Material for the *Annual Report 2017*

Christer Oscar Kiselman

1. Writings

1.1. Eleven publications (registered in DiVA)

During 2017, eleven publications have appeared with me as joint author or sole author:

- three scientific articles on mathematics (17-2, 17-3, 17-5), the last one joint with Shiva Samieinia;
- two essays on language and mathematics, joint with Hania Uscka-Wehlou (17-1, 17-4);
- a note on Lars Hörmander (1931–2012) translated into Chinese (17-i);
- an account of Mikael Passare's mathematics (17-iv);
- two minor notes on Mikael Passare (17-ii, 17-iii);
- a chapter in a conference proceedings volume (17-6);
- a report from an excursion to Wyoming (17-v).

Bibliographical details follow.

17-1. Kiselman, Christer O.; Uscka-Wehlou, Hania. Bråk och språk — vad som är förnuftigt och logiskt [Fractions and languages—what is rational and logical]. *Nämnaren* (2017), No. 1, 45–49.
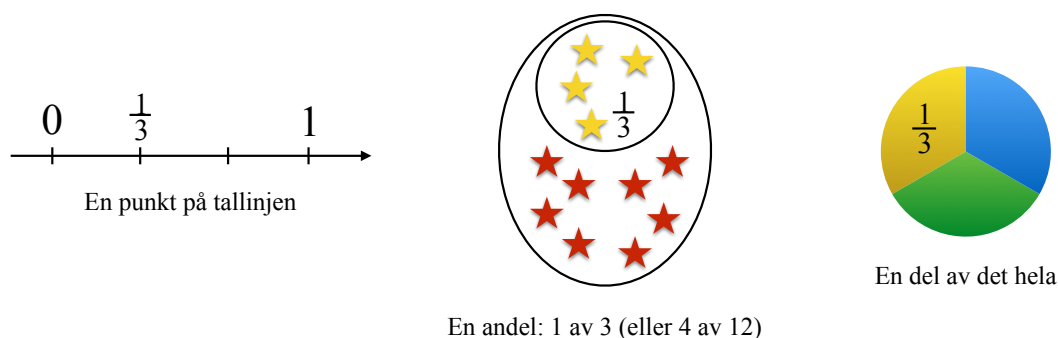

Figure 1.1. (From publication 17-1.) The fraction one third can be represented in several ways (courtesy Hania Uscka-Wehlou).

Figure 1.2. (Publications 17-1 and 17-4.) Hania Uscka-Wehlou.

17-2. Domains of holomorphy for Fourier transforms of solutions to discrete convolu-
tion equations. *Science China Mathematics* **60**, No. 6, 1005–1018. A special
issue in memory of Professor Qikeng Lu (1927 May 15 — 2015 August 31), doi:
10.1007/s11425-015-9029-0. [Submitted on 2015 December 31. Accepted on 2017
February 09. Published online by Science China 2017 February 23; by Springer
2017 March 02. Print version published 2017 June. Reviewed in *MathSciNet*,
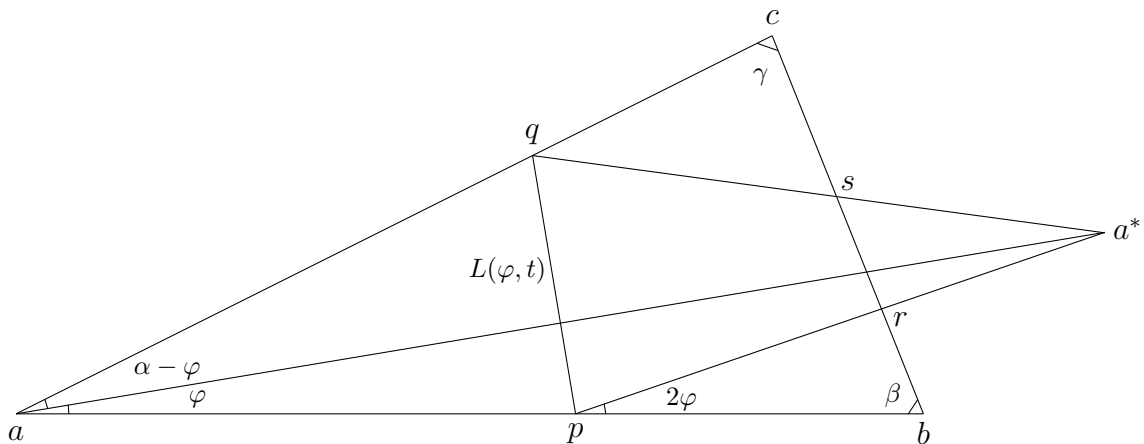MR3647130.]

Figure 1.3. (From publication 17-3.) The original triangle $T(a, b, c)$ has its ver-
tices at a, b and c. We fold it along a line, denoted by $L(\varphi, t)$. The folded object
is a heptagon with vertices at p, b, r, a^*, s, c, q, where a^* is the reflection of
a in the line $L(\varphi, t)$. The doubly covered set is a quadrilateral $Q(p, r, s, q)$ with
vertices at p, r, s, q.

17-3. How to best fold a triangle (25 pages). *Mathematische Semesterberichte*, pub-
lished online 2017 May 12, doi: 10.1007/s00591-017-0192-5. [Submitted on 2016
December 28. Accepted for publication on 2017 March 03.]

17-4. Kiselman, Christer O.; Uscka-Wehlou, Hania. 2017. Falska vänner, vassa vrår och språkliga fällor [False friends, sharp corners, and language traps]. *Nämnaren* (2017), No. 2, 43–51.

