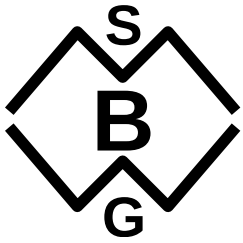


Newsletter

BELGIAN MATHEMATICAL SOCIETY

124, September 15, 2019

Comité National de Mathématique CNM

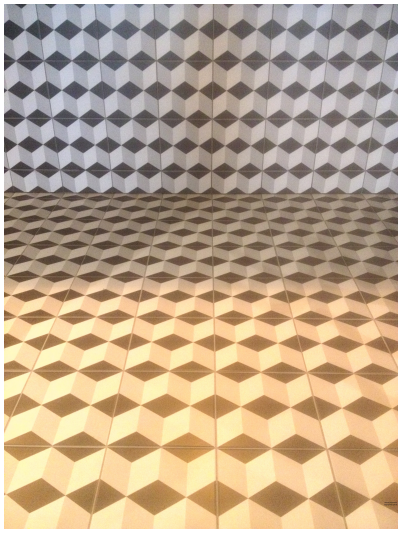
C W M
N

NCW Nationaal Comité voor Wiskunde

Newsletter of the Belgian Mathematical Society and the National Committee for Mathematics

ULB Campus Plaine, C.P. 218/01,
Bld du Triomphe, B-1050 Brussels, Belgium

Website: bms.ulb.ac.be
Newsletter: wendy.goemans@kuleuven.be



Contents

The next edition of this newsletter will appear on November 15th, so from now till November 8th all content is welcomed very much at wendy.goemans@kuleuven.be.

Any information that you qualify as interesting to be spread among the Belgian Maths community is considered! Examples of such information are: PhD defenses, seminars, conferences, workshops, meetings, interaction with other sciences or business companies, popular lectures, school initiatives, math exhibitions, job opportunities, . . .

The President's Foreword

Dear members of the BMS, dear colleagues,

Let's start this new academic year on a serious note.

Recently Volker Mehrmann (President of the European Mathematical Society) shared an important message concerning ERC grants; for those of you who have not read it, the message is available below. As many of us are already aware, what is said in this message is entirely correct : mathematicians are generally too shy to apply to ERC grants! This is particularly true for Belgian mathematicians who seem to be even too shy among European mathematicians (see some data below).

There are obviously many reasons for being weary of applying to such grants : the application process is demanding, there is a low success rate, we would not know what to do with such a large budget, we are very busy, ...

Nevertheless, there are also many arguments which should encourage us – collectively – to apply.

1. Paper work. The application itself is not considerably more elaborate than the application for an FWO or FNRS research project. Obviously, applicants are competing with top mathematicians from the whole of Europe. So you need to spend time on setting up your project. But that is useful independently of getting the funding. If you get an ERC grant, the paperwork is really light. According to those who have experience managing starting or consolidator grants, the administrative part turns out to be much lighter than e.g. a typical Horizon 2020 project.
2. Success rate. The principle is that the success rate is the same across panels. It is around 12 per cent. The problem that the EMS president explains in his letter is that mathematicians are much more "self selective". They apply less than scientists in other fields. And thus they get less grants, because the success rate in each panel is the same. If we can convince a double number of European mathematicians to apply, then the number of mathematics grants will double.

On the web site https://erc.europa.eu/projects-figures/statistics you can find and export a wealth of statistics. More links are provided below.

Here are two illustrations concerning the starting grants (deadline 16/10/19):

- The budget of the ERC has considerably increased over the past 10 years. But this is not reflected in mathematics grants. The reason is simple: in 2009, the fraction of mathematics applications among all starting grant applications was 3,8%. In 2018, it was already down to 2,8%. If this "increased self selection" continues, this will be a disaster.
- In the past 10 years, the Belgian share of all starting grant applications in all fields is 3,5%. But the Belgian share of all starting grant applications in mathematics is only 2,5%.

To conclude, if you have a good project then you should apply, if not for yourself, at least for the community.

