Informatics Alexander M. Kytmanov and by head of the chair of the theory of functions August K. Tsikh.

An independent external assessment of the educational program has been conducted by AKKORK experts on the 27 - 28th September, 2016.

### **CURRENT STATUS AND TRENDS OF DEVELOPMENT OF THE REGIONAL MARKET OF EDUCATIONAL SERVICES IN THIS DIRECTION OF TRAINING**

*Analysis of the role and place of the program (with adducing of statistics and data of research agencies, data of hr-agency and others.)*

The educational program "Complex analysis" is a program of academic magistracy, ie the regional labor market for its graduates is formed primarily by educational and scientific organizations. Secondly, it is the organizations requiring specialists with a good mathematical background and analytical skills: banks, insurance companies, defense industry, etc. The main employers of graduates of the educational program in the Krasnoyarsk Territory are the structural units of SFU (including the Department of theory of functions of implementing this educational program), Reshetnev Siberian State Aerospace University, Astafiev Krasnoyarsk State Pedagogical, Kirensky Institute of Physics - Siberian Branch of Academy of Sciences. In Russia as a whole: the Mathematical Institute of Russian Academy (Moscow), Ailamazyan Program Systems Institute (Pereyaslavl- Zaleski), Sobolev Institute of Mathematics - Siberian Branch of the Russian Academy of Sciences (Novosibirsk), etc. The majority of employers are universities and accept alumni of this educational program to work as research and teaching staff. The specificity of the labor market of such educational program is that, as a rule, the graduate is employed not directly after the magistracy, but after postgraduate studies and defending doctoral dissertation. Sometimes magistracy alumnus entered the postgraduate school of the employer.

Large universities have large math departments and sometimes whole faculties of physical and mathematical profile. Due to the large labor groups there is constant staff rotation therein. It provides stable labor market to alumni of this educational program.

The educational program "Complex analysis" is realized on the basis of the scientific school of complex analysis, existing for decades in Krasnoyarsk and is one of the strongest in Russia. This educational program has no analogues in Russia and, therefore, has no direct competitors. At the same time, the graduates of other educational program mathematical structure claim on jobs of research and teaching staff of Mathematical Departments of educational organizations, primarily of other academic master programs of Institute of Mathematics and Fundamental Informatics (IMFI) SFU (namely the program "Algebra, logic and discrete mathematics"). These can be attributed to indirect competitors of this educational program. The given educational program graduate annually an average 5 persons. Total alumni of IMFI magistracy on a specialty 01.04.01 "Mathematics" is an average 10 persons per year. The following number of persons Are trained in the Krasnoyarsk Territory on various specialties of mathematical structure ("Applied Mathematics and Computer Science", "Modern mathematical education" and others):

- SFU - 540 persons;
- Siberian State Aerospace University - 45 persons;
- Krasnoyarsk State Pedagogical University - 18 persons.

The institution did not give exact numbers describing need of the regional labor market for graduates of this educational program, but estimated the market situation as far from saturation. Because of the small number of graduates of IMFI magistracy in "Mathematics" specialty, experts consider this assessment reasonable. Employers, who participated in the meeting with the experts during the expert's visit to SFU, have confirmed their readiness and willingness to hire alumni of this educational program.

### ***Additional material***

As the result of the analysis of the role and place of the program and the characteristics of the formation of the regional educational market, and according to data provided by the educational institution, experts have determined that the educational program provides 100% of graduates of magistracy "Complex analysis" specialization and 50% of graduates of magistracy "Mathematics" direction on regional labor market.

### ***Analysis of informational indicators provided by the university (conclusions)***

- *The Percentage of students combining an education with work on major – 0%.*
- *The Percentage of alumni contingent employed within one year after the end of the main education in the direction of training (specialty) obtained as a result of training on the main educational program – 40%; if we consider alumni in specialty continuing education in postgraduate study as employed – 80%.*
- *The Percentage of alumni contingent, employed at the request of enterprises - 63% (taken into account alumni invited to work by the results practice).*
- *The Percentage of the number of students enrolled on order of employers, for example, on the basis of tripartite (target) Treaty - 0%.*
- *The Percentage of alumni contingent working on the profile of training in the region - 40% (80% taking into account enrolled in graduate school).*
- *The Percentage of alumni contingent working on the profile of training outside the region - 0%.*
- *the number of complaints to the alumni - none.*
- *Number of positive feedback of organization on the work of alumni - none.*
- *The Percentage of the contingent of students within the main educational program enrolled for studying on magistracy programs who have completed training in the bachelor program - 100%.*

### ***Additional material***

As a result of self-assessment conducted by the educational institution, here are presented the data on the distribution of alumni. Data provided by the institution have been confirmed during the studying of the relevant documents. The share of alumni employed on the profile of the specialty in the region - 40%; outside the region - 0%; unemployed - 60%. Alumni unemployed in specialty continuing their studies in postgraduate program - 67%, are employed not in specialty - 33%.

## ***SUMMARY OF THE PROGRAM***

### ***Strengths of the analyzed program***

The quality of learning outcomes of graduates of the master's program "Complex analysis", implemented in the SFU, experts have estimated as high, the guarantees of the quality of education provided by the institution in the implementation of the program have been estimated as sufficient. Strengths of the program may be classified as follows.

- Competence model of the graduate of this educational program completely corresponds to the federal state educational standards of higher education in the field of training 01.04.01 - "Mathematics".

- This educational program has no analogues in the region, nor in Russia as a whole.

- The close relationship IMFI SFU, which implements this educational program, with major employers in Russia and the region (through basic departments, joint workshops, etc.): other structural units of SFU, Astafiev Krasnoyarsk State Pedagogical University (Krasnoyarsk), Siberian State Aerospace University (Krasnoyarsk), Ailamazyan Program Systems Institute (Pereyaslavl- Zaleski), and others.

- Experts consider a very successful a proposed range of disciplines within the educational program and its program and well coordinated with the educational program objectives and competency model of graduate. In particular, part of the basic set of discipline "Contemporary Mathematics" contributes, on the one hand, the expansion of student mathematical outlook, and, on the other hand, the conscious choice of the direction of their future practice.

- The educational process of the educational program is implemented by a highly qualified teaching staff. It is expressed, firstly, in absolute academic degree holders rate of professors involved in the educational program, and secondly, in that all members of the teaching staff are active in research work on the profile of educational program. Management of the educational program is implemented by teaching staff who have extensive experience both in the domestic educational system and in a number of Western European universities. Two faculty members have academic degrees awarded by Western European universities (PhD).

