FOREDRAG NASJONALT MATEMATIKERMØTE
BERGEN, 13-14. SEPTEMBER 2018

Berit Stensønes *(Plenum torsdag 10.40-11.30, "Kongesal 1-2")*:
THE CAUCHY-RIEMANN EQUATION IN SEVERAL COMPLEX VARIABLES

The so-called dbar equation is a central topic in complex analysis. L^2 theory with weights gives information in the interior. In order to get good estimates up to the boundary a Kernal approach has showed itself to be the best.

We shall study the so called Henkin kernal, which can be a viewed as a version of the Cauchy kernal $\frac{1}{z-\zeta}$ in $\mathbb{C}$ in several variables. In several complex variables there are several potential choices.

To understand how one can make a good choice of such a kernal we have to take a lot of complex geometry into account. This lecture will try to display some of the types of Mathematics that come into play when one attempts to construct a kernel with good properties.

Snorre H. Christiansen *(Plenum torsdag 12.00-12.50, "Kongesal 1-2")*:
NUMERICAL ANALYSIS WITH DIFFERENTIAL COMPLEXES: FINITE ELEMENT METHODS MEET HOMOLOGICAL ALGEBRA

Many physical processes, such as electromagnetic wave propagation and fluid flow, can be modelled with partial differential equations. A better understanding of these equations can be obtained by grouping the partial derivatives into differential operators, such as the gradient, curl and divergence. Finite element methods discretize such equations by constructing finite dimensional spaces of function and vector fields which are adapted to these differential operators, in the sense that certain structural properties of the operators are preserved at the discrete level. Such spaces have also been constructed in differential topology, for the purposes of proving de Rham's theorem that differential forms and simplicial cochains have isomorphic cohomology groups. We develop the point of view that many of the best finite element methods consist in constructing inverse systems of complexes of differential forms, attached to a geometric decomposition of space, such as a simplicial complex. A crucial question is how smooth the fields should be and what boundary conditions can be imposed, and we use the abstract framework to define new discrete de Rham complexes of differential forms that are at least continuous, as required by the Stokes equation of fluid mechanics.

HENVISNINGER

[1] S. H. Christiansen, H. Z. Munthe-Kaas, B. Owren, *Topics in structure-preserving discretization*, Acta. Numer., Vol. 20, p. 1 – 119, 2011

[2] S. H. Christiansen, F. Rapetti, *On high order finite element spaces of differential forms*, Math. Comp., Vol. 85, No. 296, p. 517 – 548, 2016

[3] S. H. Christiansen, K. Hu, *Generalized Finite Element Systems for smooth differential forms and Stokes' problem*, Numer. Math., 2018

Valentin Lychagin *(Parallell torsdag 14.00-14.45, "Dræggen 3")*: CLASSIFICATION OF THE SECOND ORDER DIFFERENTIAL OPERATORS AND DIFFERENTIAL EQUATIONS

We'll discuss a local classication of the second order linear differential operators and corresponding differential equations. Possibly Riemann ([1]) was the first who analyzed this problem and found curvature as an obstruction to transform differential operators of the second order to operators with constant coeffcients. In dimension two Laplace ([2]) found "Laplace invariants" which are relative invariants of subgroup of rescaling transformations of unknown functions and Ovsyannikov ([3]) found the corresponding invariants. All invariants for hyperbolic equations in dimension two with respect to pseudogroup transformations included also diffeomorphisms of the base manifold were found by Ibragimov ([4]). For the case of ordinary differential operators it was done by Kamran and Olver ([5]) and for the case of linear ordinary differential equations of any order relative invariants were found by Wilczynski ([6]). We are going to consider the problem in all dimensions . The talk is based on joint work with Valeriy Yumaguzhin ([7]).

HENVISNINGER

[1] Riemann, Bernard, Gesammelte mathematische werke und avissenschaftlicher nachlass , XXII, pp. 357-370, Leipzig, Teubner, 1876.
[2] Laplace, P. S., Recherches sur le calcul int egral aux di erences partielles, in: Memoires de l'Acad emie royale des Sciences de Paris (1773/77), pp. 341-402; reprinted from P. S. Laplace, Oeuvres Compl etes, Vol. 9, Gauthier-Villars, Paris (1893).
[3] Ovsyannikov,L. V., Group properties of the Chaplygin equation, J. Appl. Mech. Tech. Phys., 3, 126-145 (1960).
[4] Ibragimov, N. Kh. Invariants of hyperbolic equations: solutions of the Laplace problem, Journal of Applied Mechanics and Technical Physics, Vol. 45, No. 2, pp. 158-166, 2004.
[5] Kamran, Niky and Olver, Peter, Equivalence of differential operators, SIAM J. MATH. ANAL. Vol. 20, No. 5, pp. 1172-1185, 1989.
[6] Wilczynski, E.J., Projective differential geometry of curves and ruled surfaces, Leipzig, Teubner, 1905.
[7] Lychagin. Valentin and Yumaguzhin Valeriy, Classification of the second order differential operators and differential equations, Geometry and Physics, v. 130, pp. 213-228, 2018.