17-5. Kiselman, Christer O. & Samieinia, Shiva. Convexity of marginal functions in the discrete case. **In:** Andersson, Mats; Boman, Jan; Kiselman, Christer; Kurasov, Pavel; Sigurdsson, Ragnar, Eds. 2017. *Analysis Meets Geometry. The Mikael Passare Memorial Volume*, pp. 287–309. Cham: Birkhäuser. ISBN 978-3-319-52469-6.

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\uparrow \\
\begin{array}{ccccccccccc}
8 & 7 & 6 & 5 & 4 & 3 & 2 & 1 & 0 & 1 & 2 \\
6 & 5 & 4 & 3 & 2 & 1 & 0 & 1 & 2 & 3 & 4 \\
4 & 3 & 2 & 1 & 0 & 1 & 2 & 3 & 4 & 5 & 6 \\
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0 & 1 & 2 & 3 & 4 & 5 & 6 & 7 & 8 & 9 & 10 \\
2 & 3 & 4 & 5 & 6 & 7 & 8 & 9 & 10 & 11 & 12 \\
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$$

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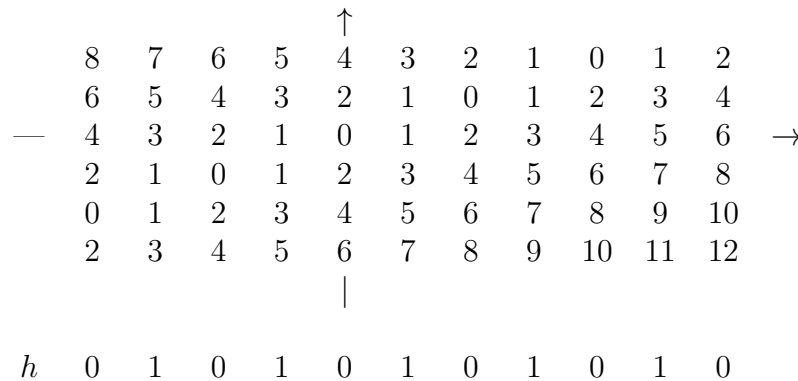
Figure 1.4. (Publication 17-5.) Define $f(x, y) = |x - 2y|$, $(x, y) \in \mathbf{Z}^2$, a convex extensible function, and let $h(x) = \inf_{y \in \mathbf{Z}} f(x, y)$, $x \in \mathbf{Z}$, be its marginal function. We see that h is not convex in any sense of the word.

Figure 1.5. (Publication 17-5.) Shiva Samieinia.

17-6. Discrete convolution operators, the Fourier transformation, and its tropical counterpart: the Fenchel transformation. **In:** Kasozi, Juma; Nannyonga Kivumbi, Betty; Mirumbe, Geoffrey I., Eds. 2017. *Proceedings of the Third EAUMP Conference: Advances in Mathematics and Its Applications, Makerere University, Kampala, Uganda, 26th to 28th October 2016*, pp. 7–28. Kampala: Makerere University, xv + 350 pp.

17-i. Lars Hörmander—some early memories. *Mathematical Advances in Translation*, **36**, No. 2, 120–121 (2017); ISSN 1003-3092. [A translation into Chinese of the original in English, published in 2015 (paper 15-iv).]

17-ii. *Curriculum Vitae:* Mikael Passare. **In:** Andersson, Mats; Boman, Jan; Kiselman, Christer; Kurasov, Pavel; Sigurdsson, Ragnar, Eds. 2017. *Analysis Meets Geometry. The Mikael Passare Memorial Volume*, pp. 3–4. Cham: Birkhäuser. ISBN 978-3-319-52469-6.

17-iii. Mikael Passare's publications. **In:** Andersson, Mats; Boman, Jan; Kiselman, Christer; Kurasov, Pavel; Sigurdsson, Ragnar, Eds. 2017. *Analysis Meets Geometry. The Mikael Passare Memorial Volume*, pp. 5–9. Cham: Birkhäuser. ISBN 978-3-319-52469-6.

17-iv. Mikael Passare (1959–2011). **In:** Andersson, Mats; Boman, Jan; Kiselman, Christer; Kurasov, Pavel; Sigurdsson, Ragnar, Eds. 2017. *Analysis Meets Geometry. The Mikael Passare Memorial Volume*, pp. 35–57. Cham: Birkhäuser. ISBN 978-3-319-52469-6.

Figure 1.6. (Publication 17-iv.) Mikael Pettersson (age 24), Jean François Colombeau, Leif Abrahamsson, and Urban Cegrell in November 1983. Mikael changed his family name to Passare in 1984. (Published in paper 17-iv, page 35. Photo Christer Kiselman)

17-v. Watching solar eclipses 1945–2017. *The Bulletin of the Swedish Mathematical Society*, October 2017, pp. 17–21.

1.2. Four papers accepted for publication (registered in DiVA)

1.2.1. Language choice in scientific writing: The case of mathematics at Uppsala University and in a Nordic journal

Accepted for publication in *Normat*, volume **61**, No. 2.