- Foreign scientists are attracted in the educational program for the participation, including the internationally known (for example, A. Laptev, Imperial College of London (UK)).

- Leading Russian scientific school of multidimensional complex analysis and algebraic geometry is working based on the theory of functions department of the IMFI SFU, which implements this educational program, since the 1990s. High quality of scientific research team, realizing this educational program is confirmed by grants for research activities, which have repeatedly won by the team of the department and its individual members.

- Heads of this educational program actively involve young scientists to the program, it is evidenced by several Russian Federal Property Fund grants for young PhDs won by the young faculty members.

- Readiness of teaching staff of department of theory of functions IMFI to teach in the English language. This perspective will enhance the international competitiveness of this educational program and its alumni.

- A small number of students on a given educational program (about 10 persons per course) promotes closer contact between student and teachers, in particular, with supervisors. This factor is particularly important for the academic magistracy programs, which include this educational program.

- The high information openness of this educational program. The official website of SFU has an attractive design and comfortable structure; the main documents relating to this educational program (abstract disciplines, curriculum, and so on) are in the public domain. Educational materials relating to each discipline, practice, final state attestation, are available by

individual user name and password; thus all teaching materials are easily available to students at any time.

- A team implementing this educational program develops and maintains the website <http://amoebas.sfu-kras.ru/> which, firstly, provides a convenient teaching materials for some subjects of the curriculum of this educational program; secondly, serves as a kind of advertising of this educational program attracting students, and, thirdly, serves to popularization of modern mathematics.

### ***Weaknesses of the analyzed program***

The experts noted several shortcomings and areas in which the master's program "Complex analysis" could be improved.

- During direct assessment of competencies of students of this educational program, a slightly unequal (with an overall high enough level) level of formation of professional competence was discovered. Namely, some students showed insufficient development of the GPC-1 (the ability to find, formulate and solve significant problems of fundamental and applied mathematics), PC-1 (the ability to intensive research work), PC-3 (the ability to publicly present their own new scientific results). The reason seems to experts in not enough high motivation of some students to continue research activities after the end of the Magistracy.

- Some formal approach to the work of the professional development of teachers, which is characteristic, however, for many domestic institutes (visiting studies at the Faculty of Advanced Training with a certain periodicity). An intensive research and development activities of the leading teaching staff of this educational program is ignored when directing to the training.

- Insufficient flexible system of allocation of educational work of professors from the perspective of conditions for their scientific work, which also is common in the majority of domestic institution.

- University is not signed on the specialized electronic mathematical abstracts MathSciNet and Zentralblatt bases, the largest in coverage of scientific mathematical literature, especially periodicals. This creates certain inconveniences for the research activities of faculty and students of IMFI.

- The SFU Library, with in general rich fund and perfect technical equipment, does not have a subscription to some large foreign mathematical journals such as the Annals of Mathematics, Inventiones mathematicae, Journal of Algebraic Geometry.

### ***The main Recommendations of the expert for the analyzed program***

- The heads of the educational program should pay extra attention to the system of selection of students to this educational program and improve it to attract the strongest and most motivated students. The means for this, firstly, is already available in SFU as proseminar on complex analysis, designed for bachelor students of IMFI. Experts recommend to the staff of this educational program to actively develop this proseminar. Another step could be the development of the experience (already available in this educational program) attracting foreign students to this master's program.

- High qualification and the level of a high school professor of mathematics competence is maintained and supported, above all, by his scientific work. In this connection, it is recommended to the SFU to count as an advanced training the publishing articles in top professional journals and making presentations at international conferences.

- It is recommended to the SFU Administration and the heads of this educational program to analyze the possibilities for borrowing the experience of some foreign universities that allow

the teaching staff to concentrate, as an option, most of his teaching load in one semester, and scientific work in another. It is necessary that the total workload for the year corresponds to the established norms and respects labor law requirements for working time standards.

- It is possible to recommend to the SFU Administration to raise funds for the subscription of the University on the mathematical abstracts database MathSciNet and / or Zentralblatt. It should be noted that the subscription MathSciNet and / or Zenralblatt would be useful not only for students and teaching staff of this educational program, but for all participants of the educational program of physical and mathematical profile.

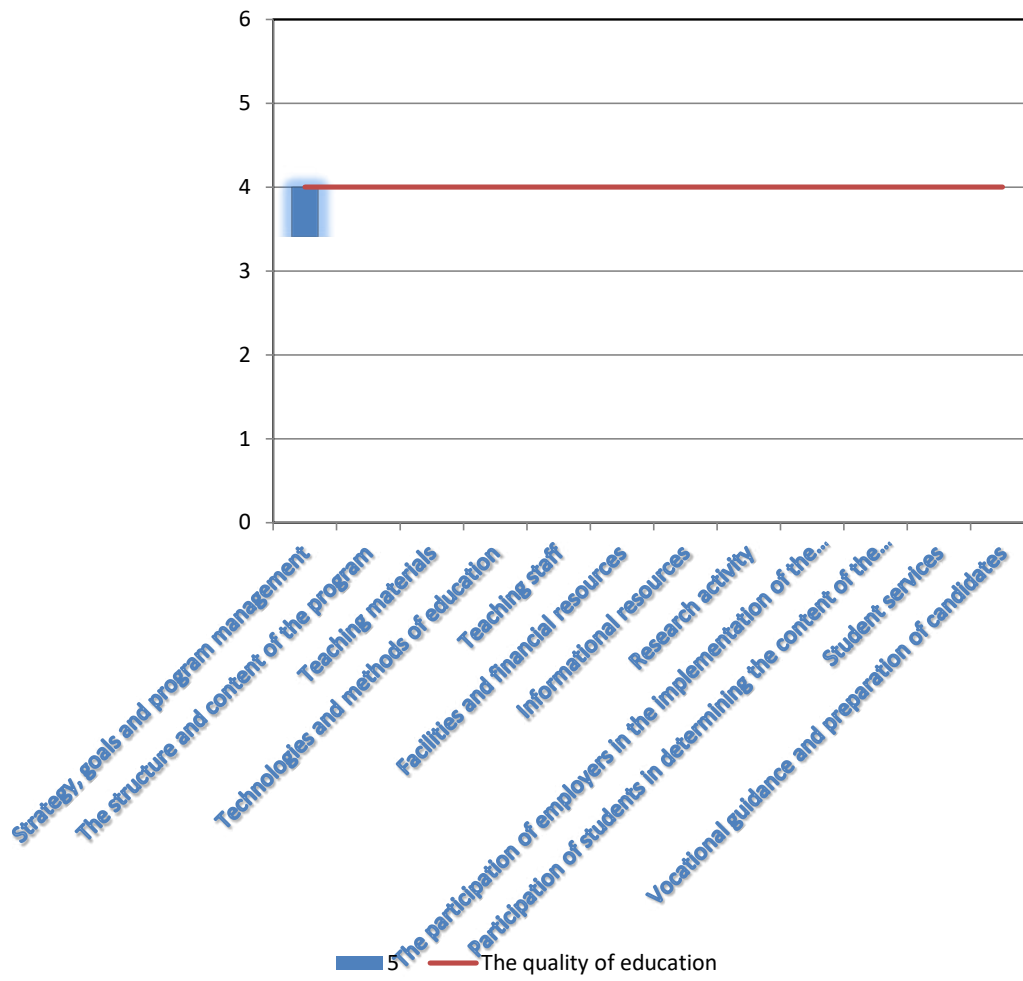
- It is possible to recommend to the SFU Library Administration to subscribe to the large foreign mathematical journals, the most interesting for participants of the "Complex analysis" educational program.

