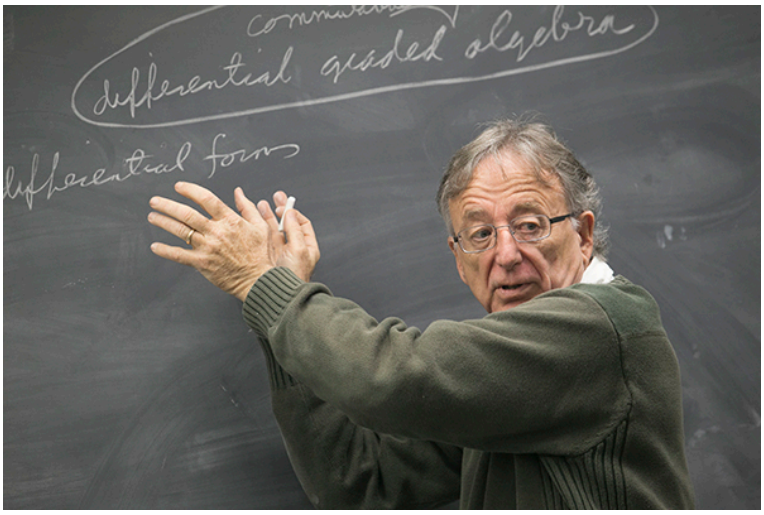
INFOMAT

MARS 2022

ABELPRISEN 2022



The Norwegian Academy of Science and Letters has decided to award the Abel Prize for 2022 to

Dennis Parnell Sullivan

of City University of New York and State University of New York at Stony Brook

"for his groundbreaking contributions to topology in its broadest sense, and in particular its algebraic, geometric and dynamical aspects."

INFOMAT kommer ut med 11 nummer i året og gis ut av Norsk Matematisk Forening. Deadline for neste utgave er alltid den 15. i neste måned. Stoff til INFOMAT sendes til

arnebs at math.uio.no

Foreningen har hjemmeside http://www.matematikkforeningen.no/
Ansvarlig redaktør er Arne B. Sletsjøe, Universitetet i Oslo

Matematisk kalender

2022

Mai:

23.-25. Abelprisutdeling, Oslo
<abelprisen.no>

30.-1. juni Conference on Climate, Weather and Carbon Risk in Energy and Finance, Oslo
<https://www.mn.uio.no/math/english/research/projects/spatus/events/conferences/conference-on-climate-weather-and-carbon-risk-in-e/index.html>

Juni:

6.-10. Abelsymposiet 2022: Triangulated categories in representation theory and beyond, Ålesund
<https://wiki.math.ntnu.no/abel2022/>

7.-9. 14. Nordiske kombinatorik-konferanse, Tromsø
<https://norcom2022.puremath.no/>

12.-19. Seminar Sophus Lie, Nordfjordeid
<https://www.mathematik.uni-marburg.de/ agricola/SSL2021/>

20.-24. Topics in real and tropical algebraic geometry, Nordfjordeid
<https://www.mn.uio.no/math/english/research/groups/algebra/events/conferences/nordfjordeid2022/index.html>

August:

8.-12. Motivic Geometry, Oslo
<https://sites.google.com/view/motivicgeometry-conference/home/>

September:

1.-2. Nasjonalt matematikermøte, Tromsø
<https://nmm2022.puremath.no./>

Nye doktorgrader

Gard Olav Helle ved Univ. i Oslo forsvarte 4. mars 2022 sin avhandling *Instanton Floer Homology and Binary Polyhedral Spaces* for graden PhD.

Veiledere har vært Associate Professor Kim Frøyshov and Professor John Rognes, UiO.

Sammendrag:

To a mathematician, a surface is a shape that, upon close enough inspection, looks like a flat piece of paper around each of its points. Thus, to an ant, the surface of a bagel is conceived as flat, while the (roughly) spherical surface of the earth looks flat to us. Nevertheless, on a global level these shapes are topologically distinct in the sense that one cannot deform one into the other through stretching, bending and shrinking.

Manifolds generalize the notion of a surface to other dimensions. In this terminology, a surface is a 2-manifold and a curve is a 1-manifold. These low-dimensional shapes have been completely classified. Much progress has been made in dimension 3, but several serious questions still remain.

In my thesis, I have explored a recent version of an algebraic invariant known as instanton Floer homology associated with a restricted class of 3-manifolds. It is built from geometric data extracted from the solution spaces of the instanton equation – a partial differential equation special to dimension 3 and 4. I have developed algebra needed to properly define this invariant and provided complete calculations for the binary polyhedral spaces – a family of 3-manifolds intimately linked with the platonic solids and their symmetries. I have also employed techniques from quiver theory to construct several hyper-Kähler bordisms between members of this family.

Andrea Raffo ved Univ. i Oslo forsvarte 18. mars 2022 sin avhandling *Mathematical methods for geometry reconstruction and shape analysis* for graden PhD.