1.2.2. Werner Fenchel, a pioneer in convexity theory and a migrant scientist

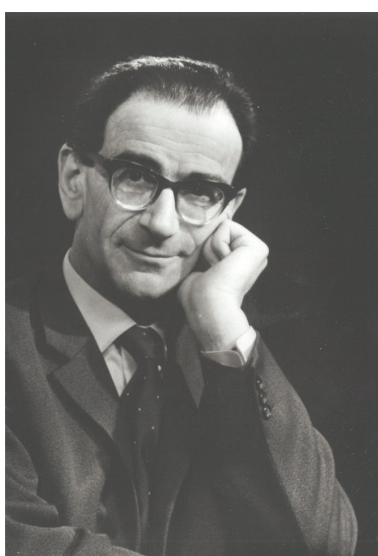Accepted for publication in *Normat*, volume **61**, No. 2.

Figure 1.7. (Manuscript 1.2.2.) Werner Fenchel (1905–1988).

1.2.3. Akademio de Esperanto fronte al novaj taskoj

Manuscript based on a presentation during the Conference on Esperanto Studies in Buenos Aires on 2014 July 31, organized by Esther H. Schor and José Antonio Vergara. To appear in 2018: *"Esenco kaj Estonteco": Lingvoscienco, Tradukado kaj Komunumo. Aktoj de la 37-a Esperantologia Konferenco en la 99-a Universala Kongreso de Esperanto, Bonaero 2014*, pp. 23–32. Editors: José Antonio Vergara and Esther Schoor.

1.2.4. Enkonduko, *Aliroj al esperanto*

Christer Oscar Kiselman. 2018. Enkonduko [Introduction]. **In:** Kiselman, Christer Oscar; Corsetti, Renato; Dasgupta, Probal, Eds. *Aliroj al esperanto*, pp. 5–8. Dobřichovice: KAVA-PECH, 229 pp. ISBN 978-80-87169-86-5. [Published in January 2018.]

1.3.   Editorial work

1.3.1. Editor, together with Mats Andersson, Jan Boman, Pavel Kurasov, and Ragnar Sigurdsson, of a book entitled *Analysis Meets Geometry. The Mikael Passare Memorial Volume*, viii + 466 pp. Cham: Birkhäuser. ISBN 978-3-319-52469-6. Published in September 2017.

> *Period:* 2011–2017.

1.3.2. Editor, together with Renato Corsetti and Probal Dasgupta, of a book entitled *Aliroj al esperanto*, 229 pp., to be published in 2018. ISBN 978-80-87169-86-5. See also Subsubsection 1.2.4. The book contains fourteen chapters written by outstanding Esperantists. [Published in January 2018].

> *Period:* 2015–2017.

1.3.3. Editor, *Esperantologio / Esperanto Studies*, Issue No. **8**.

> *Period:* 2015[–2018].

2.   Objects with the name of Kiselman

The largest known material object with the name of Kiselman is the asteroid with number 12673, officially named for my oldest son Dan Samuel Kiselman. Its estimated diameter is 7.837 km. A Euclidean ball of that diameter has a volume of some 252 billion cubic meters, but the gravity on Kiselman is much too small to force the material to form a ball. Whatever the shape may be, Kiselman 12673 is certainly much larger than the roundabout Kiselman in Uppsala, at the intersection of Dag Hammarskjölds väg and Regementsvägen, inofficially named so for my efforts during my time as dean to get a roundabout built there. However, there are also some non-material objects, to be described below.

2.1.   Kiselman's minimum principle

In my paper in *Inventiones Mathematicae* in 1978, item 78-1 in my web site, I proved a result on convexity of marginal functions of plurisubharmonic functions. It became known as "Kiselman's minimum principle" and has since been used in many situations and referred to by that name. The name appears in the following titles of published articles.

Berndtsson, Bo. 1998. Prekopa's theorem and Kiselman's minimum principle for plurisubharmonic functions. *Math. Ann.* **312**, no. 4, 785–792.

Darvas, Tamás; Rubinstein, Yanir A. 2016. Kiselman's principle, the Dirichlet problem for the Monge-Ampère equation, and rooftop obstacle problems. *J. Math. Soc. Japan* **68**, no. 2, 773–796.

However, the name also appears in the text of several papers without being mentioned in the bibliography. In those cases it will be missing in bibliometric analyses and I will not receive any points in the race.

2.2.   Kiselman's semigroup

In my paper in the *Transactions of the American Mathematical Society* in 2002, item 02-1 in my web site, I studied a semigroup of order eighteen with three generators, which later became known as "Kiselman's semigroup" or "Kiselman's monoid." Generalizations to any number of generators are easily done, which explains the plural in the title of five of the following seven articles.

Aragona, Riccardo; D'Andrea, Alessandro. 2013. Hecke-Kiselman monoids of small cardinality. *Semigroup Forum* **86**, no. 1, 32–40.

Ashikhmin, D. N.; Volkov, M. V.; Zhang, Wen Ting. 2015. The finite basis problem for Kiselman monoids. *Demonstr. Math.* **48**, no. 4, 475–492.

Collina, Elena; D'Andrea, Alessandro. 2015. A graph-dynamical interpretation of Kiselman's semigroups. *J. Algebraic Combin.* **41**, no. 4, 1115–1132.

Forsberg, L.: Effective representations of Hecke-Kiselman monoids of type A. *arXiv:1205.0676.*

Ganyushkin, Olexandr; Mazorchuk, Volodymyr. 2011. On Kiselman quotients of 0-Hecke monoids. *Int. Electron. J. Algebra* **10**, 174–191.

Grensing, Anna-Louise. 2016. Monoid algebras of projection functors. *Journal of Algebra*, **369**, 16–41. [This paper does not quote any paper by me, but has *Hecke–Kiselman semigroup* as a keyword and refers to Ganyushkin & Mazorchuk (2011) and Kudryavtseva & Mazorchuk (2009) that mention me in their titles.]