In general, the master's program "Complex analysis" is characterized by a very high quality of educational activities, meets the modern requirements of the labor market and can be recommended for accreditation.

***Assessment Profile for learning outcomes and quality of education guarantees***

No	Criterion	Mark
<i>I</i>	<b>Quality of education outcomes</b>	<b>5</b>
	1. Demand for graduates of the program on labor market	
	2. Satisfaction of all customers	
	3. The results of direct assessment	
<i>II</i>	<i>Quality Assurance:</i>	
	1. Strategy, goals and program management	4
	2. The structure and content of the program	5
	3. Teaching materials	5
	4. Technologies and techniques of educational activities	5
	5. Teaching staff	5
	6. Physical facilities and financial resources	4
	7. Informational resources	4
	8. Research activities	5
	9. The participation of employers in the implementation of educational programs	5
	10. Participation of students in determining the content of the program	5
	11. Students' services	5
12. Career guidance and preparation of applicants	5	

### Profile assessment of learning outcomes and guarantees of the quality of education





## QUALITY OF LEARNING OUTCOMES

### *Direct assessment of competence by the expert*

The direct assessment of competencies of graduates was conducted during the on-site visit. 1st year master students, 5 members, representing 63% of the course, and 2nd year master students, also 5 members, representing 80% of the graduating class participated in the direct assessment. In addition, interviews were conducted with alumni of last year which is also allowed to evaluate level of formation of competences.

Measurement and control materials developed by the experts were used during the procedure of direct assessment of alumni.

The expert chosen following competencies for the analysis of the competencies formation:

GPC-1 - the ability to find, formulate and solve urgent and important problems of fundamental and applied mathematics;

PC-1 - the ability to extensive research and development work;

PC-3 - the ability to publicly present their own new scientific results.

When implementing the direct competence assessment procedure, the expert used the following measurement and control materials.

1. Each student was asked to tell about his master (over which the student is working at the moment) or, to choose from, bachelor (already protected) graduate qualification work: to describe the problem and formulate the basic results.

After and during the performance of each student the following questions were asked.

1. To define the basic concepts used, terms, and explain the meaning of symbols used.  
2. To formulate the fundamental theorems and write basic formulas, he had used to solve the problems.

3. To explain the relationship of the task with other relevant fundamental or applied research or problems.

In addition, during the performance, the following tasks were offered for the rest of the students (one or a group of students - one task) in core subjects of the curriculum.

1. Calculate the integral of a rational function in a closed circuit in the complex plane (the intended use of the residue)

2. Find the homology groups of a sphere or a torus

3. Arrange the specified meromorphic function (of several variables) in a Laurent series.

As a result of the direct assessment of competencies expert revealed that 67% of students have coped with 80% of tasks and 33% of students have coped with 60% of tasks.

Level Students ratio	Sufficient level (have managed with 80% of the proposed tasks)	Acceptable level (the percentage of solved tasks from 50 to 79%)	Low level (percentage of solved tasks is less than or equal to 49%)
67%	+		
33%		+	

In assessing the quality of education, expert has acquainted with 4 graduate qualification work, representing 80% of the graduate works of the last year in this area. He has concluded that consideration by graduate qualification work correspond to all the requirements stated below:

### GRADUATE QUALIFICATION WORKS

No	Objects of assessment	Comments of experts
1.	Subject of graduate qualification work corresponds to	yes

	the direction of training and modern level of science, technology and (or) software technology.	
2.	Tasks and contents of graduate qualification work are aimed at confirmation of graduate competences.	yes
3.	Utilization rate of materials collected or obtained during the passage of pre-degree practice and implementation of course papers in the graduate qualification work.	high
4.	Subject of graduate qualification work is defined by demands of industrial organizations and tasks of experimental activities solved by faculty of the institution.	yes
5.	The results of graduate qualification work find practical application in the workplace.	is irrelevant to a given educational program
6.	Utilization rate of the results of research activities of the department, faculty, and third-party research and production and / or research organizations when performing independent research parts in the graduate qualification work.	high

## Conclusions and recommendations of the Expert

### Conclusions

- The quality of education on the program "Complex analysis" corresponds to the modern level of development of this discipline.

- Teaching staff implementing the program constitutes the basis of for the multidimensional complex analysis of the Krasnoyarsk Scientific School under the supervision of A.K. Tsikh. The recognition of this scientific school is supported by a grant from the state support NSH-9149.2016.1 of Leading Scientific Schools. However, as identified during the full-time visit, students enrolled in the program "Complex analysis" are actively involved in the work of this scientific school. It is noteworthy that at the present time in Russia in the field of complex analysis the Krasnoyarsk scientific school is equaled only by the Moscow Scientific School on Complex Analysis. Moreover, the involvement of young researchers in Krasnoyarsk school is higher than in Moscow. An important role in this has the master's program "Complex analysis" in SFU.

- A significant part of the program graduates continue training in postgraduate study of SFU and more than half of them successfully defends his thesis, and replenish the faculty of SFU and other universities in the region. Thus the master's program "Complex analysis" is an important link in the preparation of qualified scientific and pedagogical staff in the region.

- Unfortunately, it was found out during full time visit that the level of preparation of students of 2nd year of graduate training is lower than the last year's level and the level of students of 1st year (taking into account the volume of the material studied). According to faculty, the reason for this was the lack of attention to proseminar on complex analysis for baccalaureate students of 2nd year of education, which has been subsequently fixed.

### Recommendations

The following measures to improve the program may be recommended to heads of this educational program.