Veiledere har vært Professor Michael Floater, UiO, Chief Scientist Tor Dokken, SINTEF, Senior Research Scientists Georg Muntingh, SINTEF, Senior

Data Scientist Heidi Elisabeth Iuell Dahl, Posten Norge AS, Senior Research Scientists Oliver Joseph David Barrowclough, SINTEF.

Sammendrag:

The last decades have witnessed an exponential growth in the amounts of data that are collected, stored and shared worldwide daily. Yet, much of it remains, totally or partially, unexploited.

In many scientific disciplines, information consists of a set of sample points describing some phenomena. A natural question deals with geometry reconstruction, i.e., the recovery of the shape of such data points through some representations. Approximation theory has traditionally focused on the case of data points sampled from smooth curves and surfaces; however, in most real-world scenarios, data is affected by noise and potentially other imperfections which can significantly reduce the capability to generalize on unseen data. When dealing with the need of analysing and comparing data automatically, shape descriptions are often preferred to shape representations: despite the latter being more complete than the former, they do not necessarily disclose any high-level information useful to discriminate between shapes.

This thesis addresses a range of problems in geometry reconstruction and shape analysis, motivated in the light of real-world applications, including the need to identify geometric relationships in mechanical engineering, the approximation of noisy point clouds in life and earth sciences and the recognition of proteins from an ensemble of geometries in structural biology.

Elisa Cazzador ved Univ. i Oslo forsvarte 18. mars 2022 sin avhandling *Topics in the geometry of spaces of symmetric tensors* for graden PhD.

Veiledere har vært Professor Kristian Ranestad og Professor John Chr. Ottem, UiO.

Sammendrag:

A tensor is a multi-dimensional data array, occurring ubiquitously in mathematics, physics, engineering and, more generally, in all the situations where one needs to organize data by more than two indices. If tensors remain unchanged after index reordering, they are called symmetric tensors, and in real-life situations they can be simply thought of as homogeneous polynomials of a fixed degree and a given number of variables. A key feature of symmetric tensors is their rank, namely the minimal number of data that is required to fully describe them.

The work of my thesis is concerned with low-dimensional symmetric tensors. A central role is played by the so-called catalecticant matrices, that store polynomial's coefficients in a suitable order. The first part of my work focuses on the study of some geometric objects, known as reciprocal varieties, which are defined by taking inverses of catalecticant matrices. Points on these varieties are also tensors, and therefore the rank structure is analyzed, together with other relevant geometric properties. The second main topic pertains to alternative notions of rank, which approximate the classical one. Under suitable conditions, I give formulas to compute these invariants via catalecticant matrices of inhomogeneous polynomials.

NYHETER

ABELPRISEN 2022 TIL DENNIS SULLIVAN

The Norwegian Academy of Science and Letters has decided to award the Abel Prize for 2022 to

Dennis Parnell Sullivan

"for his groundbreaking contributions to topology in its broadest sense, and in particular its algebraic, geometric and dynamical aspects.?

In the late 19th century, a new qualitative way of looking at geometry was born: the subject of topology. In topology a circle and a square are the same, but the surface of the earth and that of a donut are different. Developing a precise language and quantitative tools for measuring the properties of objects that don´t change when they are

deformed has been invaluable throughout mathematics and beyond, with significant applications in physics to economics to data science.

Dennis Sullivan has repeatedly changed the landscape of topology by defining new concepts, proving landmark theorems answering old conjectures and formulating new problems that have driven the field. He moved from area to area, seemingly effortlessly, using algebraic, analytic, and geometric ideas as a true virtuoso.

His early work was on the classification of manifolds, spaces which cannot be distinguished from Euclidean flat space in the small, but globally are different (as the surface of a sphere is, in the small, roughly a plane). Building on work of William Browder and Sergei Novikov, he developed an algebraic topological perspective on this problem and invented some brilliant techniques to solve the problems that arise. This included the ideas of "localising a space at a prime number" and "completing a space at a prime". These are ideas exported from pure algebra that gave a new language for expressing geometric phenomena, and have become tools for resolving multitudes of other problems. Nowadays it is commonplace to work at one prime at a time, using different methods for different primes.

Another breakthrough of his was the study of what is left when one ignores all of the primes, what is called rational homotopy theory. He and Daniel Quillen gave two different complete algebraic descriptions of what is left from a space in this setting. Sullivan´s model is based on differential forms, an idea of multivariable calculus, enabling direct connection to geometry and analysis. This made a major part of algebraic topology suitable for calculation, and has proved revolutionary. The use of differential forms made it especially relevant to algebraic geometry in combination with Hodge theory, as is shown in work of Sullivan with Pierre Deligne, Phillip Griffiths and John Morgan.

To understand smooth manifolds, the completions were necessary, and one of the high points of his work here was his proof of the Adams conjecture, independently of Quillen. Sullivan also called attention to the idea of a "homotopy fixed set", formulating a central conjecture in homotopy theory (solved decades later by Haynes Miller) and introducing a widely used tool.

