Juha-Matti Huusko
juha-matti.huusko@aalto.fi
tel. +358 40 528 2815
October 30th 2022

Cover letter

Dear Dean of School of Science,

I wish to apply for the

Lecturer position in Mathematics, in Department of Mathematics and Systems Analysis, in Aalto University.

I believe my experience in teaching, research, and online teaching make me a possible candidate. Namely

- **I have a pedagogical qualification and a vast teaching experience.** I have lectured courses spanning 38 ECTS and supervised exercises spanning 36 ECTS. Topics include: Algebra, analysis (complex, Fourier, introduction, numerical), calculus, Euclidean geometry, Introduction to mathematics, Measure and integration theory, and Topology.
- **My dissertation** gives sufficient conditions for solutions of complex ODEs to reside in certain function spaces, to have exponential growth, or to have zero sequences satisfying a geometric property. Moreover, I have studied univalence criteria for analytic and harmonic functions; and I am a second supervisor of one PhD student in Nevanlinna theory.
- **I have made online courses for two years.** I have prepared theory texts (with LaTeX & MathJax), visualizations (with TikZ & JSXGraph & Three.js), exercises (with STACK, CodeRunner, custom), and videos (via tablet, slideshows, and Matlab).
- I also actively participate in international workshops, mentor PhD students, and edit scientific journals such as Metodologia (editor-in-chief).

I further demonstrate these qualities in the attached documents.

Yours sincerely,
Juha-Matti Huusko

Juha-Matti Huusko
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Curriculum vitae

1. Personal details and the date of the CV

- Huusko, Juha-Matti Aleksanteri
- ORCID: https://orcid.org/0000-0001-8389-6436
- This document was made on October 30th 2022.

2. Degrees

- 15.06.2017, Doctor in Philosophy, mathematics, University of Eastern Finland, Joensuu, Finland.
- 20.09.2013, Master of Science, teacher in mathematics and physics, University of Eastern Finland, Joensuu, Finland.

3. Other education and expertise

- studies in computer science, University of Eastern Finland

4. Language skills

- Finnish - native
- English - excellent
- Swedish - mediocre
- Bengali - mediocre
- German - basics

5. Current employment

- 10/2022-, university teacher, Aalto University
- akateeminen tutkijanuravaihe, porras 2
- part-time student: University of Eastern Finland, Joensuu, computer science

6. Previous work experience

- 3/2022-9/2022, university teacher, University of Eastern Finland (UpTech project)
- 6/2021-5/2022, university teacher, University of Eastern Finland, (Linear analysis project Ministry of Education and Culture)
- 9/2020-5/2021, part-time teacher in mathematics, University of Eastern Finland
- 8/2019-12/2019, university teacher, University of Eastern Finland
- 12/2018-7/2019, postdoctoral researcher, University of Eastern Finland
- 9-10/2018, part-time teacher, University of Eastern Finland
- 2-12/2018, IT helping person, University of Eastern Finland
- 10-12/2017, part-time teacher, Savonia UAS
- 7-9/2017, postdoctoral researcher, University of Eastern Finland

7. Career breaks

- no breaks, one child

8. Research funding and grants

- doctoral school funding, University of Eastern Finland, 10/2013-6/2017
- travel grant, 2500€, Väisälä, 2019.
- travel grant, 1000€, Oskar Öflunds Stiftelse, 2017.

9. Research output

In total 8 peer-reviewed publications.

- Pesonen, H.A., J.-M. Huusko, X. Zang, A.T. Friberg, J. Turunen and T. Setälä, Partial spectral and temporal coherence of plane-wave pulse trains in second-harmonic generation, J. Opt. (2021).
- Hu, G., J.-M. Huusko, J. Long, Y. Sun, Linear differential equations with solutions lying in weighted Fock spaces, Comp. Var. Ell. Eq., Volume 66, 2021.
- Pesonen, H., A. Halder, J.-M. Huusko, A.T. Friberg, T. Setälä and J. Turunen, Spatial coherence effects in second harmonic generation of scalar light fields, Journal of Optics, Volume 23, Number 3
- Huusko, J.-M., T. Vesikko, On Becker's univalence criterion, Journal of Mathematical Analysis and Applications, 458 (1), 781-794.
- Huusko, J.-M., Methods for complex ODEs based on localization, integration and operator theory, Publications of the University of Eastern Finland. Dissertations in Forestry and Natural Sciences, 268
- Gröhn, J., J-M. Huusko, J. Rättyä, Linear differential equations with slowly growing solutions, Trans. Amer. Math. Soc. 370 (2018), 7201-7227.
- Huusko, J.-M. and M. Martin, Criteria for bounded valence of harmonic mappings, Comput. Methods Funct. Theory (2017).
- Huusko, J.-M., T. Korhonen, A. Reijonen, Linear Differential Equations With Solutions in the Growth Space , Ann. Acad. Sci. Fenn. Math. 41 (2016), no. 1, 399 – 416.
- Huusko, J.-M., Localisation of Linear Differential Equations in the Unit Disc by a Conformal Map, Bull. Aust. Math. Soc. 93 (2016), 260–271.