Wishing you all a good start of the academic year,

on behalf of the BMS board,
Yvik Swan,
BMS President

Further interesting information can be found at:

- **Starting grants:** see https://erc.europa.eu/funding/starting-grants and specifically https://erc.europa.eu/sites/default/files/document/file/erc_2018_stg_statistics.pdf
- **Consolidator grants:** see https://erc.europa.eu/funding/consolidator-grants and specifically https://erc.europa.eu/sites/default/files/document/file/erc_2018_cog_statistics.pdf
- **Advanced grants:** see https://erc.europa.eu/funding/advanced-grants and specifically https://erc.europa.eu/sites/default/files/document/file/erc-2018-adg-statistics.pdf

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Dear colleagues,

As President of the European Mathematical Society (EMS) I would like point out a very urgent and unfavourable situation for the funding of mathematics in Europe. The European Research Council (ERC) budget for each discipline is allocated each year in proportion to the number of proposals and the requested budget received. It has been observed that, since the founding of the ERC, the budget for mathematics in the three funding streams (advanced, consolidator, and starting grants) has dropped to almost half, because there are not enough applications.

There may be several reasons for this decline in applications, e.g. low acceptance rate, the feeling that certain subfields of mathematics have small chances, or the fact that for interdisciplinary research of mathematics with other sciences it is difficult to get funding. Also in mathematics there are often complaints that the maximal possible budgets are too large.

All this is partially right, but not submitting applications leads to a vicious cycle, and further decline of mathematics funding. How can we counteract this unfortunate development? First of all, there is no reason to apply for the full possible budget if this is not appropriate for a research project, smaller proposals are very welcome, and second we mathematicians should be more self-confident in writing proposals. It is not a wasted time, even one is not funded. In several European countries there is even financial support for proposals that make it to the second round but do not get funded due to budget restrictions.

It is very important that applications are encouraged throughout the mathematical community and the EMS is planning to create an initiative to support applicants. So please distribute this information within your community.

Volker Mehrmann, EMS President

1 News from the BMS & NCM

1.1 Bulletin of the Belgian Mathematical Society - Simon Stevin

In June 2019 Volume 26, Number 2, of the Bulletin of the Belgian Mathematical Society - Simon Stevin appeared with the following table of contents:

- **Michel Balazard** Fonctions arithmétiques multiplicativement monotones. 161–176.
- **Hassan Al-Zoubi, Mutaz Al-Sabbagh, Stylianos Stamatakis** On surfaces of finite Chen *III*-type. 177–187.

- **Yusuke Sawada** A remark on the minimal dilation of the semigroup generated by a normal UCP-map. 189–202.
- **Mohammad Shahbazi Asl, Mohammad Javidi** Numerical evaluation of order six for fractional differential equations : stability and convergency. 203–221.
- **Maha Belhadj, Afif Ben Amar, Mohamed Boumaiza** Some fixed point theorems for Meir-Keeler condensing operators and application to a system of integral equations. 223–239.
- **Adnane Elmrabty** On the compatibility between the differential topological index and the analytic Bunke-Schick push-forward construction. 241–253.
- **Davinder Singh, Harshit Mathur** Generalizations of Connected and Compact Sets by d_δ-Closure Operator. 255–273.
- **Oussama Ajbal, Eddy Godelle** Double centralizers in Artin-Tits groups. 275–298.
- **Pham Viet Hai** Polynomial stability of evolution cocycles and Banach function spaces. 299–314.

For the table of contents of previous issues, see https://projecteuclid.org/all/euclid.bbms.

1.2 In Memoriam

It is with great sadness that we announce the passing of our colleague **Paul van Praag**. Paul was born in Uccle on June 12, 1938 and passed away on August 30, 2019 after a relatively short illness. He studied Mathematics at the Université Libre de Bruxelles, where he obtained his PhD in 1965 under supervision of Papy. He retired as a professor of Mathematics at the Université de Mons. Besides his research field in algebra he was also interested in the history and teaching of Mathematics. He had a thorough knowledge of Belgian Mathematicians of the 20th century and could comment on their work and interactions in his own personal style. Until his death Paul Van Praag has been a member of the Belgian Mathematical Society. He has been an active board member of the Society and served as a president from 1986 until 1988. He contributed a lot to the transition of the Society after the Hirsch period[1]. To Paul's family we present our condolences.

2 Meetings, Conferences, Lectures, ...

2.1 Meetings and conferences

2.1.1 September 2019

The Beautiful Impact of Mathematics in Society - BIMS III

September 25, 2019

VUB

Deze derde editie heeft als thema "Wiskunde en Data Science".

[1] A brief history of our Society just appeared on page 37 of the September issue of the Newsletter of the London Mathematical Society. A more detailed (but somewhat outdated) version can be found at https://bms.ulb.ac.be/documents/BMS-history-2011May12.pdf.