Kudryavtseva, Ganna; Mazorchuk, Volodymyr. 2009. On Kiselman's semigroup. *Yokohama Math. J.* **55**, no. 1, 21–46.

3.   Memberships in academies

Royal Academy of Arts and Sciences, Uppsala	1983−date
Royal Society of Sciences, Uppsala	1984−date
International Academy of Sciences, San Marino (AIS), Professor	1984−date
Internacia Scienca Akademio Comenius	1986−date
Esperanto Academy	1989−2015-12-15
Royal Swedish Academy of Sciences	1990−date
Polska Akademia Umiejętności (Polish Academy of Arts and Sciences)	2002−date
Confirmed by the President of the Republic of Poland on	2002 July 12
The diploma handed over by the Ambassador of Poland to Sweden, Marek Prawda, on	2003 June 10

4.   Memberships in learned societies

Swedish Astronomical Society (Life member)	1954−date
Swedish Mathematical Society (Life member)	1960s−date
American Mathematical Society (Life member)	1966−date
Société Mathématique de France	1960s−date
European Mathematical Society	1990s−date
Scandinavian Society for Iranian Studies (Associate member)	2010−date

5.   Six invited talks

5.1.   Sida conference, Stockholm

I was invited to give a talk at the conference *First Network Meeting for Sida- and ISP-funded PhD Students in Mathematics*, held at the Sida Headquaters in Stockholm, 2017 March 07–08. The title was "Discretization and tropicalization: How are they related?" In addition to Sida (The Swedish International Development Cooperation Agency), the organizers were Linköping University and the International Science Programme.

My doctor #18, Adama Arouna Koné (Figure 12.4), also gave a talk at this conference. His title was "Optimal methods for discrete configurations of some continuous shapes."

5.2.   Conference to the memory of Gennadi Henkin

I was invited to a conference entitled *Multidimensional Complex Analysis — In Memory of Gennadi Henkin* at Institut Mittag-Leffler, July 03–07. I gave a talk there on July 05 with the title "Gennadi Henkin (1942–2016). Some memories."

5.3.   Scientific meeting in Warsaw

The International Academy of Sciences (San Marino), AIS, held its Thirtyfourth University Session in Warsaw, September 10–15, at *Warszawska Szkoła Zarządzania, Szkoła Wyższa* (Warsaw Management School, Graduate and Postgraduate School). I was invited to give a course on digital geometry, mathematical morphology, and discrete optimization.

5.4.   Limmud, Stockholm

I was invited to present Zamenhof's Yiddish grammar and his language Lingvo universala at the Limmud Conference, held in Stockholm, November 18–19. The talk was given in Swedish.

5.5.   Meeting in Wrocław

I was invited to give a talk on Esperanto and its predecessors *Lingwe uniwersala* (1878), *Lingvo universala* (1881), and *La Mondo Lingo* (1886), on December 11, at a public meeting in the *Klub Muziki i Literury* (The Club for Literature and Music) in Wrocław. The talk was given in Esperanto.

5.6.   Conference at POLIN, Warsaw, December 13–15

I was an invited speaker at the conference *The Heritage and Legacy of Ludwik Lejzer Zamenhof Between Judaism and Esperanto* held at *Muzeum Historii Żydów Polskich POLIN* (The Museum of the History of the Polish Jews, POLIN), in Warsaw, 2017 December 13–15. All talks were in English. My title was: "Zamenhof's Yiddish grammar and his Universal Language."

6. Organization of meetings

6.1. Release Party on October 27 at Stockholm University for the book mentioned in Subsubsection 1.3.1 above and entitled *Analysis Meets Geometry. The Mikael Passare Memorial Volume*, viii + 466 pp. Cham: Birkhäuser. ISBN 978-3-319-52469-6. Published in September 2017.

6.2. Michael Breuß, Alfred M. Bruckstein, Petros Maragos, and me applied in October 2017 to organize a Dagstuhl Seminar on *Shape Analysis: Euclidean, Discrete, and Algebraic Geometric Methods.* [Application approved on 2018 January 26; the seminar to take place 2018 October 14–19.]

7. Seminar at VI2

On November 13, I gave a seminar at the Division of Visual Information and Interaction of the Department of Information Technology, Uppsala University, entitled "Thoughts on discretization and tropicalization."

8. Commissions

8.1. The International Science Programme

The International Science Programme (ISP) has activities in three fields: Physics, Chemistry, and Mathematics. It has three Reference Groups, one for each of the three activities.

Figure 8.1. Left: Peter Sundin, Director of the International Science Programme (ISP). Right: Leif Abrahamsson, Director of the International Programme in the Mathematical Sciences (IPMS).

I was a member of the Reference Group for Mathematics from 2002 and up to 2017 December 31.

The Reference Group for Mathematics met in Livingstone, Zambia, October 09–11, and discussed applications from several research networks, viz.,

- The Network Partial Differential Equations, Modelling, and Control (West Africa);
- The East African Universities Programme (EAUMP);
- Addis Ababa University;
- SEAMaN, South-East Asia.

8.2. A committee under the Center for Research and Documentation on World Language Problems

I was a member of a committee to judge grant applications to the Center for Research and Documentation on World Language Problems (CED) concerning research on Esperanto and interlinguistics, 2006 December 30 — 2017.