Other publications are available at http://integraali.com/phpcv/order4.php

The online version includes links to teaching related visualizations.

10. Research supervision and leadership experience

- second supervisor for a PhD 9/2021 –

11. Teaching merits

I am a teacher in mathematics and physics. I have created many online materials and I have a vast teaching experience. Next, I will explain these things in more detail.

- **Pedagogical qualification.** I completed my pedagogical studies (60 ECTS) in my Master of Science degree, awarded on September 20th 2013.

- **Developing online materials.** I worked in the Department of Physics and Mathematics, in University of Eastern Finland, in the following projects:

  o Multidisciplinary university level ensemble in linear analysis, Ministry of Education and Culture, 2021-2022. University teacher position started 6/2021 and ended 5/2022. I prepared materials to courses: Linear algebra a and b; and Introduction to numerical computing.

  o Continuous learning project by University of Eastern Finland, 2019-2020. University teacher position started 8/2019 and ended 7/2020. The project was shared by Department of Physics and Mathematics (Joensuu) and Department of Appled Physics (Kuopio). I prepared online materials for courses: Integral Calculus and Basics in Mathematics.

My work included typesetting mathematical text to Digicampus Moodle platform by using HTML and MathJax-library which enables the use of LaTeX codes. I prepared static and dynamic pictures by using TikZ-package and JSXGraph JavaScript library. In addition, I made various teaching videos via tablet/PC where I used self-made slideshows and Matlab visualizations. For the Moodle courses, I have prepared automatic evaluation exercises, randomized STACK exercises and CodeRunner programming exercises.

- **Teaching experience in general.** In 2015-2021, I have taught in University of Eastern Finland a vast selection of courses in mathematics (Introduction to topology, Algebra a, Euclidean geometry, Measure and integration theory, Introduction to Fourier analysis, Differential calculus in several variables). In addition, I have taught exercises in these courses and also in Analysis III, Numerical analysis, Topolgoy, Complex analysis a, Introduction to mathematics, and Introduction to analysis. In total, I have lectured courses spanning 38 ECTS, and supervised exercises in courses spanning 36 ECTS.

12. Awards and honours

- UEF DSA Julian Assange award (Given for an excellent critical journalism and support of freedom of expression)

13. Other key academic merits

- editor-in-chief UEFDSA newspaper (2019-2022)

- editor-in-chief, Metodologia, international, peer-reviewed (2020-)

14. Scientific and societal impact

15. Other merits

Dr. Juha-Matti Huusko
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tel. +358 40 528 2815
November 30th 2022

Teaching portfolio

for Lecturer position in Mathematics, in Department of Mathematics and Systems Analysis, in Aalto University

Contents

1. Approach to teaching and learning

My conception of teaching and learning

I believe that every person in the world has unique capabilities and circumstances to create something new. Whatever background and experiences you have, you will get a chance to utilize them at some point. I don't wish anybody to suffer from harsh experiences; however, if some of those experiences cannot be avoided, they can point mistakes in the society or prove useful in other way.

Every person is precious the way they are. When it is your time to make an impact, it is your responsibility to speak up and teach the world.

Therefore, education is not just for passing knowledge to the best students. Education is for learning work routines, social skills, and opening horizons for everybody. Each student learns the subject matter the amount what is possible for them at that time. Some knowledge and skills come to our everyday toolbox; some others reappear one day.

How I teach

I wish to encourage the best students to achieve higher goals. At the same time, I want to support students with challenges. Therefore, the assessment criteria need to be clear, so everyone can focus to their goal: what is enough to pass the course; and what is enough for grade 5/5.

The path to simply pass the course should be straightforward. Most exercises should be based on examples. On the other hand, everyone should have a chance to discover things themselves – an idea which comes from socio constructivist learning philosophy.

To motivate and to set future goals, the context of the course in the tree of knowledge should be explained. See Appendix 4.

I interact with the students in a down-to-earth fashion. We focus on the course topics but also share personal experiences such as:

- One semester, I taught pendulums in a physics class for two groups. To make the pendulum visible, I climbed on a table. While climbing, I tore two sets of jeans during the same week! (Example of work safety.)
- My ex-flat mate passed a course on power series after trying the exam four times. Exams can make people frozen. (Let's value also exercises in course evaluation.)

I am available to the students also in the hallways and after the courses. I greet students who calculate in cafeterias and might ask how they are doing. Whether they are studying my course or something else, I try to support them.

Justification for my way of teaching

For two years, I was coaching first year university students in their homework. Exercises and exams should have a task, which you can do first to get you going and to boost your confidence. A good principle for exam questions is: if you can draw a picture, you will get at least one point.

I have got feedback that my video lectures are very peaceful and that my exercise sessions are relaxed.

Sometimes my approach does not work. Some students have a too large knowledge gap to be able to approach the course. I should discuss with them to find other ways for them to learn.