We verwelkomen onze rector, Jonathan Berte (Robovision), Jan Schepers (Materialise), Eva Vandersmissen (Agfa Radiology Solutions), Eric Michiels (IBM) en Françoise Chombar (Melexis en STEM-platform) als sprekers! De lezingen worden telkens ingeleid door een collega van de Vakgroep Wiskunde die de toepassing zal verbinden met VUB-onderzoek in de wiskunde. U zal tevens ook kennis kunnen maken met onze vernieuwde Bacheloropleiding Wiskunde.

Op ons avondprogramma staat een filmvoorstelling van "Hidden Figures", u aangeboden door 20th Century Fox.

Meer informatie over het programma en registratie vindt u op https://we.vub.ac.be/en/beautiful-impact-mathematics-society-bims-iii

Deelname is gratis (attest zal verkrijgbaar zijn), maar inschrijven is verplicht. Plaatsen zijn beperkt, dus wees er snel bij! De conferentie staat in het bijzonder open voor klassen van het middelbaar en hoger onderwijs.

Academy Contact Forum "Coding Theory and Cryptography VIII"

September 27, 2019

Brussels

This eighth contact forum continues the tradition started in 2005 to give young and established researchers the possibility to present current research topics on coding theory and cryptography, and to establish new scientific contacts.

See all information at http://cage.ugent.be/ ls/website2019/contactforum2019.html

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2.1.2 October 2019

Workshop at the occasion of the retirement of Marc Coppens

October 9, 2019

KU Leuven

The following four speakers, all of whom have played a significant role in Marc's academic life, have kindly agreed to speak at this event:

- Jan Denef (KU Leuven)
- Gerriet Martens (FAU Erlangen-Nürnberg)
- Frans Oort (Universiteit Utrecht)
- Marta Panizzut (TU Berlin)

See all information and the registration form at https://wis.kuleuven.be/agenda/sem-ntag/ay18-19/sem026

The XIII-th International Conference of Differential Geometry and Dynamical Systems (DGDS-2019)

October 10-13, 2019

Bucharest, Romania

DGDS-2019 offers to researchers and university faculty members from all around the world the opportunity to meet with colleagues, share new research advances and ideas in the area of differential geometry, dynamical systems, mathematics in engineering and numerical physics, and has set up new collaborations and research projects.

See all information at http://www.mathem.pub.ro/dept/dgds-19/dgds-19-2.htm

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Bourgain Day

October 31, 2019

Brussels

Bourgain, a Belgian mathematician who was considered one of the giants in the field, passed away on December 22, 2018. Jean Bourgain was active in the branch of mathematics known as 'analysis', and performed in this area, with technical mastership, groundbreaking work of the highest originality.

Jean Bourgain started his career at the VUB, where he obtained his PhD in 1977 under Freddy Delbaen. After a professorship at VUB (1981-1985), he combined a position as J.L. Doob professor in mathematics at the University of Illinois with a position at the IHES in Bures-sur-Yvette, France. From 1994 he was appointed at the prestigious Institute for Advanced Study, Princeton, where he became IBM von Neumann professor in 2010.

During his career, Jean Bourgain was honoured with the highest mathematical distinctions, including the Salem prize (1983), the Ostrowski prize (1991), the Fields medal (1994), the Shaw prize (2010), the Crafoord prize (2012), the Breakthrough prize (2017) and the Leroy P. Steele prize (2018).

In commemoration of Jean Bourgain, we invite you to this 'day of analysis', in which prominent mathematicians will highlight aspects of their work which have close ties to the research in which Jean Bourgain was active.

The programme of the day is as follows:

- 09:30–10:00: Registration and coffee
- 10:00–10:30: Welcome
- 10:30–11:30: Stefaan Vaes (KU Leuven): The Kadison-Singer problem and the Bourgain-Tzafriri restricted invertibility theorem
- 11:30–12:30: Emmanuel Breuillard (University of Cambridge): Random walks on finite fields and random polynomials
- 12:30–14:00: Lunch
- 14:00–15:00: Jean Van Schaftingen (UCLouvain): Sobolev topology, Ginzburg-Landau energy and elliptic systems regularity
- 15:00–16:00: Mariusz Mirek (University of Wroclaw): Dimension free estimates for the discrete Hardy-Littlewood maximal functions

- 16:00–17:00: Closing event
- 17:00– : Reception

This event takes place in the 'Rubenszaal' of the Academy Palace, in the vicinity of the train station of Brussels-Central.

This event is organized with the support of the Belgian Mathematical Society and the Royal Flemish Academy of Belgium for Sciences and Arts.