8.3. The Board of the Center for Research and Documentation on World Language Problems

I am a member of the board of the Center for Research and Documentation on World Language Problems, 2013 — date.

8.4. International Symposium for Mathematical Morphology, ISMM 2017

ISMM 2017 took place May 15–17 in Fontainebleau. I was a member of the Program Committee, appointed in November 2016.

8.5. Discrete Geometry for Computer Imagery, DGCI 2017

DGCI 2017 took place September 19–21 i Vienna. I was a member of the Program Committee.

8.6. Dean at the International Academy of Sciences

I am appointed as Dean of the Faculty of Structural Sciences of the International Academy of Sciences, 2017 July 28 [— 2019 December 31].

9. Participation in conferences without giving a talk

During 2017, I have participated in four conferences without giving a talk:

9.1. International Symposium on Mathematical Morphology (ISMM 2017), Fontainebleau, May 15–17. (See Subsection 8.4 above.)

9.2. The 2017 World Congress of Esperanto, held in Seoul, 2017 July 22–29.

9.3. *Discrete Geometry for Computer Imagery*, DGCI 20, in Vienna, September 19–21. (See Subsection 8.5 above.)

9.4. A conference in Stockholm on November 26 with lectures on themes from Zamenhof's life, ideas and work by Giorgio Silfer, Perla Martinelli, and Bertil Nilsson.

10. Visitor

Alfred Marcel Bruckstein from Technion, Haifa, visited me April 15–19. He gave an invited lecture at the Cosy Seminar of the Center for Interdisciplinary Mathematics at Uppsala University (CIM) on April 18, entitled "The Joys of the Elementary: Three Easy Pieces."

His travel expenses were covered by CIM. For his stay in Uppsala I received a grant from the Royal Academy of Arts and Sciences to the amount of 5,320 SEK.

Figure 10.1. Alfred M. Bruckstein surrounded by hoarfrost in Uppsala, 2017 April 17.

11. Visits

11.1. Jean Serra

Figure 11.1. Jean Serra.

Jean Serra and Marie-Françoise Colomé-Serra accepted me in Fontainebleau on May 14 and 17 for discussions on mathematical morphology and many other subjects.

11.2.   Lawrence Gruman and Ahmed Zeriahi

I visited Lawrence Gruman and Ahmed Zeriahi at Université Paul Sabatier in Toulouse for mathematical discussions, May 18–20.

12.   Eight current research projects

⋆ Good problems

> Problems worthy
> of attack
> prove their worth
> by hitting back
> (Piet Hein)

⋆ An explanation . . . or is it an excuse?

> The primates are notable by reason of their activity and restlessness, and especially because of their curious concern with what goes on around them.
> (Colbert, Edwin H. 1966, p. 272. *Evolution of the Vertebrates: A History of the Backboned Animals Through Time.* New York: John Wiley & Sons, Inc.)

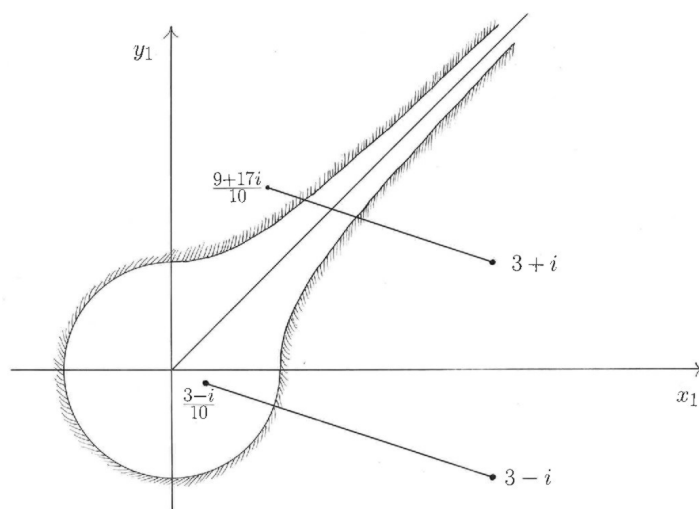## 12.1.   Complex convexity

Figure 12.1. (Project 12.1.) The base in the complex plane of a locally linearly convex set in $\mathbf{C}^2$ which is not lineally convex (from publication 16-1; courtesy Hania Uscka-Wehlou).

Project manager: Christer Kiselman.

Project abstract: A bounded open set with boundary of class C^1 which is locally weakly lineally convex is weakly lineally convex, but, as shown by Yuriĭ Zelinskiĭ, this is not true for unbounded domains. We construct explicit examples, Hartogs domains, showing this. Their boundary can have regularity $C^{1,1}$ or C^∞.

Obstructions to constructing smoothly bounded domains with certain homogeneity properties are presented.

A current activity is a study of one-sided regularity of subsets of $\mathbf{R}^n$ or $\mathbf{C}^n$. Preliminary results on this kind of regularity were presented at a conference at Stockholm University on 2015 September 16.

Period: 1967-10-01 — .

Advisors: Jan Boman, Ragnar Sigurdsson, and Mats Andersson.

Financed by: (1) Université de Nice 1967-10-01 — 1968-09-30;
(2) Uppsala University 1968-10-01 — 2006-04-30;
(3) Kingdom of Sweden 2006-05-01 — .

Publications: There are several publications in this project. The latest paper was published in March 2016 (16-1).

12.2. Elements of Digital Geometry, Mathematical Morphology, and Discrete Optimization

Project manager: Christer Kiselman.

Project abstract: A book on fundamentals of three related fields of knowledge: digital geometry, mathematical morphology, and discrete optimization.