Best example, what I have seen, is from my doctoral studies. On lectures, we worked with complicated things step-by-step, with no rush. After each result, we noted it's key features. We proceeded hierarchically with only the tools which we had at that time. However, this approach did not give the overall perspective to the topic, the big picture.

My son and Montessori teaching

My son is now 1.5 years old. With him, we found a YouTube channel about Montessori activities, what we implement in our home. I am learning how every person has their own activities and learns through them. Someday, this will approach will affect my university teaching too.

2. Teaching experience

I have a vast teaching experience in University of Eastern Finland. The lists of courses are in Appendices, in Table 1. But the experience is explained here.

During 2008-2009, I coached first year students in their homework. Unfortunately, there are no documents from this work available.

In 2011-2014, I was a teaching assistant in various courses. Most of the courses were about analysis. Analysis III contained things about integrals and series. In Numerical analysis, we calculated things via Matlab. The course I have taught the most, is Introduction to Fourier-analysis. I have taught the exercises 3 times and the whole course once – I began this journey in 2012 and taught the exercises again in 2022.

However, the first lectures I ever taught were in Introduction to topology 4 ECTS. My doctoral advisor planned the thing very well. In 2014, I taught the exercises of the course. Then in 2015, I was well prepared to teach the lectures. I re-taught the lectures in 2016.

Later on, I have taught various courses from first year courses to doctoral level courses.

3. Curriculum development and educational leadership

I have taken part in the developing of teaching at Department of Physics and Mathematics in University of Eastern Finland. We have discussed e.g. the structure of studies, mandatory and voluntary courses, use of calculators in exams and electronic exam solutions.

In UpTech project, we discussed the structure of studies for DI students. We planned the structure in Excel files discussing details with various teachers. I added application related exercises to the first-year mathematics courses.

Myself, I have been developing visualizations in JSXGraph Javascript library. See Appendices 5-6. I presented a method for 3D visualizations, which the JSXGraph developers will add to the official library. A learning platform requested to use my approach to 3D visualizations. My examples have been discussed also in a master's thesis. I am not supervising that thesis and I think it is still not completed.

4. Development as a teacher

Record of pedagogical studies

I am a qualified teacher in mathematics and physics. I completed my pedagogical studies, 60 ECTS, in my master's degree in September 20, 2013.

Key learnings from pedagogical studies and development of teaching skills

In the pedagogical studies, the socio constructivist learning theory was emphasized. Its idea is that teachers create a suitable situation for the students to experiment and construct the knowledge themselves. The social aspect is that if the students work in teams and then the teams debate each other the construction process becomes more active and deeper. Most of the socio constructivist learning theory is reasonable and meaningful in teaching solutions. I prefer to use the tools when they are applicable.

Some necessary theory can be introduced in the classroom or via short videos. The students can utilize the ideas from examples and solve related exercises. The creative work and team work can be encouraged. Students can experiment with problems and visualizations.

My development.

I have evolved from a quite shy teaching assistant to a more confident lecturer. In my teaching, I have now the confidence to try new things where it seems meaningful. However, if there is no reason to do things otherwise, a common course structure of the department is fine. Let the students be surprised by the mathematical phenomena instead of the surprising choices.

To develop myself more, I consider that I would learn the most, if I could teach different courses to different audiences. At the same time, I could produce materials for such courses.

Moreover, when a different teacher teaches a course, some new inventions in exercises and materials are made. For example, I have had two good experiences I would like to mention.

1. I taught Euclidean geometry in 2018. Unlike the standard course in UEF, I gave more emphasis on the classical results from Euclid's Elements. During each week, the exercises contained a task to make an origami. Also, the exam contained one origami task with the option to bring your own origami paper!
2. In Autumn 2021 I taught the course Basics in Fourier Analysis. There were also two English speaking students, so I recorded the videos in both Finnish and English. I would love to teach the topic again. Now I would be capable to produce dynamic images explaining many concepts.

I would be interested to teach some topic, which I have not taught before. For example, differential equations or number theory.

As mentioned, I have completed my pedagogical studies during my master's degree. Nowadays, I participate in
events where I can learn about teaching. For example,

- I took a course on producing electronic exams in Abitti system.
- I have participated in Integraalipäivät teaching event in Helsinki this spring.

5. Feedback

Student feedback; evidence based on courses delivered.

I get most of my feedback face-to-face in relaxed teaching sessions. However, something in written is in Appendices 1-3.

Other feedback (from fellow teachers, superiors etc.)

I gave a teaching sample on 4.6.2021 and it was rated that I did "very well". See more at Appendix 7.

Credentials and rewards received.

None.