See all information and the registration page at https://www.vub.be/events/2019/bourgain-day

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2.1.3 November 2019

125e Anniversaire de Georges Lemaître

November 21, 2019

Bern (Switserland)

Georges Edouard Lemaître (1894 - 1966) était un physicien et astronome belge et un prêtre catholique romain. Il a proposé le modèle d'un univers en expansion et est ainsi la figure centrale et le père fondateur du modèle du Big Bang.

Le symposium organisé par la Société suisse de physique en collaboration avec la plateforme MAP de la SCNAT célébrera le 125e anniversaire de Georges Lemaître, désormais reconnu comme le père fondateur du modèle de l'univers en expansion résultant d'un "Big Bang". Il aura lieu dans l'après-midi du jeudi 21 novembre 2019 dans la salle "Kuppelsaal" de l'Université de Berne. Il sera suivi dans la soirée par une présentation de l'origine des éléments chimiques en relation avec l'Année internationale du tableau périodique (IYPT 2019).

See further information at

https://sciencesnaturelles.ch/organisations/map/117006-125e-anniversaire-de-georges-lemaitre?_ga=2.205413392.1654515274.1566894820-1505667855.1566894820

2.1.4 February 2020

14th Workshop on Symplectic Geometry, Contact Geometry, and Interactions (CAST 2020)

February 6-8, 2020

Universiteit Antwerpen

This is the 14th workshop in the series of 3-day-workshops on Symplectic Geometry, Contact Geometry and Interactions. See all information at

https://www.uantwerpen.be/nl/personeel/sonja-hohloch/private-webpage/conference-workshop/workshop/

2.2 Seminars

2.2.1 Analysis & Geometry Seminar at Universiteit Antwerpen

For the upcoming seminars, see the calender at

https://www.uantwerpen.be/nl/personeel/sonja-hohloch/private-webpage/seminars/analysis—geometry-/

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3 PhD theses

On the symplectic invariants of semitoric systems

Jaume Alonso i Fernández

Universiteit Antwerpen
September 11, 2019

Thesis advisor: Prof. Dr. Sonja Hohloch (Universiteit Antwerpen)

Summary

Completely integrable systems are mathematical models that describe systems with many conserved quantities. Each possible state of the system corresponds to a point in the phase space. The time evolution of the system draws a curve in this space that must be confined in the common level sets of the conserved quantities. This allows us to use geometric tools to obtain dynamical results. In the underlying work we focus on semitoric systems, a specific class of completely integrable systems in four dimensions, where one of the conserved quantities is a proper map that induces a circular action. We require further that all singularities are non-degenerate and have no hyperbolic components. These systems appear in different areas of science, such as quantum chemistry and quantum optics, and can exhibit interesting phenomena like monodromy, an obstruction to the existence of global action-angle coordinates related to the presence of focus-focus points.

Semitoric systems were classified a few years ago using five symplectic invariants. However, it was unclear how to compute these invariants in practise. In the underlying work we have addressed this situation by studying three families of semitoric systems: the coupled spin-oscillator, the coupled angular momenta and a special family of systems that can have two focus-focus points at the same time. By using mathematical software and exploiting the properties of elliptic integrals, we have developed different methods to compute their symplectic invariants and completed their symplectic classification. We have also discovered some extra properties of these families, such as superintegrability in a specific energy level set with vanishing twist, diverging coefficients in the Taylor series invariant and certain symmetries between the different components of the invariants.

Reidemeister spectra for almost-crystallographic groups

Sam Tertooy

KU Leuven Campus Kulak Kortrijk
October 15, 2019 at 17:00
Auditorium C611
KUL Campus Kulak Kortrijk, Etienne Sabbelaan 53, 8500 Kortrijk

Thesis advisor: Prof. dr. Karel Dekimpe (KU Leuven Campus Kulak Kortrijk)

Summary

The notion of conjugacy in a group can be generalised to *twisted conjugacy*. For any endomorphism φ of a group G, we may define an equivalence relation $\sim_\varphi$ on G by

$$\forall g, g' \in G : g \sim_\varphi g' \iff \exists h \in G : g = hg'\varphi(h)^{-1}.$$

The number of equivalence classes is called the *Reidemeister number* and is denoted by $R(\varphi)$, and the set of all possible Reidemeister numbers of automorphisms is called the *Reidemeister spectrum*. This notion originates in topological fixed-point theory. A continuous self-map f on a (sufficiently well-behaved) topological space X induces an endomorphism f_* on the fundamental group $\pi_1(X)$. The Reidemeister number $R(f_*)$ is related to the number of fixed points of the self-map f. More specifically, $R(f_*)$ is an upper bound for the Nielsen number $N(f)$, which in turn is a lower bound for the number of fixed points of f.