- to pay extra attention to attracting strong and motivated bachelor students to this educational program. To do this, it is necessary to actively develop proseminar on complex

analysis designed for bachelor students. In particular, it may be recommended to advertise the proseminar, its heads, topics etc. on the website of IMFI.

- To develop the existing experience of attracting to this educational program international students; to support faculty's readiness to teaching in English; to develop the English version of the IMFI website.

### **Additional information**

As a result of questioning of students, the data were represented by educational institution. These data have been verified by the expert during the full-time visit and were confirmed by the expert as a result of full-time visit. 71% of students evaluate the quality of education as "excellent", 29% - as "good".

## QUALITY ASSURANCE OF EDUCATION

### *1. Strategy, goals and program management*

#### *Evaluation of criteria: good*

##### *Strengths of the program*

- Presence of a well-developed strategy of development of educational program.
- A clear adherence to the developed strategy. At the moment the program is in its second stage of development: ensuring a high level of educational process in view of global trends - the orientation on students centric training and integration into the international educational space.
- The close relationship (through basic departments, joint workshops, etc.) with the major employers of Russia and the region: other structural units of SFU, Astafiev Krasnoyarsk State Pedagogical University (Krasnoyarsk), Siberian State Aerospace University (Krasnoyarsk), Ailamazyan Program Systems Institute (Pereyaslavl-Zalesski), and others.
- Availability in open access on SFU website of all documentation related to educational program: the actual education program, subjects annotations, etc., some of the documents available in English.

##### *Recommendations*

- Heads of the educational program should regularly (approximately once a year) implement a survey of employers for compliance with the educational program objectives of and labor market demand. Such survey is necessary for maintaining the relevance of educational program and its timely modifications. Employers located in Krasnoyarsk may be questioned orally at a joint meeting of the department, workshop and so on. Employers of the other regions can be interviewed by e-mail.

##### *Additional material*

- During the full-time visit, interviews of employers were conducted, by results of which it is possible to conclude that at the moment they consider the objectives of the educational program are relevant to demands of the labor market.
- Education institution presented data on the awareness of students and teachers about the goals of the educational program in the process of self-assessment . Data of professors' survey have showed that 40% of teaching staff are fully aware of the purpose of the program, while the remaining 60% are not fully informed, but know where this information can be read. For students the respective figures are 50% and 50%. Experts believe that 40% of professors completely aware of the educational program is not quite enough and recommend the management of the educational program to bring the program goals and objectives to the professors at faculty meetings.
- Also, during the self-assessment education institution presented data on the survey about professors' satisfaction with personnel policy, the existing system of motivation and loyalty of employees. 90% of professors realizing this educational program are fully satisfied with personnel policies, 10% are partially satisfied. 30% of teachers are fully satisfied with motivation system, 40% are partially satisfied, 10% are not satisfied, and 20% were undecided on this issue. 80% of professors are loyal to the organization, 10% are thinking about dismissal, and 10% are considering the dismissal in the long term. The given data indicate a lack of professors' satisfaction with labor motivation system operating in the SFU. It may be recommended to SFU administration to improve the system of motivation in view of the professors' opinions.

### *2. The structure and content of the program*

#### *Evaluation of criterion: Excellent*

### ***Strengths of the program***

- Range of disciplines proposed as part of the educational program and their programs should be recognized as a very successful and well coordinated with the objectives of educational program and competency model of graduate.

- The discipline "Contemporary Mathematics" included in the basic set contributes, on the one hand, the expansion of student mathematical outlook, and, on the other hand, the conscious choice of the direction of their future practice. This discipline especially assists in the formation of competencies GC-1 (the capacity for abstract thinking, analysis, synthesis), GC-3 (readiness for self-development, self-realization, the use of creativity), GPC-1 (the ability to find, formulate and solve urgent and important problems of fundamental and applied mathematics), GPC-2 (the ability to create and explore new mathematical models in the natural sciences), PC-11 (the ability and propensity for educational and pedagogical activities, readiness to promote and popularize scientific achievements).

- Topics of graduate qualification works are coordinated with modern scientific research in the field of complex analysis and related areas (the theory of differential equations, algebraic geometry, and others.). For graduates planning to continue their education in postgraduate school, master's graduate qualification works can serve as groundwork for future PhD thesis.

- The program structure enables the mastering of the program by students with different levels of initial training; in particular, there is a possibility to attend classes of Bachelors.

### ***Recommendations***

- Experts recommend to the heads of the educational program to consider the advisability of having the issues on LaTeX computer publishing system in the final state attestation examination cards, taking into account the views of employers. Knowing of graduates of mathematical specialties of this system, of course, is necessary for graduated, however, students are introduced to it when studying "Mathematical typography" discipline and its mastering is verified, first, at the corresponding intermediate attestation, and secondly, when preparing the master's thesis, which is made in the LaTeX system. The inclusion issues only in mathematics in the final state attestation examination cards is traditional for mathematical specialties, so the inclusion of questions on LaTeX system is debatable.

- Perhaps, in order to create a transitional link from the classic to the multidimensional complex analysis, it is necessary to add to the list of taught courses the course on the Riemann surfaces theory. In our opinion, the most suitable for this purpose is a book by O. Forster "Riemann surface"; you can also recommend a more modern book by E.M. Chirka "Riemann surface".

### ***Additional information***

During the full-time visit, the experts met with the students of the program being evaluated. One of the issues discussed is matching the structure and content of the program with expectations of direct consumer programs - students. These interviews are consistent with the data of the survey conducted in the process of self-assessment by institution. 57% of students believe that the structure and content of the program completely meet their expectations; 43% believe that the structure and content of the program generally correspond to their expectations. It allows experts to conclude that a student satisfaction with the content of the educational program is good.

### ***3. Teaching materials***

***Evaluation of criterion: Excellent***

### ***Strengths of the program***

- This educational program is fully provided with necessary teaching materials.

- Some teaching materials developed by faculty members, realizing this educational program, have been published as monographs by major international (Springer) and Russian (Science) publishers (Sadykov T.M., Tsikh A.K., Hypergeometric and algebraic functions of several variables; Kytmanov A.M., Myslivets S.G., Multidimensional Integral Representations).

- The main documents relating to this educational program (annotation of disciplines, curriculum, etc.) are freely available at SFU website; detailed teaching materials relating to each discipline, practice, final state attestation are available to students by individual user name and password. Thus, all teaching materials are easily and almost at any time available for students.