Appendices

Table 1. Teaching experience

a. Bachelor's level courses

Year	Name of the course	University	No of enrolled students	My role in the course	Status of the course
2022	Differential and integral calculus	Aalto University	240	responsible teacher	compulsory, 5 ECTS
2021	Differential calculus in several variables	UEF	54	responsible teacher	compulsory, 9 ECTS
2020	Introduction to analysis	UEF	60	teaching assistant	compulsory, 4 ECTS
2020	Introduction to mathematics	UEF	60	teaching assistant	compulsory, 4 ECTS
2019	Euclidean geometry	UEF	40	responsible teacher	optional, 4 ECTS
2019	Algebra a	UEF	50	responsible teacher	compulsory, 4 ECTS
2015?	Complex analysis a	UEF	50	teaching assistant	compulsory, 4 ECTS
2013?	Analysis III	UEF	40	teaching assistant	compulsory, 8 ECTS

b. Master's level courses

Year	Name of the course	University	No of enrolled students	My role in the course	Status of the course
2022	Introduction to Fourier analysis	UEF, Oulu	26	teaching assistant	optional, 9 ECTS
2020	Introduction to Fourier analysis	UEF	19	responsible teacher	optional, 9 ECTS
2014, 2012	Introduction to Fourier analysis	UEF	15, 15	teaching assistant	optional, 9 ECTS
2015, 2014	Introduction to topology	UEF	15, 15	responsible teacher	optional, 4 ECTS
2013	Introduction to topology	UEF	15	teaching assistant	optional, 4 ECTS
2012	Numerical analysis	UEF	10	teaching assistant	optional, 8 ECTS

c. Doctoral level courses

Year	Name of the course	University	No of enrolled students	My role in the course	Status of the course
2019	Seminar on K. Yamanoi's paper: Zeros of higher	UEF	8	co-teacher	optional

	derivatives of meromorphic functions in the complex plane				
2019	Measure and integration theory	UEF	15	responsible teacher	optional, 4 ECTS
2020	Topology	UEF		teaching assistant	8 ECTS

Table 2. Supervision experience

Name of the student	University	Title of the thesis	My role	Status of the thesis
Bachelor theses				
Master's theses				
Doctoral theses				
Lasse Asikainen	UEF	Nevanlinna theory for difference operators?	co-supervisor	20% done

Appendix 1. Email discussion with a student.

Lähettäjä: Juha-Matti Huusko juha-matti.huusko@uef.fi
Lähetetty: torstai 10. joulukuuta 2020 11.41
Vastaanottaja: Valtteri Rossi <vrossi@student.uef.fi>
Aihe: VS: Alkeisanalyysi Laskuharjoitus1/ Valtteri Rossi

Valtteri > Vaikka kurssipalautetta toki annoinkin sekä JoMan että tämän alkeisanalyysin osalta, niin ajattelin nyt sanoa tässä vielä ihan suoraankin että olipa kaikin puolin hyvin selkeästi ja onnistuneesti vedetty syksy vallitsevassa tilanteessa!

Hyvä kuulla! 😊 Ensi viikolla on jokin keskustelutilaisuus syksyn opetusjärjestelyistä. Epsilon ja laitos ovat keränneet palautetta ja jotakin kehitysideoitakin on ilmennyt.

Valtteri > Toki itselleni on vähän outoa ja ikävää, kun kaikki kontaktit ovat näin tietokoneen välityksellä, eikä pääse oikeasti kunnolla vuorovaikuttamaan toisten kanssa kasvokkain. Monenlaista kurssia on tässäkin syksyllä jo tullut tehtyä ja nähtyä, mutta tämä vain mielestäni toimi tosi hyvin.

Tähän olisi hyvä keksiä jotain apusysteemiä. Ehkä jokin reaaliaikainen laskeskeluhengailu.

Valtteri > Joka kerta kun palautin laskareita, jaksoit paneutua niihin vastauksiin ja selventää tarkasti missä kohdin on mennyt vikaan ja/tai mitä olisin voinut tehdä toisin, vaikka sinulla varmasti muutamat muutkin kommentit annettavina.

Hyvä kuulla! Pystyin antamaan hyödyllistä täsmäpalautetta! 😊

Valtteri > Olin katsovinani jossain kohdin, että vedät keväällä jonkun toisen kurssin harkkoja mihin osallistun (olisikohan ollut usean muuttujan diffi). Palataan siis ensi vuoden puolella asiaan ☺ Hyvää ja rauhallista joulua sekä onnekasta uutta vuotta sinulle! 🎅

Joo, olen opettamassa UMD-kurssilla. Nähdään ensi vuonna. 😊

(Vuosi sitten tein verkkokurssiprojektissa videomateriaalit, jotka kattavat noin puolet UMD-kurssista.