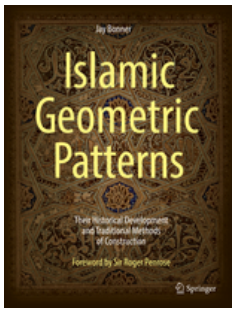
In this thesis, we investigate the Reidemeister spectra of almost-crystallographic groups. These groups are generalisations of the crystallographic groups, in the sense that their translation subgroup is nilpotent rather than abelian. The main results include an algorithm to calculate the Reidemeister number of any given automorphism of a crystallographic group, the calculation of the Reidemeister spectra in low dimensions, and rationality of the Reidemeister zeta function up to dimension 3.

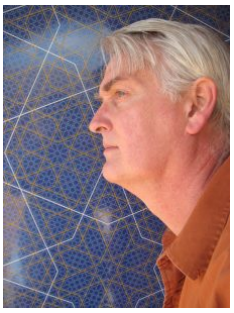
4 History, maths and art, fiction, jokes, quotations ...

4.1 Adhemar's corner

This new academic year we start with a review of Adhemar Bultheel on the book 'Islamic Geometric Patterns' by Jay Bonner.

Islamic Geometric Patterns by *Jay Bonner*. Springer Verlag, New York, 2017, isbn 978-1-4419-0216-0 (hbk) xxv+595 p.



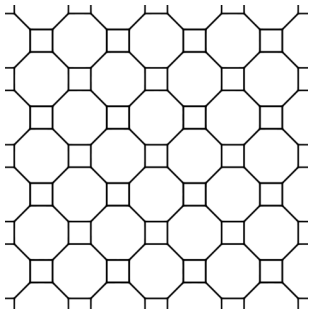


Jay Bonner

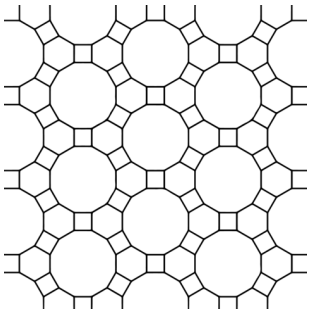
Jay Bonner is a graphic designer from New Mexico who specializes in Islamic geometric designs. These geometric patterns are very recognizable by their beautiful symmetric structures, often with characteristic pointed stars. Many different patterns can be found on walls and domes of numerous Islamic mosques, their grills, woodcuts, etc. since the earliest Eastern caliphates in the seventh century and all the other Muslim territories up to the medieval al-Andalus.

In this book Bonner explains the polygonal design methodology, which he believes was the general method used throughout Islamic culture. Therefore he has collected many historical examples that he surveys in his first chapter, which is richly illustrated with many photographs. Very few documents are available from which one might deduce the method that was used by the historical artists. The Topkapi scroll shows several polygonal construction grids and this has inspired Bonner to propose his polygonal design technique as a general principle.

The polygonal methodology consists in first defining a polygonal tessellation of the plane. That can be regular like an isometric, a triangular, square, or hexagonal grid, but in most cases there is a mixture of polygons of different sizes and shapes, and not all of them are regular (i.e. with equal edges and angles). One particular kind of almost regular grid that is often used consists of regular octagons and squares with matching edges. This is a 4.8.8 grid since such grids are indicated by enumerating the n-gons that coincide at the vertices as in the schemes on the left. Pattern lines are then added in these polygons that will generate the stars of the designs. There are four possibilities to generate these patterns (see next page). Three of them are lines that emerge at the midpoints of the edges under certain angles that will depend on the number of edges in the polygon. Depending on these angles that will generate the points of the stars, the design is called acute, median or obtuse. The fourth possibility is that the patterns lines start at two symmetric points on the edges. The next page gives examples of the effect of these methods applied to a tessellation of a grid consisting of squares and hexagons in the top two rows leading to fourfold symmetries. More complicated polygonal patterns with decagons, pentagons and hexagons are used in the bottom rows resulting in sixfold symmetries.