Nadia Larsen *(Parallell torsdag 14.00-14.45, "Dræggen 7")*: PHASE TRANSITIONS FOR C^*-DYNAMICAL SYSTEMS FROM ALGEBRAIC NUMBER FIELDS

In the mid 1990's J.-B. Bost and A. Connes introduced a C^*-dynamical system having remarkable connections with number theory. The C^*-algebra of the system is a completion of the Hecke algebra of a group-subgroup pair arising from the ring inclusion of the integers in the rationals, and the time evolution of the system emerges from the natural modular function of the Hecke pair. The system admits a phase transition for equilibrium states and has the Riemann zeta function as partition function. Generalisations of the Bost-Connes construction have been proposed for algebraic number fields. I will explain the main ingredients in the Bost-Connes construction and describe a phase transition in the context of arbitrary number fields obtained in joint work with M. Laca (Victoria) and S. Neshveyev (Oslo).

Andrea Ingeborg Riebler *(Parallell torsdag 14.00-14.45, "Dræggen 8")*: MODELLING DEATH IN CHILDREN UNDER-5 YEARS IN THE DEVELOPING WORLD

In this talk I would like to present recent work on modelling under-5 mortality in a developing world context [1]. The challenge in this setting is that there is only limited or deficient vital registration and data are based mostly on survey data. I will present a new Bayesian continuous space/discrete time model that acknowledges the complex survey design. The methodology will be illustrated by producing yearly subnational estimates in Kenya for the period 1980-2014 using data from the Demographic and Health Surveys (DHS).

HENVISNINGER

[1] Jon Wakefield, Geir-Arne Fuglstad, Andrea Riebler, Jessica Godwin, Katie Wilson, Samuel J. Clark. (2018) *Estimating Under Five Mortality in Space and Time in a Developing World Context.* **Statistical Methods in Medical Research**, Accepted.

Gereon Quick *(Parallell torsdag 15.00-15.45, "Dræggen 3")*: ALGEBRAIC VS TOPOLOGICAL CLASSES

Calculating integrals of rational functions in complex variables is a classical problem. Though it seems elementary, it is notoriously difficult and its study led to many ground-breaking discoveries by, among many others, Euler, Jacobi and Abel.

From a geometric perspective, it is related to the following problem: Let X be a complex algebraic manifold, i.e., the set of simultaneous zeroes of nice polynomials in complex variables. We can measure the topological complexity of X by its singular cohomology. There are particularly nice cohomology classes which arise as the fundamental classes of algebraic submanifolds $Z \subset X$. Such classes are called *algebraic*, since they are determined by the polynomial functions which define Z. However, not all classes are algebraic. This gives rise to the question we would like to address: *What kind of tools do we have to decide whether a class in the singular cohomology of X is algebraic or of merely topological nature?*

In the talk, we will introduce some of the key players of the story and explain how classical examples of non-algebraic classes in singular cohomology can be constructed. Then we will apply what we learn from these examples to find new examples of non-algebraic classes in other topological cohomology theories such as, for example, Brown-Peterson cohomology.

Alexander Rashkovskii *(Parallell torsdag 15.00-15.45, "Drægen 7")*:
PLURISUBHARMONIC GEODESICS, HOLOMORPHIC HULLS, AND INTERPOLATION

Plurisubharmonic geodesics on a bounded hyperconvex domain $D \subset \mathbb{C}^n$ [BB], [R1] are local counterparts of weak geodesics in the space of metrics on compact Kähler manifolds due to Mabuchi and Donaldson. In the talk, we relate them to some known notions from complex and convex geometry.

Let u_t, $0 \le t \le 1$, be the geodesic whose endpoints u_0 and u_1 are relative extremal functions of compact, polynomially convex subsets K_0 and K_1 of D, respectively. We interpolate K_0 and K_1 by the sets $K_t = \{z \in D : \ u_t(z) = -1\}$ and show that K_t are sections by $\{|\zeta| = e^t\}$ of the holomorphic hull of the set $(K_0 \times A_0) \cup (K_1 \times A_1) \subset \mathbb{C}^{n+1}$ with respect to the collection of all functions holomorphic on $\mathbb{C}^n \times (\mathbb{C} \setminus \{0\})$; here $A_j = \{\zeta \in \mathbb{C} : \ |\zeta| = e^j\}$, $j = 0, 1$.