Opetellaan usean muuttujan diffin laskentaa ensi keväänä. Vaikka ei kannata mennä asioiden edelle, niin sanonpa varalta jo tässä vaiheessa, että videot löytyvät

* täältä http://integraali.com/vektorilaskenta/videot/vektorivideolista.html

* ja täältä http://integraali.com/usean/usean-listaus.html)

Valtteri > Mainittakoon tässä vielä vertailun vuoksi, että aloitin ensimmäisen yliopistourani LUTissa syksyllä 2012 (valmistuminen toki jäi aika pahasti vaiheeseen..). Siellä minulla oli todella suuria vaikeuksia matikan kurssien kanssa läpäisyn kanssa ja moni jäikin suorittamatta. Ne mitkä sain jotenkin "taiottua" läpi, olivat niukin naukin nollan ja ykkösen rajan paremmalla puolella. Puhutaan siis vaikeudeltaan ja sisällöltään vastaavan tasoisista kursseista kuin tämä alkeisanalyysi tai johdatus matematiikkaan. Voitkin siis kuvitella ihmetykseni kun aloin täällä huomata osaavani asioita ja sainkin lopulta JM- kurssista sen vitosen. Eivät muuten LUTin aikaiset kaverit meinanneet uskoa, vaikka näytin kuvaa Weboodista 😊

Ahaa, LUT! Siellä LUTissa on ollut opettajana Tuomo Kauranne, Arbonaut-yrityksen presitentti. Todella mukava ihminen ja jutustelee paljon eri asioista. Nyt hän on jo eläkkeellä. Lienetkö Tuomoa nähnyt Lutissa?

Valtteri > Kiitokset sinulle!

Ole hyvä!

Kiitos myös sinulle! Tänä syksynä sinulta on tullut kaikista pohdiskelevimmat sähköpostit. Hyviä laskentoja ja pohdiskeluja!

Lähiopetuksessa on muutama muu ihminen, jotka pohtivat asioita kovasti ääneen. On aina hyvä asia, että asioita pääsee pureskelemaan tarkemmin.

Samoin, hyvää ja rauhallista joulua. Onnellista uutta vuotta! 😊

t.Juha-Matti

Appendix 2. Systematic summary of course feedback from students

Most of my teaching experience is from University of Eastern Finland, which just shifted to Peppi from Weboodi. Since of this shift, all records of automatically collected feedback have been lost.

Usually in UEF, in the courses, there are not very many students. Perhaps 15 to 40 students. To protect single students of being identified, the course feedback is usually hidden. Still open answers are shown. In 2019, I got such open feedback from Algebra a: "Some of the examples did not progress the course and seemed irrelevant to the topic."

Appendix 3. Examples of open or other feedback from students, peers and external partners

I get the most feedback face-to-face in exercise sessions. Such as

- 2022: "Can you just explain the correct answer to us. We don't want to discuss our answers in Zoom, because they have mistakes, and we don't have the tools to write with nice handwriting."
- 2021: "It has been really relaxed to be here in the exercises. Earlier, I studied in Oulu. There the assistant was mean, if somebody made a mistake, people would be laughing. Do you teach any other courses?"
- 2017: "Do you teach any other courses? In your course I could learn something."