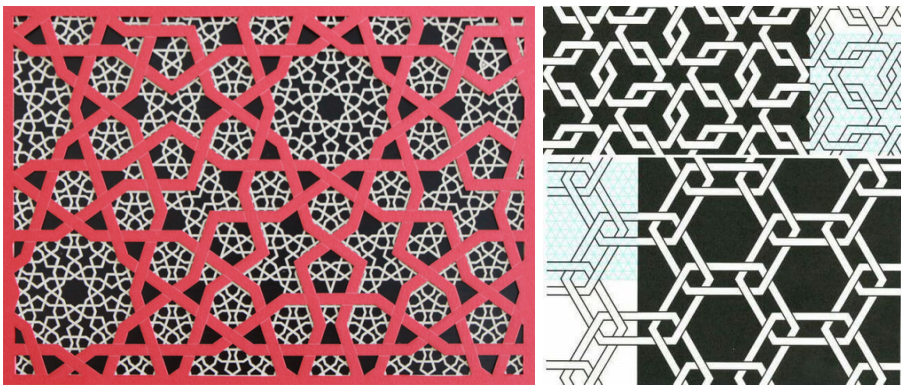


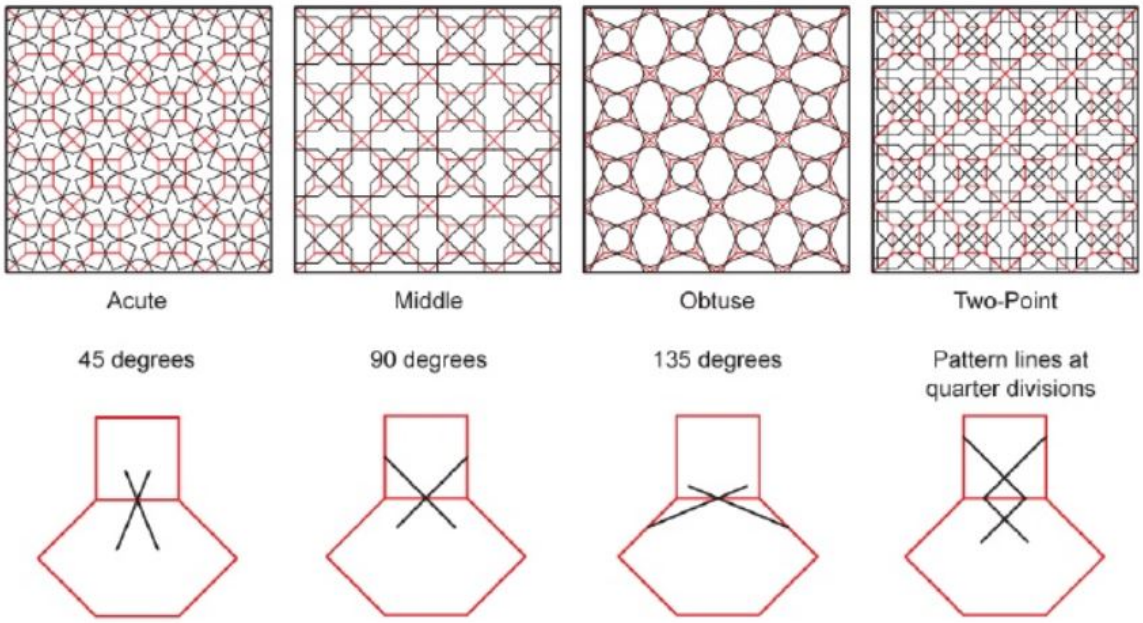
4.8.8= 4.8^2 grid and

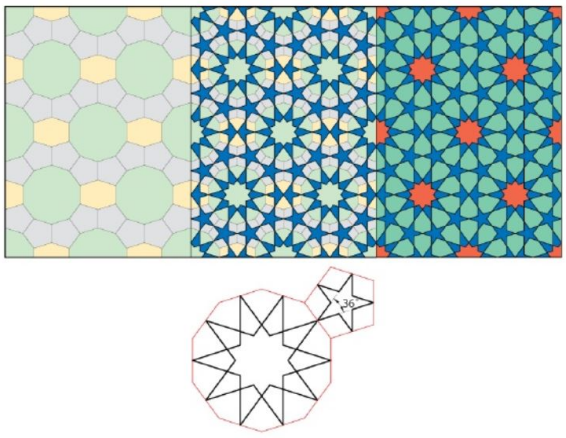


4.6.12 grid

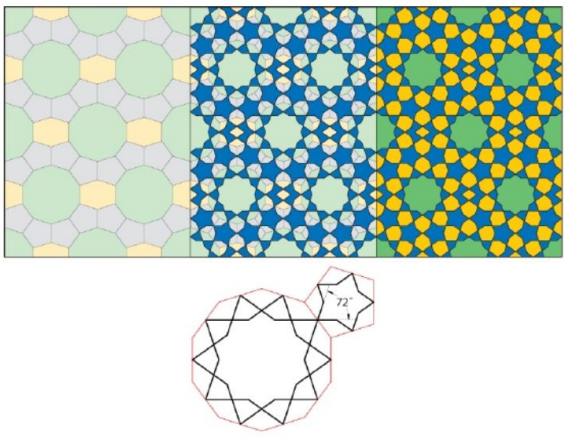
Here is another example on the right where the polygonal system is made clear. Once the pattern is on all the polygonal tiles the overall design appears and then the polygonal grid can be dropped. What remains is a tiling of the plane that gives a pleasing pattern when coloured appropriately as seen on the next page. On the other hand, the pattern lines can be widened, to form strips like the red ones