- The staff implemented this educational program have designed and maintained a website <http://amoebas.sfu-kras.ru/> which, firstly, is a convenient teaching materials for subjects "Additional chapters of complex analysis", "Algebraic geometry" et al.; secondly, it serves as a kind of advertising of the educational program, attracting students, and, thirdly, it serves to popularization of modern mathematics.

### ***Recommendations***

The following measures to improve the program may be recommended to the heads of the educational program.

- Since the institution did not provide information about using the teaching materials, developed in the framework of the educational program, by other educational institutions, it may be recommended to collect the appropriate information to managers and staff of the educational program. If it turns out that teaching materials are used in other institutions, it will serve as additional evidence of the high quality and relevance of the educational program.

- To study the question of advisability of incorporating into final state attestation examination cards on LaTeX computer publishing system, taking into account the views of employers. Read more on this, see. recommendations for the previous section.

### ***Additional information***

- During the full-time visit, the experts familiarized with the teaching materials established in the educational institution. The study of five teaching materials has confirmed the data collected in the process of self-assessment of the institution, namely, that not less than 75% of teaching materials are coordinated with employers. These data allow the experts to conclude that there is a well-established process of actualization of teaching materials with the involvement of employers in the educational program. This, however, is quite natural in view of the fact that a significant portion of employers are the structural units of SFU.

- During the full-time visit, experts have analyzed the measurement and control materials, which are used by the educational institution for the ongoing monitoring of progress. Data on the analysis of test materials are follows: about 35% of the measurement and control materials are based on real practical situations (in the context of the educational program, it includes situations of scientific and educational communication and execution of the research work), about 65% of the measurement and control materials are based only on a theoretical material; there is no measurement and control materials, developed by employers. Taking into account the specifics of the academic master's programs, experts concluded the complete adequacy of test materials to program's objectives.

- By results of the questionnaire represented by the educational institution, the results of which were confirmed during the full time visit, most of the students (43%) believe that their opinion is not taken into account in developing and updating of teaching materials. 43% believe that their opinion is taken into account, and 14% do not know that the inclusion of the views of students in the development of educational program is possible. In connection with this, experts recommend to the heads of the educational program to be more interested in students' opinion about the content of educational program, as teaching materials and measurement and control materials. The means to this might be the annual meeting of the students with management of educational program, on which such issues would be discussed.

#### ***4. Technologies and techniques of educational activities***

##### ***Evaluation of criterion: Excellent***

- Technologies, methods and forms of training sessions are completely consistent with the objectives of the educational program.

- Especially one should allocate the involvement practiced at this educational program of all master students in the work of scientific seminar of the Department of Theory of Functions and regular consultation with the supervisor. These forms of training are better than others contribute to the formation of GPC-1 (the ability to find, formulate and solve urgent and important problems of fundamental and applied mathematics), PC-1 (the ability to intensive research work), PC-11 (the ability and propensity for educational and pedagogical activities, the willingness to promote and popularize scientific achievements), occupying, according to experts, a central place in the competence model of the graduate of "Complex analysis" program as a graduate of academic Magistracy.

- The technological base is almost fully prepared for the educational process, or a part of it in form and distant electronic.

##### ***Recommendations***

The following measures to improve the program can be recommended to the heads of the educational program.

- As a proposal for consideration, experts recommend to the heads of the educational program (in coordination with employers) to consider the possibility of introducing in the educational process of such forms of training sessions as a workshop on problem solving and laboratory work (ensuring compliance with the teaching load on student). Possibly, laboratory work would be expedient in the "Mathematical typography" course and "Layout in LaTeX system"; also the laboratory work may be used, for example, in the "Gröbner bases in algebraic geometry" discipline for the students' familiarity with modern computer algebra systems (Singular, Macaulay 2, Cocoa, etc.). The workshop on problem-solving would be useful in the course of the homology and cohomology theory (enabling learners to have experience of calculating the homology of simplicial complexes, of working with exact sequences, etc.), Gröbner bases and algebraic geometry (solution of systems of algebraic equations), and perhaps in some other.

##### ***Additional information***

During on-site visit, the expert visited the study, which analysis is presented below.

Name of lecturer: August K. Tsikh

Group / Specialty: A group of students of the 1st year Master specialty "Complex analysis".

1. Discipline / module: Modern problems of mathematics

2. Type of training

lecture +

seminar

laboratory work

practice

integrated lesson

other \_\_\_\_\_

3. **Lesson Focus:** 13th Hilbert problem

4. **The purpose of class:** formation of students' knowledge about the actual mathematical problems and methods, grouped around the 13th Hilbert problem; development (by demonstration) abilities and skills of consistent presentation of theoretical material, of working with the audience.

5. **The aims of the class:** formation of students' knowledge about the history of the problem of solving algebraic equations by radicals, explanation idea of reduction functions of several variables to the functions of fewer variables, the study Tschirnhaus transformation, setting the 13th Hilbert problem, its history and current status (including an explanation on the available level of the latest results, received lecturer and colleagues in the current year).

6. **Facilities:** audience, equipped with educational furniture and marker board.

7. **Specify:**

No	The knowledge and skills which are planned to generate in class and competences, which affect the formation of the knowledge, and skills (must be announced by lecturer)	The forms, tools, methods and techniques used for the formation of competence in class
1.	GC-1 - the ability to abstract thinking, analysis, synthesis	Consistent and logical presentation of theoretical material, personal example of the professor
2.	GPC-1 - the ability to find, formulate and solve urgent and important problems of fundamental and applied mathematics	Consistent and logical presentation of theoretical material, historical digressions, personal example of the professor
3.	PC-11 - the ability and propensity for educational and pedagogical activities, readiness to promote and popularize scientific achievements	Historical digressions, personal example of the professor

#### ASSESSMENT OF A LECTURER

No	Criteria of analysis	Indicators	Mark (0,1,2)
1.	Compliance with lesson's regulations	Timely start and end of lesson, balanced time of sections.	2
2.	Organization	Greeting. Informing about topics and target (connection between target and evolving competences).	2
3.	Motivating students for the upcoming activities	Indication of urgency, of formed professional and / or social and personal competencies.	2
4.	The psychological climate in the classroom	Presence of a positive emotional interaction between lecturer and students; mutual goodwill and audience participation.	2
5.	The quality of presentation	Structured material; clarity of designations of current tasks; consistency and availability of presentation; adaptation presentation to the specific of the audience; examples of relevant facts.	2
6.	Compliance with the content of the course program	Compare with study programs of the disciplines (teaching materials).	2



