



# INFOMAT

MAI 2020



**Forsknings- og høyere utdanningsminister Henrik Asheim:**

**”Målet vårt er at semesterstart i høst skal kunne gjennomføres med åpne dører til lærestedene.”**

INFOMAT krysser fingrene for at ministeren får oppfyllt målet. Kanskje ikke med et fullsatt auditorium, men i nærheten av hva vi kan kalle normal drift.

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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

På grunn av den pågående situasjonen mht koronaviruset kan flere av arrangementene bli utsatt eller avlyst. Følg med på web-sidene.

## Juni:

**2.-6.** Sommerskole: *Mathematics and Data*, Tromsø [UTSATT TIL HØSTEN 2020]

<<https://mathdat.puremath.no/>>

**22.-26.** *Sommerskole: Topics in real algebraic geometry*, Nordfjordeid [AVLYST]

<<https://www.mn.uio.no/math/english/about/collaboration/nordfjordeid/conferences/real-alg-geo-2020/>>

**25.-30.** *10th International Conference on Mathematical Methods for Curves and Surfaces*, Oslo [UTSATT TIL SOMMEREN 2021] <[www.mn.uio.no/MMCS10](http://www.mn.uio.no/MMCS10)>

## September:

**3.-4.** *Nasjonalt matematikermøte*,

Trondheim

<<https://www.ntnu.no/imf/matematikermote>>

**28.-29.** *Mathematics without Borders, IMU 100 år*, Strasbourg

## November/desember:

**30.-4.** Vinterskole: *Geometry and analysis of quantum groups*, Oslo

<<https://www.mn.uio.no/math/english/research/groups/operator-algebras/events/conferences/ge-anq-2020/index.html>>

## NYTT OM NASJONALT MATEMATIKERMØTE 2020

Dear Colleagues,

We hope this message finds you and your families and friends well!

We are monitoring the current health situation. Since the Nasjonalt Matematikermøte i Trondheim is scheduled for early September 2020 we'll take the final decision whether to hold the meeting on Monday, June 15.

Meanwhile, we are happy to announce the speakers:

Plenary speakers:

**G. Dahl** (UiO)

**G. Fløystad** (UiB)

**M. Rognes** (Simula)

**K. Seip** (NTNU)

Elizabeth Stephansen plenary lecture:

**E. Malinnikova** (NTNU/Stanford)

Viggo Brun prize plenary lecture: TBA

Session speakers: **K. Rognlien Dahl** (UiO) **F. Godtliebsen** (UiT) **K. Grunert** (NTNU) **B. Krugilov** (UiT) **A. Massing** (NTNU) **H. Munthe-Kaas** (UiB) **T. K. Nilssen** (UiAgd) **C. Riener** (UiT) **S. Selberg** (UiB) **K. Shaw** (UiO) **S. H. Sørbye** (UiT) **V. Vitelli** (UiO)

Kind regards,

Organising committee

K. Ebrahimi-Fard, S. Grepstad, G. Quick

## Nye doktorgrader

M.Sc. **Francesco Patrizi** ved SINTEF/UoI forsvarte 29. april 2020 sin avhandling *Refinement strategies and linear independence for LR B-spline* for graden PhD.

Veiledere har vært Førsteamanuensis Arne B. Sletsjøe, UiO, Sjefsforsker Tor Dokken, Forsker Georg Muntigh, Forsker Oliver Barrowclough og Seniorforsker Heidi E.I. Dahl, alle SINTEF.

## Sammendrag:

In numerical simulations local refinements are used for balancing accuracy and computational costs. Traditional B-spline spaces are formulated as tensor products of univariate B-spline spaces and therefore cannot address local refinements. In order to break the tensor structure of the underlying mesh and achieve local refinements, a wide variety of new formulations of multivariate B-splines have been introduced. One of these is the Locally Refined B-splines, or LR B-splines. The underlying mesh, called LR-mesh, is build through a sequence of local splits inserted into a coarse tensor product mesh. LR B-splines satisfy the same properties of classical B-splines, such as positivity, local support, piecewise polynomials, partition of unity. However, a particular structure

of the LR-mesh is required to guarantee local linear independence. In this work we describe the first really adaptive refinement ensuring the local linear independence of the LR B-splines. More generally, the set of LR B-splines can even be linearly dependent if no assumptions on the LR-mesh are established. Linear dependence constitutes a difficulty when performing simulations, as it requires the resolution of singular linear systems to assemble the numerical approximation.

In this work we also look at geometric necessary conditions for the LR-mesh to have a linear dependence relation among the LR B-splines. These allow also the computation of the minimal number of LR B-splines that can form a linear dependence relation. A fundamental step to generate a spline surface approximation of the acquired data is what is called mesh parametrization. The mean value coordinates turned out to be a successful choice for mesh parametrization. These can also be used to construct smooth functions that interpolate piecewise linear continuous data prescribed at the boundary of a polygon. In this work we extend the mean value coordinates to interpolate any continuous data at the boundary of a polygon.

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Siv.ing. **Håvard Heitlo Holm** ved NTNU forsvarte 15. mai 2020 sin avhandling *Efficient Forecasting of Drift Trajectories using Simplified Ocean Models and Nonlinear Data Assimilation on GPUs.* for graden PhD.