In the particular case when K_0, K_1 are Reinhardt subsets of the unit polydisk, we have $K_t = K_0^{1-t} K_1^t$ and the geodesic u_t can be represented in terms of the Legendre transform of convex functions generated by u_0 and u_1. Furthermore, in this case the relative capacity of K_t is proved to be a logarithmically convex function of t.

Part of the results are obtained in collaboration with Dario Cordero-Erausquin.

HENVISNINGER

[CR] D. Cordero-Erausquin, A. Rashkovskii, *Plurisubharmonic geodesics and interpolating sets*, arXiv:1807.09521

[BB] R.J. Berman and B. Berndtsson, *Moser-Trudinger type inequalities for complex Monge-Ampère operators and Aubin's "hypothèse fondamentale"*, arXiv:1109.1263.

[R1] A. Rashkovskii, *Local geodesics for plurisubharmonic functions*, Math. Z. 287 (2017), 73–83.

[R2] A. Rashkovskii, *Copolar convexity*, Ann. Polon. Math. 120 (2017), no. 1, 83–95.

Martin Rypdal *(Parallell torsdag 15.00-15.45, "Drægen 8")*:
FROM FRACTALS TO CLIMATE SENSITIVITY

Complex dynamics is often characterized by responses on a range of spatial and temporal scales, and in natural and socioeconomic systems we tend to observe emergent scale invariance. Examples are fractal-like geometrical objects and fractal time series. Mathematical constructions such as fractional stochastic differential equations provide elegant and parsimonious descriptions of these objects. They can also be used to make more accurate data-based estimates of key quantities. In this presentation we will present an example from climate science, and we will see how emergent scale-invariance can be used to constrain the so-called Equilibrium Climate Sensitivity (ECS) from observational data and ensembles of Earth System Models (ESMs).

Steffen Oppermann *(Parallell torsdag 16.15-17.00, "Dræggen 3")*:
COMPACNESS AND COCOMPACNESS IN TRIANGULATED CATEGORIES

An object in an abelian category is called *compact* if any map from it to some direct limit (or more generally filtered colimit) factor through one of the terms. Similarly, one may define an object in a triangulated category to be compact if any map from it to a direct sum factors through a finite subsum.

In my talk, I will illustrate this notion with some typical examples, and then proceed to discussing why we are interested in finding compact objects: By work of Neeman they lead to strong representability theorems, which in turn make for a reasonably constructive localization theory.

As with any categorical notion, one may dualize the definition of compactness by "turning all arrows". However, as we will see, the resulting notion does not really appear in our favourite categories. In the last part of my talk I will report on joint work with Psaroudakis and Stai, in which we weaken this dual notion to cover more of our favourite examples while still keeping (some of) the benefits of compact objects.

Ragnar Winther *(Parallell torsdag 16.15-17.00, "Dræggen 7")*:
FINITE ELEMENT DISCRETIZATIONS OF THE DE RHAM COMPLEX

The de Rham complex is closely related to several important mathematical models based on partial differential equations, such as Maxwells equation and flow in porous media. As a consequence, there is a link between the construction of numerical methods for these systems and discrete versions of the de Rham complex. In these talk we will discuss how these discrete complexes should be constructed in order to obtain stable and accurate finite element methods for the relevant systems of partial differential equations.

Dag Tjøstheim *(Parallell torsdag 16.15-17.00, "Dræggen 8")*:
A NEW MEASURE OF STATISTICAL DEPENDENCE

The correlation coefficient ρ is the standard measure of dependence in statistics. It works well in many situations, and for normally distributed variables it gives a complete characterization of dependence. In this case $\rho = 0$ if and only if one has independence. However, it is easy to find examples where it may give a rather misleading quantification of statistical dependence, or where it does not work at all. The standard textbook example is where two random variables X and Y are strongly dependent via $Y = X^2$, but where under very weak assumptions $\rho = 0$. In a number of recent papers my coauthors and myself have proposed a new measure of dependence, which, in the bivariate case, with a joint density function $f_{X,Y}$ of (X, Y) is based on approximating $f_{X,Y}$ by a family of Gaussian distributions $\{\psi_{x,y}\}$. More precisely, for a given point $X = x, Y = y$ we approximate $f_{X,Y}$ in a neighbourhood of (x, y) by the bivariate Gaussian distribution $\psi_{x,y}$. The correlation coefficient $\rho(x, y)$ of the approximating Gaussian is taken to be the local correlation at the point (x, y). Moving to another point (x', y') will result in another correlation $\rho(x', y')$ being the ordinary correlation of the approximating Gaussian $\psi_{x',y'}$ in a neighborhood of

(x', y'). If $f_{X,Y}$ happens to be Gaussian itself, then $\rho(x, y) \equiv \rho$. A number of properties of this local correlation will be given in the talk. Among other things I will discuss global and local correlation in financial markets, extensions to the general multivariate case with estimation of multivariate densities evading the curse of dimensionality, local autocorrelation for time series and local spectral analysis capable of detecting periodicities hidden in ordinary spectral analysis. References to recent publications and ongoing research will be given.