in the image above. But most often these strips are not just crossing each other, but they are used to form some interweaving where one strip is on top of the other. On several occasions the strip is even split into two parallel narrower strips with possibly a different weaving pattern for each like in the right picture above.



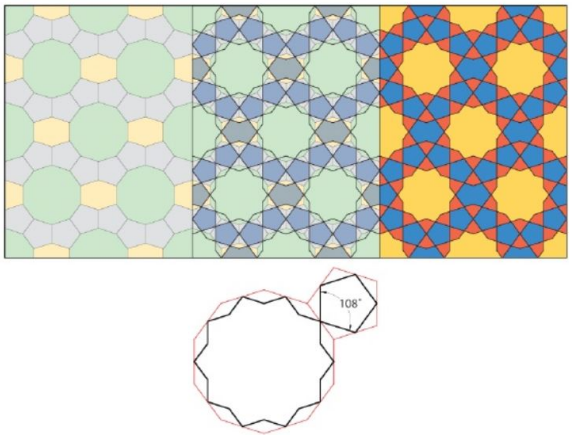




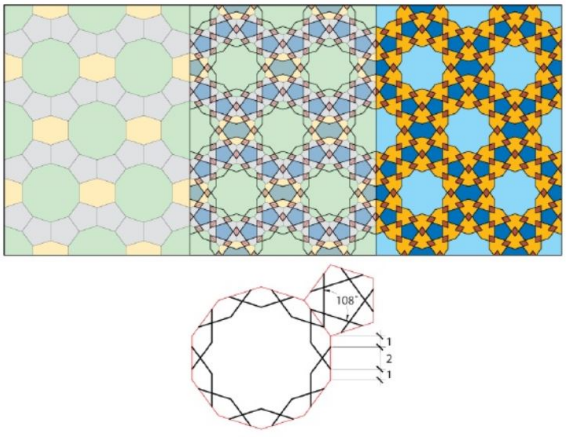
Acute



Median

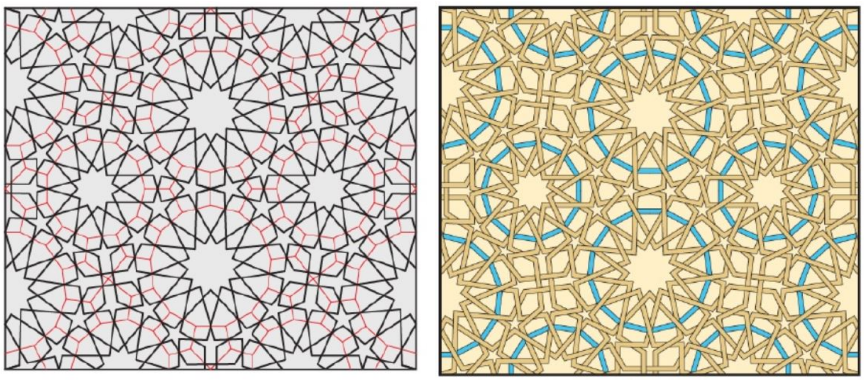


Obtuse



Two-point

*The images on this page are copied from slides of a lecture by Jay Bonner that he shared on SlideShare.