Appendix 4. Structure of mathematics studies
Available at https://flinga.fi/s/F6P47YX
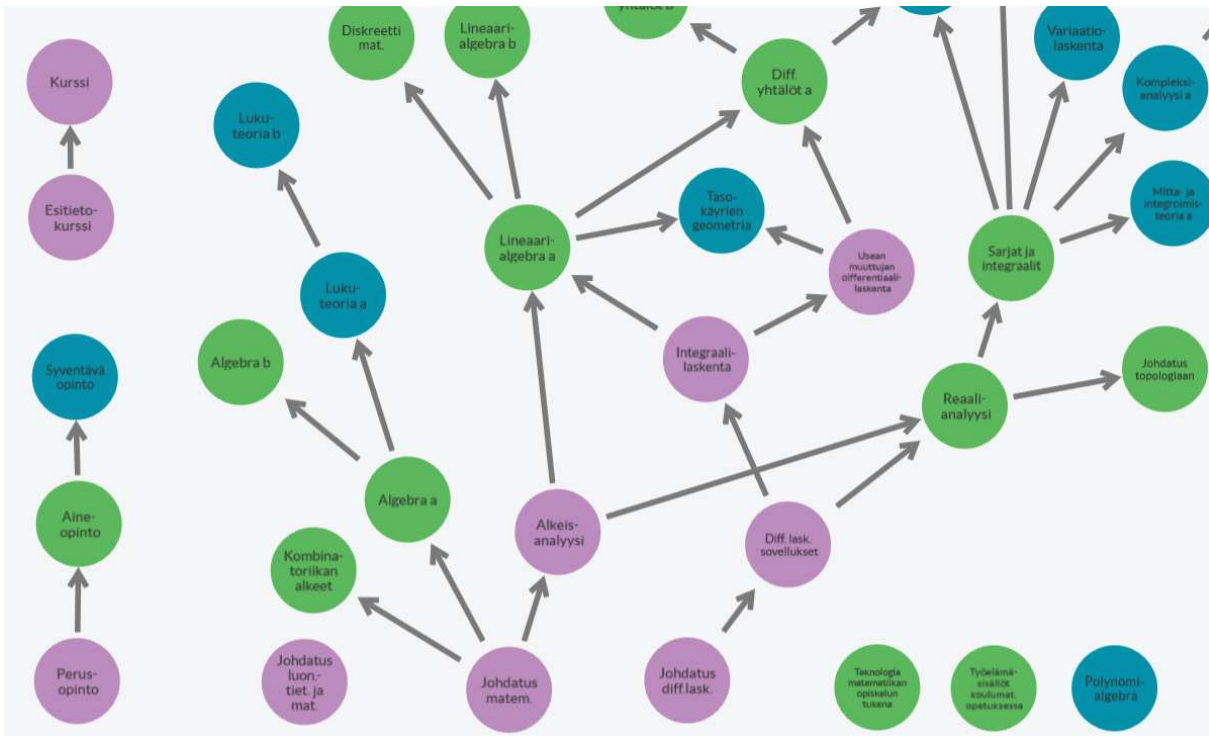
Appendix 5. JSXGraph visualization about a matrix and its inverse matrix
Available at http://integraali.com/jsxgraph/kuvat/lineaarialgebra/matr-ja-kaant-matr.html
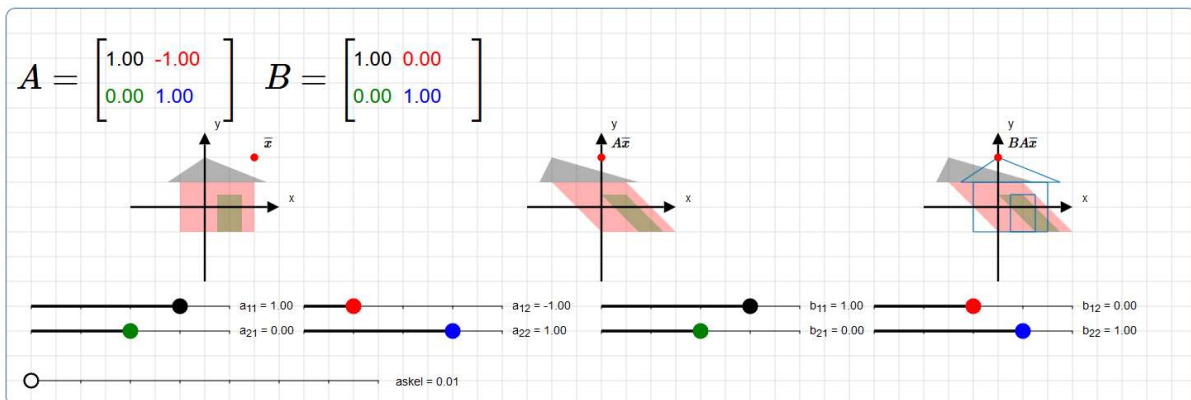
Matriisi ja käänteismatriisi

Opetellaan säätämään matriisi B niin, että se on matriisin A käänteismatriisi.

Vasemmalla on talo T, keskellä talo AT ja oikealla talo BAT.
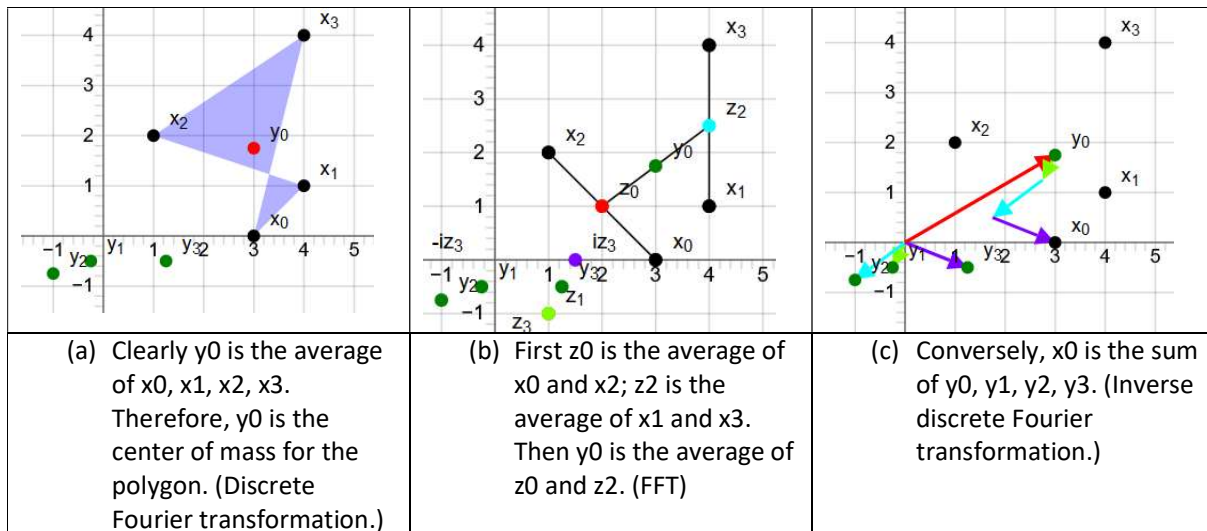
Jotakin kokeiltavaa testailun tueksi.