7.	The use of visual aids	Textbook, workshop handouts, tables, figures, etc.	2
8.	Oratory	Audibility, intelligibility, euphony, literacy, rate of speech; facial expressions, gestures, pantomime; emotional intensity performances.	2
9.	Sensitivity to the audience	The ability to react to changes in the perception of the audience.	2
10.	Correctness to students		2
11.	Methods of regulation of attention and behavior	Increasing the interest among the audience (the original examples, humor, rhetorical devices etc.); Involving the audience in a dialogue, in the process of performing tasks, etc. But do not: open call to the attention of the audience; demonstration of disapproval; psychological pressure, blackmail.	2
12.	Feedback during the lecture	Control of material learning	1
13.	Summing up (organization of reflection)	Organization of reflection in which students are actively discussing the results	1
14.	Image	Compliance with corporate identity, presentable, charisma	2
15.	Total		26
16.	Comments and suggestions of experts: 1) the lecturer did not voiced target competencies at the lesson, but experts believe it is justified, because it would be too formal; moreover, these competencies were clear in the topic and the method of presentation; 2) the lecturer used the article of major mathematician of XX and XXI century S. Abhyankar of the 13th Hilbert problem as handouts; 3) lack of feedback (questions, and so on. D.) on the part of students was explained, most likely, by stiffness students because of experts presence.		

As a result of analysis of desk review of self-assessment, curriculum and class schedules analysis, the expert determined that the Percentage of classes conducting in an interactive way for the whole program is 20-25%. During on-site visit, teaching materials of five subjects were studied. Data on these classes conducting in an interactive way in the context of the teaching materials studied earlier are presented below.

1. Current problems in mathematics - 20%;
2. History and Methodology of Mathematics - 20%;
3. Mathematical typography - 25%;
4. Methods of the theory of Hilbert spaces - 25%;
5. Cohomology and multiple integration - 20%.

On the basis of these, experts conclude that the number of classes conducted in an interactive form is sufficient, with account of the academic nature of Magistracy.

### ***5. Teaching staff***

***Evaluation of criterion: Excellent***

#### ***Strengths of the program***

- This educational program is implemented within the scientific school of complex analysis, which has a nationwide and international renown.

- Management of the educational program is performed by lecturers who have extensive experience in the domestic educational system, and in several Western European universities. Several faculty members have academic degrees, awarded by the Western European universities.
- Foreign scientists are involved in the educational program as participants, including the internationally known (for example, A. Laptev, Imperial College of London, UK).
- A high general level of professional skills, is manifested, in particular, by absolute academic degree holders rate of professors involved in the educational program. All members of the teaching staff are active in research work on the profile of educational program.
- Structure of lecturers realizing this educational program is well balanced by age.

### ***Additional information***

Analyzing the facts set out by the educational institution in the statement of self-examination, the expert concluded that the data are relevant and reliable. The results of a comprehensive evaluation of teaching staff (for last year), and the age structure of professors participating in the program are presented below.

According to the results of a comprehensive assessment of faculty members

- dismissed – 5%;
- directed at training courses, with subsequent integrated re-assessment – 15%;
- changes have been made in effective labor contracts with changes in stimulating component – 5%;
- labor contracts extended for the next labor contract period without any changes – 65%;
- promoted – 10%.

**Age of full-time teaching staff** of the educational program:

- Up to 30 years – 10%;
- 31 – 45 years old – 40%;
- 46 – 55 years old – 20%;
- 56-70 years old – 30%.

As a result of analysis of the submitted data, experts concluded that the teaching staff has high qualification and is age-balanced.

### ***Recommendations***

- High qualification and the level of competence of a high school lecturers of mathematics is maintained and supported, firstly, by his\her scientific work. In connection with this, we can recommend to SFU to count a lecturer's publication of the articles in top professional journals and making presentations at international conferences as advanced training.

- Standards and regulations SFU defining the educational work of lecturers, are common for domestic institutions. The disadvantage of the national system is a certain rigidity, expressed in insufficient account of features of the distribution of time between the scientific and educational work of the lecturers. Some faculty prefer to be able to concentrate on scientific work within a few weeks or months, rather than working in the mode of "a half day for educational work, half day - for science". It is especially essential for faculty conducting classes not only for masters but also for bachelors. In connection with this, we can recommend to SFU administration and heads of the educational program to look for opportunities to borrow the experience of some foreign universities that allow the lecturer to concentrate at will most of his teaching load in one semester, and scientific work - in another. It is necessary that the total workload for the year must correspond to the established norms, and labor law requirements for working time rules must be respected, too.

- The proportion of lecturers fully satisfied with the acting system of motivation in SFU seems to be insufficient to experts. It can be recommended to the administration of the institution to study opinion of the faculty (for example, by an anonymous questionnaire) on labor motivation system, acting in the University, and to modify it in accordance with the expressed wishes.

- As in most of domestic institutions, results of the survey of students are not considered at attestation of professors in this educational program. It may be, however, recommended at least to discuss the results of the survey at the department during the procedure of passing the professor of the next competition. Students are a party most completely observing the work of the lecturer and the most interested in the quality of the educational process.

#### ***Additional information***

By results of the questionnaire represented by the educational institution, the results of which were confirmed during the visit full time, 30% of teachers implementing the master's program are fully satisfied with the system of motivation, 40% - are partially satisfied, 10% are not satisfied and 20% were undecided on this issue. Analyzing the data, the experts came to the conclusion on the need to further improve the system of motivation in SFU.

### ***6. Logistical and financial resources of the program*** ***Evaluation of criterion: Good***

#### ***Strengths of the program***

- According to experts, in general, logistical and financial support for this educational program is better than the average Russian level of maintenance of mathematical profile educational program.

- In general, students and faculty of the educational program have wide access to the funds of educational and methodical documentation, library systems, etc.

#### ***Recommendations***

- University is not signed on the specialized electronic mathematical abstracts MathSciNet base and Zentralblatt, the largest in scope of scientific mathematical literature, especially periodicals. It creates certain inconveniences for the research activities of faculty and students of IMFI. It can be recommended to SFU administration to raise funds of the University for the subscription on the mathematical abstracts database MathSciNet and / or Zentralblatt. It should be noted that the subscription to MathSciNet and / or Zenralblatt would be useful not only for students and faculty of the educational program, but for all participants of physical and mathematical profile.

- In general, experts have noted a good book and journal completeness of SFU Library Fund. However, from the viewpoint of the interests of the educational program, there is a lack of subscriptions to some large foreign mathematical journals such as the Annals of Mathematics, Inventiones mathematicae, Journal of Algebraic Geometry. It can be recommended to SFU administration and libraries to subscribe to the large foreign mathematical journals, the most interesting for students and teaching staff of the educational program.