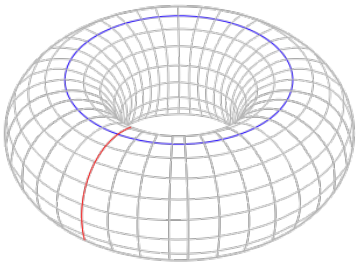
Sullivan went on to attack a host of topological, dynamical and analytic problems, always with the idea of a geometric structure on a space playing a central role.

He showed that the topological structure on a manifold of dimension five or more can always be promoted to a Lipschitz structure, allowing analytic methods to be brought to bear. His argument uses arithmetic groups to replace Kirby´s torus with a hyperbolic manifold immersed in Euclidean space. With Simon Donaldson he proved such structures need not exist in dimension 4.

In dynamics, Sullivan introduced a dictionary between Kleinian groups and iterated rational maps, pivoting on the theory of measurable complex structures. He proved that rational maps have no wandering domains, solving a 60 years old conjecture of Fatou and brilliantly drawing a parallel with Ahlfors´ finiteness theorem. He went on to use similar methods to give a conceptual proof of Feigenbaum´s universality for cascades of period doublings, recasting these results as the uniqueness of a smooth structure on a strange attractor. Sullivan´s dictionary, his rigidity theorem for Kleinian groups, and his a priori bounds for renormalisation, are now fundamental principles in conformal dynamics.

In a subsequent return to the development of algebraic structures of manifolds, with Moira Chas, he astonished the field by finding a new invariant of manifolds. With its links to topological field theory, "string topology" has grown quickly into a subject of its own.

Dennis Sullivan´s insistent probing for fundamental understanding, and his capacity to see analogues between diverse areas of mathematics, and build bridges between them has forever changed the field.



ANDREAS NOTØY VANT ABELKONKURRANSEN

Resultater Abelkonkurransen 2022:

1.	Andreas Notøy, Sandefjord vgsk.	39
2.	Noah Hessen Bjerke, Nydalen vgsk.	38
3.	Maxim Scerbakov, Bkindern vgsk.	37
4.	David S. Eikeland, Sandnes vgsk.	35
5.	Axel Dobloug, A Lyceum Paphos	32
6.	Oliver Ruden, Blindern vgsk.	29
7.	Nripendra Bhati, Oslo IS	24
8.	Emil Ryd, UWCRCN	21
8.	James Jia, Blindern vgsk.	21
10.	Astrid Mysterud, Foss vgsk.	19
10.	Edvard W. Heimdal, Oslo katedr.	19
12.	Andreas L. Pettersen, Horten vgsk.	18

Kunngjøringer

NYHETER FRA NMF

Viggo Brunprisen 2022

Viggo Brunprisen 2022 skal deles ut under Norsk Matematikermøte i Tromsø 1.-2. september.

Nominasjoner best sendt til mailto:nmf@matematikkforeningen.no innen 20. april 2022.

Statutter:
https://web.matematikkforeningen.no/viggo-brun-prisen/

Abelsymposium 2023

Vi ber om at alle som ønsker å avholde Abelsymposium 2023 sender en skisse til mailto:nmf@matematikkforeningen.no innen 20. april 2022.

Styret i NMF vil velge ut en av skissene og gi i oppgave å utarbeide en full søknad. Skissen bør inneholde: - Tema / tittel for symposiet
- Noen mulige foredragsholdere (det er ikke nødvendig med bekreftelse på dette tidspunkt)
- Mulige datoer og sted

TOPICS IN REAL AND TROPICAL ALGEBRAIC GEOMETRY

Sommerskole ved Sophus Lie Conference Center, Nordfjordeid, 20.-24. Juni 2022

Program: The aim of the summer school is to provide an introduction to recent advances in real and tropical algebraic geometry.

Lecturers:
Antonio Lerario (SISSA, Trieste): Metric algebraic geometry, **Felipe Rincon** (Queen Mary, London): Tropical ideals, **Claus Scheiderer** (Konstanz U): Sums of squares and applications

Registration deadline is **May 2nd 2022** For registration and further information check the web page:

https://www.mn.uio.no/math/english/research/groups/algebra/events/conferences/nordfjordeid2022/index.html

NASJONALT MATEMATIKERMØTE, TROMSØ

Det andre nasjonale matematikermøte, neste etter Bergen 2018, vil bli organisert i Tromsø 1-2 september 2022, se https://nmm2022.pure-math.no.

Alle vitenskapelige ansatte og emeriti ved UiB, UiO, NTNU, UiT og UiS, inkludert PhD-stipendiater, er invitert. Møtet er sponset av Trond Mohn Stiftelse (TMS), Tromsø Forskning Stiftelse (TFS) og Norsk Matematisk Forening (NMF): reise og opphold til deltagere blir dekket fra TMS/TFS-prosjektet Ren matematikk i Norge Registreringen blir åpen i løpet av neste måneder.

Møtet vil inneholde både plenumsforedrag og foredrag i tre parallelle seksjoner. PhD studenter inviteres til et ekstra møte onsdag 31 august 2022.

På vegne av organisasjonskomite,
Boris Kruglikov.