Partners: Hania Uscka-Wehlou, Shiva Samieinia, Adama Arouna Koné; possibly others.

Period: 2002 — .

Financed by: Christer Kiselman: (1) Uppsala University 2002 — 2006-04-30;
(2) Kingdom of Sweden 2006-05-01 — .

Hania Uscka-Wehlou: (1) Man In The Middle AB (MITM);
(2) Uppsala University 2017 August 15 — 2018 August 14.

Shiva Samieinia: (1) Stockholm University;
(2) The Ruth and Nils-Erik Stenbäck Foundation.

Adama Arona Koné: (1) International Science Programme (ISP) 2011–2016;
(2) Université des Sciences, des Techniques et des Technologies de Bamako (USTTB), Bamako I, 2011 — 2018 January 07;
[(3) École Normale d'Enseignement Technique et Professionnel (ENETP), 2018 January 08 — .]

Publication: Lecture notes with the title *Digita geometrio, matematika morfologio kaj diskreta optimumado* (69 pp.) from a course held in Warsaw in September 2017 (see Subsection 5.3) have been submitted to be published at the web site of the International Academy of Sciences (AIS).

12.3. Existence of continuous right inverses to linear mappings in elementary geometry

Project manager: Christer Kiselman.

Project abstract: A linear mapping of a compact convex subset of a finite-dimensional vector space always possesses a right inverse, but may lack a continuous right inverse even if the set is smoothly bounded. Examples showing this are given as well as conditions guaranteeing the existence of a continuous right inverse, also for other sets.

Period: 2005-09-08 — .

Partner: Erik Melin; possibly others.

Advisor: Hiroshi Yamaguchi.

Financed by: Christer Kiselman: (1) Uppsala University 2005 — 2006-04-30; (2) Kingdom of Sweden 2006-05-01 — .

Erik Melin: Uppsala University 2005–2008.

Publication: A manuscript by Erik Melin and me is in preparation.

12.4. Convexity of marginal functions in the discrete case

Project manager: Christer Kiselman.

Project abstract: We define, using difference operators, classes of functions defined on the set of points with integer coordinates which are preserved under the formation of marginal functions. The duality between classes of functions with certain convexity properties and families of second-order difference operators plays an important role and is explained using notions from mathematical morphology.

Several generalizations are now being studied.

Period: 2010-01-11 — .

Partner: Shiva Samieinia.

Financed by: Christer Kiselman: Kingdom of Sweden.

Shiva Samieinia: (1) The Royal Institute of Technology; (2) Stockholm University; (3) The Ruth and Nils-Erik Stenbäck Foundation.

Publications: An article (10-4), joint with Shiva, was published as a part of her PhD thesis. A joint paper (17-5, listed in Subsection 1.1 above) was published in September 2017.

12.5. Digital hyperplanes

Project manager: Christer Kiselman.

Project abstract: Digital planes in all dimensions are studied. The general goal is to generalize to any dimension the results of Kiselman's 2011 paper in *Mathematika* (11-1).

An important part of the study was finished with Adama's thesis, presented on 2016 January 14. There are, however, several possible generalizations which are now being investigated.
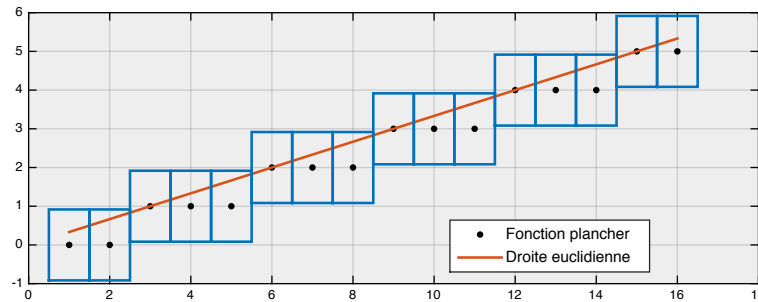
Period: 2010-01-11 — .

Figure 12.2. (Project 12.5.) Covering the Euclidean straight line of equation $y = \frac{1}{3}x$ by a dilation obtained using the floor function and with structural set equal to the rectangle $[-\frac{1}{2}, \frac{1}{2}] \times [-\frac{5}{6}, \frac{5}{6}]$ (courtesy Adama Arouna Koné).

Partner: Adama Arouna Koné.

Publications:

Koné, Adama Arouna. 2016. *Géométrie digitale utilisée pour la discrétisation et le recouvrement optimal des objets euclidiens.* PhD Thesis, 114 pages. Bamako: Université des Sciences, des Techniques et des Technologies de Bamako I (USTTB).

Koné, Adama Arouna. 2017. Covering a Euclidean line or hyperplane by dilations of its discretization. *Vietnam J. Math.* **45**, no. 3, 351–368.
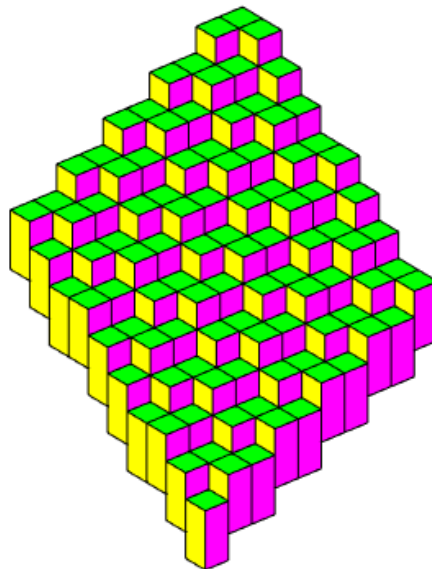

Figure 12.3. (Project 12.5.) Covering a Euclidean plane by a dilation, using the floor function and with structural set equal to the box $[-\frac{1}{2}, \frac{1}{2}] \times [-\frac{1}{2}, \frac{1}{2}] \times [-\frac{9}{8}, \frac{9}{8}]$ (courtesy Adama Arouna Koné).