- By results of the questionnaire represented by the educational institution, and by results of the teaching staff poll during the full time visit, there is some lack of educational audiences. Lack of educational audiences can not be removed without expanding the area of academic buildings, which requires considerable time and investment. A temporary solution may be optimizing of timetable or refurbishment the part of the technical classrooms or administrative offices for educational needs.

#### ***Additional information***

During the full-time visit, experts have conducted interviews with students and lecturers participating in the program on satisfaction with the quality of classroom fund, funds and the reading room of the library, facilities of departments. These findings are consistent with the data of the survey conducted in the course of self-assessment. 60% of respondents are satisfied with the parameters listed, 20% are not satisfied and 20% were undecided. These data allow the

experts to conclude that classroom fund, funds and the reading room of the library, facilities departments state is satisfactory.

The given educational program requires no laboratory with special equipment.

### ***7. Program's information resources***

***Evaluation of criterion: Good***

#### ***Strengths of the program:***

- Information support of SFU as a whole and of this educational program in particular corresponds to the best domestic and foreign models.
- The University has a modern library with a rich fund and all the necessary equipment.

#### ***Recommendations***

- This educational program lacks subscriptions to specialized mathematical abstracting base and large foreign mathematical journals. See the recommendations from the previous section in this regard.

- Not all professors implementing this educational program have complete lists of scientific and methodical works on a personal web page. It is desirable to have such lists and, if copyright allows, links to the full text of the work, as it will facilitate search of the literature, the choice of the supervisor, the evaluation of this educational program and its teaching staff for the students and other interested persons.

### ***8. Research activity***

***Evaluation of criterion: Excellent***

#### ***Strengths of the program:***

- On the basis of the Department of the theory of functions realizing this educational program, the leading Russian scientific school works since 1990 on multidimensional complex analysis and algebraic geometry.

- High quality research activity of the collective, realizing this educational program is confirmed by grants for research activities, which have repeatedly won by the team and its individual members.

- It is especially necessary to allocate a team which has won the prestigious grant of Government of the Russian Federation for scientific research under the guidance of leading scientists (A. Laptev, London). For performance of work under this grant, Laboratory of Complex Analysis and Differential Equations has been created in IMFI SFU.

- The active involvement of young scientists in the program, which is confirmed by the Russian Foundation for Basic Research grants for young PhDs, and the victory of one of the Magistracy graduates (and now a postgraduate student of the theory of functions dept.), in the competition of young mathematicians "Dynasty" in 2014.

- The presence of stable scientific relations with both Russian (some of Krasnoyarsk universities, Steklov Mathematical Institute, Ailamazyan Program Systems Institute et al.) and foreign (Imperial College of London (UK), Institute of Mittag -Leffler (Sweden), and others) scientific and educational organizations.

- To promote its research works, the team, realizing this educational program, has designed and maintained a website <http://amoebas.sfu-kras.ru/>.

#### ***Additional information***

The educational institution provided information on the results of monitoring students' opinions "The impact of research on the quality of education" In the documents of self-

assessment. The data certified by experts during the full time visit are as follows: 100% of the students surveyed believe that the research and development activities has a positive effect on the quality of education. It allows to draw conclusions about a good setting of scientific work at this educational program.

### ***Recommendations***

- The heads of this educational program and the SFU Administration should make every effort to maintain a high level of his scientific school complex analysis and to its development. It is necessary to maintain a comfortable working conditions of scientific and pedagogical staff, to attract young scientists to the program, to maintain existing and establish new scientific contacts with Russian and foreign scientists and research centers.

- Experts recommend to head of this educational program to develop their proseminar on complex analysis. Students, masters, as stated in the materials of institution's self-assessment and confirmed in the course full time experts' visit to SFU, participate in the scientific seminar of the department of the theory of functions, so proseminar should be designed for a possibly wider range of bachelor students, serving as student university science club. It will serve as a good way to attract students to this educational program.

### ***Additional information***

Employment of students in scientific circles has been analyzed. There are 6 scientific student clubs in SFU: Center for car and motorcycle sports, "Polytechnic" Students design bureau (SDB), SDB "Thermal Engineering", SDB "Designing of technological machines and oil and gas sector equipment", SDB Research and Education Center "Electronics", "Laboratory of medical equipment" SDB. However, these clubs are non-mathematical in nature. The role of the student mathematical circle to some extent is playing by proseminar on complex analysis, but it is designed for bachelor students. For students of the program being evaluated, as a circle can be considered a scientific seminar of the theory of functions department. The main purpose of the organization of science club is involvement of students in research and development, the formation of skills of independent research, the formation of abilities and skills of scientific report, an extension of their mathematical outlook. The number of students who regularly attend scientific circles is 15-20 people, depending on the amount of students at this educational program in a given year (participation in a scientific seminar is compulsory for all students). Thus, the proportion of students of this educational program involved in scientific circles, is 100%. According to the results of work in scientific circles, students publish scientific papers, speak at student conferences, receive results, form the main content of the graduate qualification works.

## ***9. Participation of employers in program implementation***

### ***Evaluation of criterion: Excellent***

#### ***Strengths of the program***

- Employers are fully involved in the educational program: participate in the formation of competence model of graduate, offer theme dissertation studies, criticize dissertations, select students for future employment.

- educational program has an extensive list (18 companies) of social partners from domestic and foreign scientific and educational organizations.

### ***Recommendations***

- Experts consider the system of interaction with employers is fully consistent with the objectives of this educational program, and hence the only recommendation is to keep the existing connection and make the maximum use of them to improve the quality of educational activities: to invite leading Russian and foreign scientists to give lectures and presentations, to

organize training in other educational and research institutions for professors and students, to discuss with employers regularly and comprehensively set of disciplines and content of this educational program, topics of graduate qualification works, the quality of training demonstrated by graduates in the course of practical work.

#### ***Additional information***

The statement of self-assessment of educational institution provides information about the results of the survey of employers in terms of their satisfaction with the quality of training of graduates. The findings of this report confirmed by an expert during an interview with employers are following: 78% of employers believe that graduates are fully compliant with the requirements of modern industry professionals, 22% of employers believe that graduates generally correspond to the requirements of modern industry professionals, but there are some non-essential notes.

At the same time, employers indicated that graduates have some problems with self-representation (professional competence PC-3 - the ability to publicly present their own new research results).

These data suggest a high level of involvement of employers in the process of implementation of this educational program.