- Säädä lukuja $a_{11}, a_{12}, a_{21}, a_{22}$ siten, että keskimmäinen talo AT vääristyy.
- Testaa: Saatko lukuja $b_{11}, b_{12}, b_{21}, b_{22}$ säätämällä oikeanpuoleisen talon BT samanlaiseksi kuin vasemmanpuoleinen talo AT on? (Talon AT ääriviivat ovat helpottamassa säätötyötä.)

Available at http://integraali.com/fourier-havainnollistus/kuvat/diskreetti-FT.html

and at http://integraali.com/fourier-havainnollistus/kuvat/FFT-ja-selitys.html

(a) Clearly y0 is the average of x0, x1, x2, x3. Therefore, y0 is the center of mass for the polygon. (Discrete Fourier transformation.)	(b) First z0 is the average of x0 and x2; z2 is the average of x1 and x3. Then y0 is the average of z0 and z2. (FFT)	(c) Conversely, x0 is the sum of y0, y1, y2, y3. (Inverse discrete Fourier transformation.)

Appendix 7. Teaching demonstration.

I gave a teaching demonstration on 4.6.2021 and it was rated that I did "very well".

The original text is: Juha-Matti Huusko on antanut 20 minuutin pituisen matematiikan alan opetusnäytteen osana yliopistonlehtorin työhaastattelua Itä-Suomen yliopistossa 4.6.2021. Opetusnäyte annettiin etätoteutuksena Teamsin välityksellä. Huusko kävi opetusnäytteessään läpi kompleksiluvun käänteisluvun ja kompleksikonjugaatin käsitteet käyttämällä hyväksi videokameraa ja liitutaulua, sekä itse laatimiaan tietokonevisualisointeja kompleksitasossa. Mielestäni Huusko suoriutui näytteestä erinomaisesti.

Google translate (via https://translate.google.fi/) gives the translation:
Juha-Matti Huusko has given a 20-minute teaching sample in the field of mathematics as part of a university lecturer's job interview at the University of Eastern Finland on June 4, 2021. The teaching sample was given as a remote implementation via Teams. In his teaching sample, Huusko went through the concepts of inverse of complex number and complex conjugate, using a video camera and a blackboard, as well as computer visualizations he created himself at the complex level. I think Huusko did very well in the sample.

The original document is in the next page.

Joensuun kampus
Fysiikan ja matematiikan laitos
PL 111, Yliopistokatu 7
80101 JOENSUU
www.uef.fi

LAUSUNTO
Juha-Matti Huusko
7.6.2021

1 (1)

Juha-Matti Huusko on antanut 20 minuutin pituisen matematiikan alan opetusnäytteen osana yliopistonlehtorin työhaastattelua Itä-Suomen yliopistossa 4.6.2021. Opetusnäyte annettiin etätoteutuksena Teamsin välityksellä. Huusko kävi opetusnäytteessään läpi kompleksiluvun käänteisluvun ja kompleksikonjugaatin käsitteet käyttämällä hyväksi videokameraa ja liitutaulua, sekä itse laatimiaan tietokonevisualisointeja kompleksitasossa. Mielestäni Huusko suoriutui näytteestä erinomaisesti.

Risto Korhonen, professori
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Research statement

In my list of publications, you can find my publications enumerated.

Earlier research in view of publications

In my PhD, I did research on complex differential equations in the unit disc, on the growth of the solutions, and whether the solutions belong to certain function spaces.

In A1, I studied the exponential growth of solutions of ODEs in the case, where the coefficients have a singularity on the boundary of the unit disc. I developed a localization mapping from the unit disc to a drop-shaped adjustable subdomain, which meets the point of singularity. Via the localization mapping, some earlier results could be recovered from the general theory.

In A2, we found the sharp condition for the analytics solutions of f''+A(z)f=0 to be bounded or to belong to the Bloch space. We developed two general methods for the nth order equation and discussed the use of these methods also in the complex plane.

In A5, we studied when the analytic solutions of f''+A(z)f=0 belong to some function spaces such as the Bloch space or BMOA. We also studied when the solutions are bounded.

In A2, we used the methods of A5 to study when solutions of differential equations belong to a weighted Fock space of the complex plane.

In addition to my PhD, I have done research on univalent analytic and harmonic functions.

In A4, we studied analytic locally univalent functions in the unit disc via Becker's univalence criterion with a linear error. We found that the condition implies the function to be univalent in certain horodisk whose size depends on the coefficient in the error. We considered many related matters such as the distribution of the preimages of the attained values of the functions.

In A6, we studied harmonic locally univalent functions in the unit disc via Becker's univalence criterion and Nehari univalence criterion. We found conditions when the functions have bounded valence.