Hovedveileder har vært Professor Knut Andreas Lie, NTNU, og medveiledere Ass. Professors André Rigland Brodtkorb og Martin Lilleeng Sætra, OsloMet.

### **Sammendrag:**

This thesis presents research on efficient, massively parallel methods and algorithms related to short-term forecasting of drift trajectories in the ocean. The topic has clear societal applications and is an important tool for, e.g., search-and-rescue operations at sea, planning of oil-spill cleanup, and early collision detection between icebergs and offshore installations.

We investigate computational techniques that can be used complementary to the operational methods already in place today. The traditional

approach is to use complex ocean models, of which it is only feasible to run a small ensemble. Due to large uncertainties in initial conditions for oceanographic simulations, we propose to use simplified ocean models that capture the relevant physics on short time horizons. We base our simplified ocean models on the rotational shallow-water equations, simulated using an explicit, high-resolution, finite-volume scheme. Since such schemes can be implemented to run efficiently on the graphics processing unit (GPU), we can afford to run a large ensemble of simplified ocean models.

Furthermore, we investigate nonlinear data-assimilation techniques, such as particle filters, that enable us to use available observations of the ocean state to reduce the uncertainty in the ensemble. Our hope is that this approach, possibly in combination with the operational methods, can give a more complete picture of the uncertainties in the forecasted drift trajectories.

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M.Sc. **Ulrik Bo Rufus Enstad** ved UiO forsvarte 15. mai 2020 sin avhandling *Heisenberg modules and Balian-Low theorems Applications of operator algebras to Gabor analysis* for graden PhD.

Veiledere har vært Professor Nadia S. Larsen, UiO og Professor Franz Luef, NTNU.

### **Sammendrag:**

The main way to study a periodic signal is to decompose it into a sum of simple signals, namely sine waves. However, when a signal changes substantially over time, such as a piece of music, different methods are needed. One method is to use Gabor frames. A Gabor frame represents a given signal in a way that emphasizes the signal's frequency content at each point in time. For instance, a Gabor frame will represent an audio signal analogously to how sheet music is written.

Constructing good Gabor frames is not an easy task, and this problem has connections to many other areas in mathematics. In my dissertation, I have connected this problem to an area called operator algebras. A basic theorem about Gabor frames is the Balian-Low theorem, which is rooted in the uncertainty principle from quantum mechanics. I have shown that this theorem has a concep-

tual interpretation in operator algebras. Moreover, one can generally talk about Gabor frames in an abstract setting, namely in the context of an abelian topological group. I have completely classified the groups to which the Balian-Low theorem extends. One of the groups to which it extends is the rational adele group from number theory.

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## NYTT FRA IMU

*Dear colleagues,*

The ongoing COVID-19 pandemic has affected modern society globally. Tragically, many thousands have died, many more have lost their jobs, and it has changed the working conditions of billions of people.

In response to the situation, we have launched the website

<https://www.mathunion.org/corona>

containing links to some resources pertaining to the pandemic. We focus on three aspects:

- general websites with information on the COVID-19 pandemic
- online seminars for a global audience
- websites which concentrate on mathematical research on the pandemic

For this website to be useful, we depend on active feedback from the community. Please send links to be included to

corona@mathunion.org

Please communicate the information about our website in your community.

Thanks!

Regards,  
*Helge Holden*  
*IMU Secretary General*

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Fra Popular Mechanics (Laura Feiveson), 22. mai 2020, har vi sakset dette:

## This Ludicrously Hard Riddle Is Our Tribute to a Late Math Genius. Can You Figure It Out?

On April 11, **John Horton Conway**, a brilliant mathematician who had an intense and playful love of puzzles and games, died of complications from COVID-19. Conway is the inventor of one of my favorite legendary problems (not for the faint of heart) and, famously, the Game of Life. I created this problem in his honor.

Carol was creating a family tree, but had trouble tracking down her mother's birthdate. The only clue she found was a letter written from her grandfather to her grandmother on the day her mother was born. Unfortunately, some of the characters were smudged out, represented here with a ?...?. (The length of the line does not reflect the number of smudged characters.)

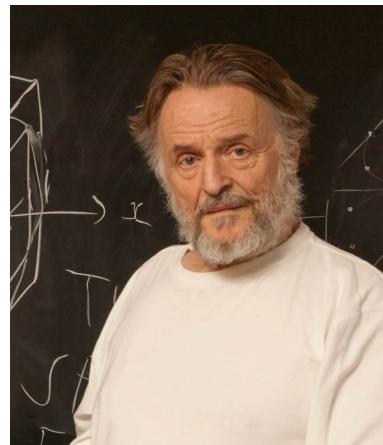
*Dear Virginia,*

*Little did I know when I headed to work this Monday morning, that by evening we would have a beautiful baby girl. And on our wedding anniversary, no less! It makes me think back to that incredible weekend day, J...27th, 19..., when we first shared our vow to create a family together, and, well, here we are! Happy eighth anniversary, my love.*

*Love, Edwin*

The question: When was Carol's mother born?

*Hint: This problem is inspired by Conway's Doomsday Rule.*



John Horton Conway (1937-2020)