### ***10. Participation of students in defining the program's content***

#### ***Evaluation of criterion: Excellent***

##### ***Strengths of the program***

- There is a good system student involvement in educational program management and monitoring of their views at the level of the University and IMFI: Students Commission on the quality of education, public reception of the rector and the management of the Institute and others.

##### ***Recommendations***

- It appears from the information provided by the institution that participation of students in the management of educational program is organized at the university level (through the Commission on the quality of student education). It would be desirable to provide a procedure for the direct involvement of students in the management of "Complex analysis" educational program. It is possible to recommend to the heads of this educational program to develop such a procedure (eg, the annual meeting of students with the participation of heads of educational program), aimed at ascertaining the views and wishes of the of students regarding the educational program.

#### ***Additional information***

In the course of full time visit, the experts analyzed the students' participation in the bodies of the student government and scientific clubs. The data reflecting the employment of students, obtained through questionnaires during the self-assessment of the institution and confirmed by experts, are follows: 86% of the students believe that they can influence decision-making, 14% - that they can not.

On the basis of analysis of the submitted data, experts conclude that there is a fairly good level of involvement of students in the educational process management.

### ***11. Services for students on a program level***

#### ***Evaluation of criterion: Excellent***

##### ***Strengths of the program***

- The institution offers students of all educational program very wide range of types of extra-curricular activities: sports clubs, art groups, Club of the Funny and Inventive, etc.
- All kinds of extra-curricular activities are provided with the appropriate infrastructure, including sports facilities and playgrounds, swimming pools, sanatorium, recreation facilities, etc...
- There is a developed system of social support for students: social grants and other payments to students from socially disadvantaged categories, fare for nonresident students, the service of psychological help, etc.
- A number of measures of social support for disadvantaged groups of students, however, depends on their (of students) academic performance (eg, well-performing students gain increased social grants). Experts decide it is particularly successful practice as frequently students of these categories have problems with academic performance and they need additional stimulus measures.

### ***Recommendations***

- As noted by the experts during the full time visit, institution is not sufficient ready to receive disabled students: not all the stairs are equipped with ramps, lifts are not enough. From the information provided in the statement of institution of self-assessment, it also follows that the institution has no hearing aids and special software for the hearing impaired or visually impaired persons. All this makes it difficult for disabled persons to access to high quality higher education provided by SFU and, in particular, the program "Complex analysis". It may be recommended to the administration of institution to buy technical equipment (hearing aids, software, etc.) equipment and prepare for the provision of services to disabled students.
- There is no specialized bookstore on the territory of SFU, where students and faculty could acquire the scientific and educational literature. It may be recommended to the administration of SFU to facilitate the opening of such store.

### ***Additional information***

In the course of full time visit, the documents confirming the visit by students of additional courses and programs were presented to the experts. There were no such students at the moment at this educational program. It is related to the high involvement of students of this educational program in scientific work, taking considerable time, and to the fact that some students are working in parallel with their studies. Experts do not think this is the lack of this educational program.

## ***12. Occupational guidance. Quality assessment of applicants' knowledge***

### ***Evaluation of criterion: Excellent***

#### ***Strengths of the program:***

- institution systematically conducts a variety of activities for vocational guidance and attracting students to its educational program: open days, competitions, summer schools, excursions and more.
- The University also has physical and mathematical school (in the form of classes with profound studying of physics and mathematics on the basis of several educational institutions of Krasnoyarsk).

### ***Recommendations***

All activities, information on which was provided by the institution, are focused on applicants - school graduates. At the same time, accredited educational program is the Magistracy program, so all of these activities are indirectly related to it. There is a risk not to convey information about master's programs and their benefits to potential students not studying

in Baccalaureate of SFU. It is necessary to devise a system to attract students to master's programs, including foreign students.

***Additional information***

As a result of the analysis of documents and interviews with program managers, experts found that the Department of Theory of functions IMFI SFU conducts the following measures aimed at vocational guidance and attracting of students to this educational program.

- 1) Weekly proseminar on complex analysis for 2nd year bachelors.
- 2) Elective discipline "Elements of geometry and algebraic topology" is also read for 2nd year bachelors; this discipline introduces students to the subject of research of the Department of Theory of Functions.
- 3) Annual Student Conference (in April), in which there is a meeting of students of the 2nd course with representatives from all departments to review the subject of the possible term papers.

By maintaining a proper level of proseminar, that should be enough, according to experts, to attract SFU students to the program. However, experts recommend to develop a system of measures to attract to the program a bachelor degree graduates of other local universities and foreign students. In particular, it is possible to develop an English version of website IMFI <http://math.sfu-kras.ru/> with information about this educational program or with reference to the corresponding English page of SFU site.



## CVs of Experts

### Andi Kivinukk

Place of work, position	The Faculty of Mathematics of the University of Tallinn (Estonia), Professor
Academic degree, academic title	PhD in Physics and Mathematics. Sciences, Professor
Deserved titles, degrees	none
Education	Faculty of Mathematics, University of Tartu (Estonia),
Professional achievements	33 published scientific works (indexed by MathSciNet) Individual Research Grant of the University of Darmstadt (Germany, 1993), the Danish Government Scholarship (1998)
Research interests	approximations and expansions, Fourier analysis
Practical experience in the direction of the program subject to assessment	Lecturing on the university course of complex analysis, work on sampling theory of Kotelnikov-Shannon related to complex analysis

### Alexander V. Komlov

Place of work, position	Steklov Mathematical Institute of RAS
Academic degree, academic title	PhD in Physics and Mathematics
Deserved titles, degrees	none
Education	Mechanics and Mathematics Faculty of Lomonosov Moscow State University
Professional achievements	12 published scientific papers
Research interests	comprehensive analysis, rational approximation, potential theory; integrable systems
Practical experience in the direction of the program subject to assessment	almost all published work use methods of complex analysis

### Dmitriy A. Stepanov

Place of work, position	Baumann Moscow State Technical University, Associate Professor
Academic degree, academic title	PhD in Physics and Mathematics
Deserved titles, degrees	none
Education	Mechanics and Mathematics Faculty of Lomonosov Moscow State University
Professional achievements	11 published scientific papers
Research interests	Algebraic geometry, singularity theory, tropical geometry
Practical experience in the direction of the program subject to assessment	Scientific papers on the theory of singularities of complex algebraic varieties, teaching of the course of complex variable theory

### Nikolai Asaturov

Place of work, position	Student, Baumann Moscow State Technical University, Associate Professor
Academic degree, academic title	

Deserved titles, degrees	
Education	
Professional achievements	
Research interests	
Practical experience in the direction of the program subject to assessment	