I have also collaborated with photonics researchers. My main contribution has been to assist with complex analytical and mathematical tools. My colleague Henri A. Pesonen uses Fourier modal method to study coherence properties of fields and pulses. We have had several mathematical discussions during the past years. As the titles suggest, A1 discusses *Partial spectral and temporal coherence of plane-wave pulse trains in second-harmonic generation* and A3 discusses *Spatial coherence effects in second-harmonic generation of scalar light fields.*

Recent research

During my postdoctoral research, I have done research on K. Yamanoi's methods in studying Zeros of higher derivatives of meromorphic functions in the complex plane. Yamanoi has obtained an asymptotic version of the Second main theorem of Nevanlinna theory. One inequality is based on detailed analysis of Jensen's formula - the analysis involves estimations of integrals, Borel type lemmas and many calculations. The other inequality is based on e.g. Ahlfors theory, and thin-thick-decomposition of the related hyperbolic

surface. Currently, I am a second supervisor for one doctoral student on the difference analogues of these considerations.

In 2019, I personally went to Japan to discuss with K. Yamanoi. I have a 2500€ travel grant to visit Japan again for one month – but I have postponed my trip due to COVID and current projects.

Related to my teaching, I have done research on visualizations of mathematics on browsers. Especially, I have studied the JSXGraph Javascript library and creating 3D visualizations there. Currently, my approach is being implemented in the JSXGraph core. I have also experimented on creating visualizations of planar mappings via Javascript. I have presented these approaches in two conferences and got enthusiastic feedback.

Future prospect

I will continue working on Yamanoi's method to study the meromorphic functions. Related to this, I will be the second supervisor of one PhD thesis. There are many difference analogues yet to be discovered. Also, there are some fundamental concepts in difference equations to be discussed. My coauthor of A6 has published the analogue of the Schwarzian derivative for harmonic locally univalent functions – this often reminds me that also in the fundamental concepts there is something to work on.

I have a method to visualize planar mappings via Javascript. It is based on an existing library which has been used for general purposes. Once the mathematical functionalities are made stronger, the visualizations ought to be very appealing.

Now, my visualizations have reached the level to be experimented in teaching. There should be some pedagogical studies on whether the visualizations help students to learn, and on how is their experience.

List of publications

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A peer-reviewed publications (most important publications in red color)

1. Pesonen, H.A., J.-M. Huusko, X. Zang, A.T. Friberg, J. Turunen and T. Setälä, *Partial spectral and temporal coherence of plane-wave pulse trains in second-harmonic generation*, J. Opt. (2021).

2. **Hu, G., J.-M. Huusko, J. Long, Y. Sun, *Linear differential equations with solutions lying in weighted Fock spaces*, Comp. Var. Ell. Eq., Volume 66, 2021.**

3. Pesonen, H., A. Halder, J.-M. Huusko, A.T. Friberg, T. Setälä and J. Turunen, *Spatial coherence effects in second-harmonic generation of scalar light fields*, Journal of Optics, Volume 23, Number 3.

4. Huusko, J.-M., T. Vesikko, *On Becker's univalence criterion*, Journal of Mathematical Analysis and Applications, 458 (1), 781-794.

5. **Gröhn, J., J-M. Huusko, J. Rättyä, *Linear differential equations with slowly growing solutions*, Trans. Amer. Math. Soc. 370 (2018), 7201-7227.**

6. **Huusko, J.-M. and M. Martin, *Criteria for bounded valence of harmonic mappings*, Comput. Methods Funct. Theory (2017).**

7. **Huusko, J.-M., T. Korhonen, A. Reijonen, *Linear Differential Equations With Solutions in the Growth Space H^∞*, Ann. Acad. Sci. Fenn. Math. 41 (2016), no. 1, $399 - 416$.**

8. **Huusko, J.-M., *Localisation of Linear Differential Equations in the Unit Disc by a Conformal Map*, Bull. Aust. Math. Soc. 93 (2016), 260–271.**

C Scientific books (monographs)

1. Huusko, J.-M., *Teatteria Kuhmossa: Kuhmon Nuorisoseura ry 60 vuotta*, Kuhmon Nuorisoseura.

2. Tervashonka, A., J.-M. Huusko, *UEFDSA Newspaper Annual yearbook 2022*, Books on Demand.

3. Tervashonka, A., J.-M. Huusko, *UEFDSA Newspaper Annual yearbook 2020*, Books on Demand.

4. Tervashonka, A., J.-M. Huusko, *UEFDSA Newspaper Annual yearbook 2019*, Books on Demand.

D Publications for the professional community

1. Huusko, J.-M., *Lukijan mielipide: Wilma vapaaksi*, Opettaja-lehti.

F Public work in art

1. Huusko, J.-M., *Kuhmon Nuorisoseura ry 60 vuotta -näyttely*, Kuhmo-talo, 2.9.-29.9.2021.

G Theses

1. Huusko, J.-M., *Bergmanin avaruuden funktioiden nollakohdista*, Pro gradu -tutkielma (18.9.2013).

I Audiovisual materials and software

1. Huusko, J.-M., *Sointu - Mahtavaa matematiikkaa 2021*, website.

2. Huusko, J.-M., *Kartta - Mahtavaa matematiikkaa 2021*, website.

3. Huusko, J.-M., *MathJax-editori*, website.

4. Huusko, J.-M., *JSGraph-editori*, website.

5. Huusko, J.-M., *JSGraph-havainnollistuksia*, website.