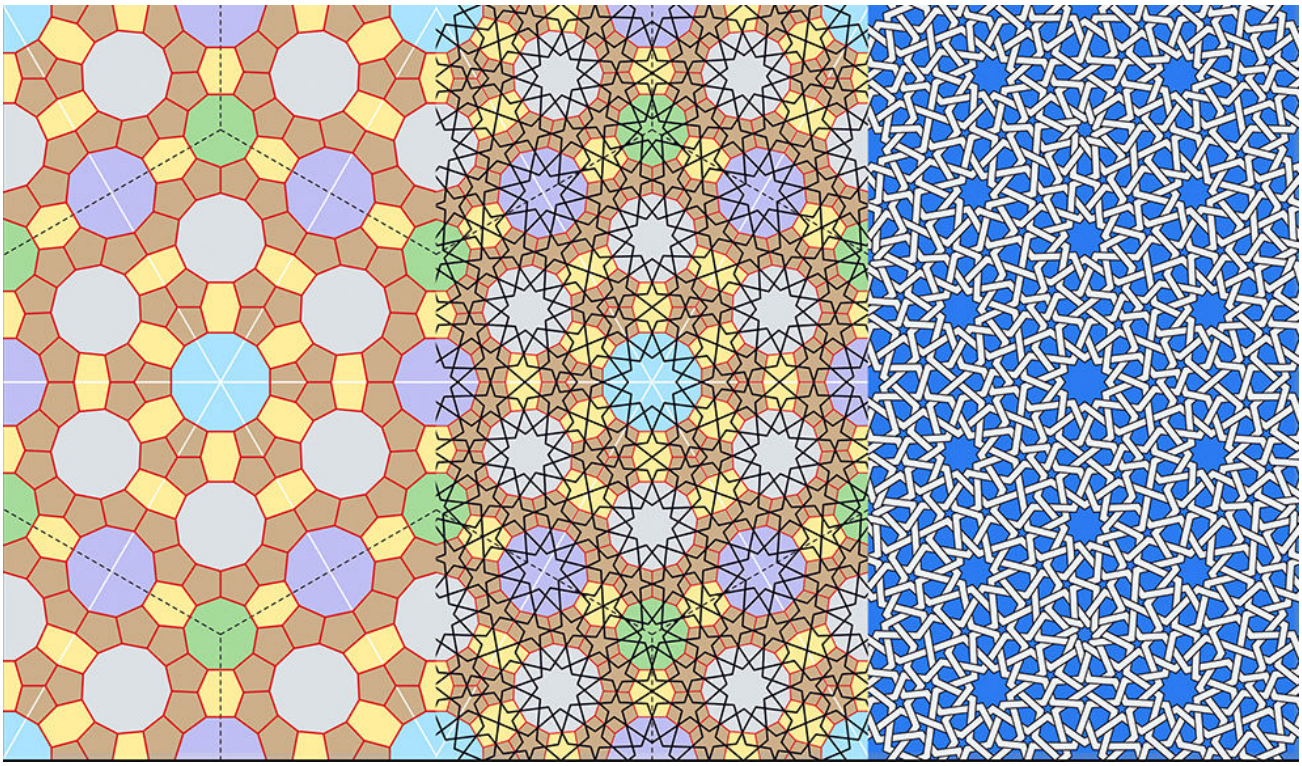


Polygonal grid with 11- and 13-pointed stars and te resulting design.

Here is another particularly nice example where 11 and 13-pointed stars are mixed in one design. On the left you see the polygonal pattern and on the right the eventual design with interweaving strips after the polygonal net has been removed.

Bonner has compiled an encyclopedic survey of the topic. In his chapter 2 he gives classifcation methods, in particular generalities about the polygonal design methodology and in his chapter 3, which is the most extensive one, he gives more details about the latter and the different implementation methods. What is explained here are just general principles, but Bonner describes the practical details of what angles should be allowed to obtain certain effects. Also the techniques that can be applied are more diverse than what I presented here. At some point, a dual level design is proposed in which a coarse grid is considered and in the wide strips a finer grid is used with stars at the intersection of the coarse grid lines. The finer grid is then extended to the whole plane. This gives two steps of what in principle could be a self-similar design. With the coarse structure removed, this has the effect that the design looks unstructured in a puzzling kind of way. The mathematics that one needs are very elementary. Bonner is an artistic designer and not a mathematician. The 17 wallpaper groups are mentioned as a possible classification method, but these are not relevant to understand the proposed construction methods.

In a last short chapter Craig Kaplan gives some details about how the designs can be generated on a computer, but the description is high level, so it requires a skilled programmer to generate the graphical software that would be able to generate the marvellous graphical illustrations of this book. This is a heavy weight book (about 1.750 kg) but oh so beautifully illustrated.



Polygonal grid + pattern lines = combination of 5-, 9-, 10-, 11- and 12-pointed stars.
This is just one of the hundreds of wonderful illustrations from Bonner's book.

Adhemar Bultheel