Figure 12.4. (Project 12.5.) Adama Arouna Koné.

12.6.   Discrete convolution equations

Project manager: Christer Kiselman.

Project abstract: We study solvability of convolution equations for functions with discrete support in $\mathbf{R}^n$, a special case being functions with support in the integer points. The more general case is of interest for several grids in Euclidean space, like the body-centered and face-centered tesselations of three-space, as well as for the non-periodic grids that appear in the study of quasicrystals. The theorem of existence of fundamental solutions by de Boor, Höllig & Riemenschneider is generalized to general discrete supports, using only elementary methods. We also study the asymptotic growth of sequences and arrays using the Fenchel transformation. Estimates using the Fourier transformation are studied.

Now duality of convolution is investigated.

A study of quasicrystals is part of this project.

Advisors: Jan Boman, Ragnar Sigurdsson.

Period: 2012-01-11 — .

Financed by: Kingdom of Sweden.

Publications: A paper was published on 2015 May 07 in *Mathematika* (15-2). A second paper appeared in 2017 (17-2); see Subsection 1.1 above.

12.7.   Zamenhof's Yiddish grammar

Project manager: Christer Kiselman.

Project abstract: Zamenhof wrote a Yiddish grammar (in Russian) around 1880. It was published in full only in 1982. A study of this grammar is being undertaken. In particular, a comparison with his language project *Universal Language* from about the same time is of interest.

Figure 12.5. (Project 12.7.) Л. Заменгофъ, L. Zamenhof (1859–1917) around 1879.

Presentations:

12.7.1. 2016 July 29 at a conference in Nitra (in Esperanto).

12.7.2. 2017 November 19 at the *Limmud* conference in Stockholm (in Swedish). See Subsection 5.4 above.

12.7.3. 2017 December 13 at the conference *The Heritage and Legacy of Ludwik Lejzer Zamenhof Between Judaism and Esperanto* at *Muzeum Historii Żydów Polskich POLIN* (The Museum of the History of the Polish Jews, Polin), in Warsaw, 2017 December 13–15. Title: "Zamenhof's Yiddish grammar and his Universal Language." See Subsection 5.6 above.

12.7.4. (planned) 2018 February at Uppsala University.

Publications: A short account (in Esperanto) was published in November 2016 (16-b). Another publication (in English) is being prepared.

Period: 2015-08-01 — .

Financed by: Kingdom of Sweden.

12.8.   Mathematical concepts and their linguistic expression in a multicultural setting

Project manager: Hania Uscka-Wehlou (Figure 1.2).

Partners: Christer Kiselman, Adama Arouna Koné (Figure 12.4), Lars Mouwitz, Fanja Rakontondrajao (Figure 12.6), Xiaoqin Wang (Figure 12.7).

Advisors: Amites Rasho, Shiva Samieinia (Figure 1.5).

Project abstract: To study the relation between mathematical concepts and their expression in several languages. Special attention is devoted to the use of non-native languages.

Project description in more detail: The languages of interest here are Swedish as the main language in Sweden, and all other languages that are used in schools in Sweden.

Since the project manager's native language is Polish and since she has perfect command also of Dutch and Swedish, it is natural that these languages come into focus. There are many students and teachers in Swedish schools with Polish as their first language. Persian, Arabic, and Kurdish are also present in Swedish schools, and the group possesses, in its advisors, competence also in those languages.

However, other languages that are not common here can be of interest, among them Bamanankan and Malagasy. In Madagascar, the language in higher education is French, but the students' first language is usually Malagasy, a language of the Malayo-Polynesian branch of the Austronesian language family, with some 18 million native speakers. Fanja is very active in the creation of mathematical terms in Malagasy. As a small example, she has created the word *tampaha* for fractal, the concept introduced and popularized by Benoît B. Mandelbrot (1924–2010), and this term has been widely accepted in Madagascar. I have received a research grant to the amount of 25,498 SEK from the Royal Academy of Arts and Sciences for a visit by Fanja to Uppsala.

The creation of scientific terms, which has a rich history and is still going on in many languages, proceeds along two distinct avenues. One is the method of etymological translation, where a term (in Classical Greek, Latin, or other languages with a strongly developed terminology) is analyzed in its components and the components are translated. Typical examples are the Dutch *sterrenkunde* and the Icelandic *stjörnufræði*, which both mean 'astronomy' (*fræði* means 'science'). When this does not work, the other method comes into focus: the phonetical translation, yielding terms like *algebra* and *geometri* in Swedish, *aljebra* and *jeometria* in Malagasy—in contrast to the Dutch and Icelandic *meetkunde* and *flatarmálafræði*, which both mean 'geometry' (*to meten* means 'to measure'; *flatarmál* means 'surface'), and are created according to the first-mentioned method of etymological translation.

The current work with Malagasy terminology illustrates basic principles in mathematical language policy and is therefore a valuable help in illustrating quite general problems, problems present in Swedish and many other languages.

Figure 12.6. (Project 12.8.) Fanja Rakotondrajao in Livingstone, 2017 October 12.

Figure 12.7. (Project 12.8.) Xiaoqin Wang.

Period: 2016-04-01 — .

Financed by:

Hania Uscka-Wehlou: (1) Man In The Middle AB (MITM);
(2) Uppsala University 2017 August 15 — 2018 August 14.

Christer Kiselman: Kingdom of Sweden.

Adama Arouna Koné: (1) Université des Sciences, des Techniques et des Technologies de Bamako (USTTB), Bamako I, 2016 — 2018 January 07;
[(2) École Normale d'Enseignement Technique et Professionnel (ENETP), 2018 January 08 — .]

Lars Mouwitz: Kingdom of Sweden.

Fanja Rakotondrajao: (1) Université d'Antananarivo;
(2) the Royal Academy of Arts and Sciences (a grant to the amount of 25,498 SEK).

Xiaoqin Wang: University of Gävle.

Presentations: Hania Uscka-Wehlou has given three presentations related to this project, and is invited to give two more in 2018.

12.8.1. 2016-04-11: Presentation *Översättarverkstan: autismens språk — matematikens språk (on translating mathematical terminology)* at the seminar on Polish language at Stockholm University, Department of Slavic Languages, for students and researchers from the department. Invited by Professor Maria Zadencka. `https://vimeo.com/162868038/b47d9f35ff` (in Swedish).

12.8.2. 2017-05-12: Presentation *Mathematics and languages* during a conference for teachers of the Polish language in Sweden organized by Stockholm University and the Swedish Institute: `https://vimeo.com/217304561` (in Swedish).

12.8.3. 2017-10-06: Presentation and workshop *Interactions between mathematics and languages in learning and teaching* for native-language teachers in Södertälje (three hours: a lecture plus workshop for about 90 teachers teaching about 40 different languages). Invited by Mary-Anne Eliasson, Municipality of Södertälje. (The municipality offers education in 53 languages, taught by 112 teachers.)

12.8.4. 2018-01-26: Presentation *Languages for mathematics: sometimes helpful, sometimes not; with examples from several European languages*, during the conference for mathematics teachers *Matematikbiennalen 2018* in Karlstad.

12.8.5. 2018-02-06 (planned): A guest lecture in the course *Mathematics Teaching Practice* for teacher candidates, invited by Veronica Crispin-Quinonez and Erik Östergren.

Publications: Publications 17-1 and 17-4, listed in Subsection 1.1.

A manuscript by Hania entitled "Svansklippning och andra förtjusande matematiska aktiviteter" was accepted for publication in 2017 [and is now published in *Nämnaren* (2018), No. 1, pp. 55–61].

13.   Four completed research projects

For some research projects finished earlier, see the material for the Annual Reports of 2015 and 2016.

13.1.   Language choice in theses in mathematics at Uppsala University and in a Nordic journal

Project abstract: A study of language choice in doctoral thesis, showing the changes from Latin over Swedish to French, German and then to English.
Period: 1998–2016.
Publication: A paper is accepted for publication in *Normat*, volume **61**, No. 2; not yet published.

13.2.   Combination of word elements in Esperanto

Project manager: Christer Kiselman.
Project abstract: This is a study of word formation in Esperanto, with an historical survey and questions for the future.
Period: 2011-01-11 — 2016-12-31.
Publication: The project was essentially finished with the article (15-a). However, some kind of continuation is possible.

13.3.   Werner Fenchel, a pioneer in convexity theory and a migrant scientist

Project abstract: Werner Fenchel (1905–1988) was a pioneer in convexity theory and in particular the use of duality there. When asked about his views on the many terms used to express this duality he described in a private letter (1977) the whole development from Legendre and onwards, as well as his preferences concerning the choice of terms. A survey of basic notions of convexity theory is sketched, as well as the background for Fenchel's leaving Germany and moving to Denmark and later to Sweden.
Period: 2013–2016.
Publication: A paper is accepted for publication in *Normat*, volume **61**, No. 2; not yet published.

13.4. How to best fold a triangle

Project manager: Christer Kiselman.

Project abstract: We fold a triangle once along a straight line and study how small the area of the folded figure can be. It can always be as small as the fraction $2 - \sqrt{2}$ of the area of the original triangle. This is best possible: For every positive number ε there are triangles that cannot be folded better than $2 - \sqrt{2} - \varepsilon$.

Period: 2005 April — 2017 March.

Advisor: Bo Senje.

Financed by: (1) Uppsala University 2005 — 2006 April 30; (2) Kingdom of Sweden 2006 May 01 — 2017 March.

Publication: See 17-3 in Subsection 1.1 above.

14. Seven referee reports (not reported to Squirrel)

2017.1, 2017.2, 2017.3: ISMM 2017 in Fontainebleau

Jesús Angulo asks about three manuscripts submitted to ISMM in Fontainebleau, 2017 May 15–17.

2017.4, 2017.5: DGCI 2017 in Vienna

The organizers of DGCI in Vienna, 2017 September 19–21, ask about two submissions.

2017.6: The journal *Mathematical Morphology – Theory and Application*

A manuscript received 2017 June 08. Report sent 2017 July 01.

2017.7: The Heritage and Legacy of Ludwik Lejzer Zamenhof Between Judaism and Esperanto

I wrote a report on one of the manuscripts submitted to the conference held at *The Museum of the History of the Polish Jews, Polin*, in Warsaw, 2017 December 13–15.

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