Christian Skau *(Plenum fredag 09.00-09.50, "Kongesal 1-2")*:
FRA VIGGO BRUN OG THORALF SKOLEM TIL ATLE SELBERG

Norsk Matematisk Forening ble stiftet i 1918. Samme året døde Ludwig Sylow (1832-1918), og få år senere døde Axel Thue (1863-1922). En ny generasjon av fremragende norske matematikere sto klar til å overta arven, først og fremst Viggo Brun (1885-1978) og Thoralf Skolem (1887-1963). I 1917 ble Atle Selberg (1917-2007) født–en kommende stjerne av verdensformat. Vi vil gi en forholdsvis bred oversikt over norske matematikere fra 1918 og fremover.

Rune Haugseng *(Plenum fredag 10.00-10.45, "Kongesal 1-2")*:
TOPOLOGICAL QUANTUM FIELD THEORIES AND HIGHER ALGEBRAIC STRUCTURES

Topological quantum field theories (TQFTs) are a special class of quantum field theories in physics that are particularly tractable mathematically and give rise to invariants of manifolds. I will review the classical definition (due to Atiyah) and motivate the more complex modern definition (as extended TQFTs). Then I will discuss recent progress on constructing and classifying such extended TQFTs from higher (or homotopy-coherent) algebraic structures, including some of my own work.

Bjørn Dundas *(Plenum fredag 11.00-11.50, "Kongesal 1-2")*:
CONTINUITY OF HOMOLOGY AND K-THEORY

Just as for functions, an invariant is *continuous* if the invariant as applied to limits of convergent sequences (in whatever the invariant eats – could be sets, groups, spaces ...) is the limit of the invariant as applied to terms of these sequences.

One evening in 1996 I had a beer to celebrate a "proof" of the continuity of algebraic K-theory. Always celebrate while your proof is still correct: next morning proved me dead wrong.

This year – finally! – someone else (Clausen, Mathew and Morrow) gave a correct proof (this one I trust). I've had my beer, but I still want to celebrate, especially since more recent work of mine has a small share in their success. Also this is an excuse to talk about some related developments and the neighboring mathematics that may have a wider interest.

The precise statement is:

Theorem [Clausen, Mathew, Morrow (arXiv 2018)] Let A be a noetherian ring which is complete with respect to an ideal I and p a prime. If A/p is "F-finite" then

$$K(A) \to \lim K(A/I^n)$$

is a p-adic equivalence.

Ironically, this is proved by reducing to something resembling the Taylor expansion of K-theory called TC. The proof that continuity holds for TC is easier (this is what I had a role in proving) and boils down to continuity of theories much resembling de Rham cohomology.

Michał Kapustka *(Parallell fredag 12.15-13.00, "Dræggen 3")*:
EQUIVALENCE OF CALABI-YAU TYPE MANIFOLDS

I will discuss several notions of equivalence between algebraic manifolds and relations between them. I will focus mainly on Derived equivalence and $\mathbb{L}$-equivalence. It appears that these notions are particularly interesting in the context of Calabi–Yau type manifolds. The discussion will be performed through presenting several examples of such non-trivial equivalences. The talk will include results from joint work with G. Kapustka, R. Moschetti, M. Rampazzo [1, 2].

HENVISNINGER

[1] Michał Kapustka, Marco Rampazzo, Torelli problem for Calabi–Yau threefolds with GLSM description, arXiv:1711.10231.
[2] Grzegorz Kapustka, Michał Kapustka, Riccardo Moschetti, Equivalence of K3 surfaces from Verra threefolds, arXiv:1712.06958.

Antonella Zanna *(Parallell fredag 12.15-13.00, "Dræggen 7")*:
A FAMILY OF MODIFIED TRIGONOMETRIC INTEGRATORS FOR HIGHLY OSCILLATORY PROBLEMS WITH GOOD GEOMETRIC PROPERTIES

In this talk, we review trigonometric integrators and modified trigonometric integrators for highly oscillatory ODE problems. In addition, we present a family of modified trigonometric integrators which includes the IMEX method as a particular example. All the methods are symplectic, second order, and resonance free. Slow energy exchange and long time preservation of energy and oscillatory energy are analyzed.

Giulia Di Nunno *(Parallell fredag 12.15-13.00, "Dræggen 8")*:
SANDWICH EXTENSIONS OF LINEAR AND CONVEX OPERATORS AND THEIR APPLICATIONS

We propose some extension theorems for linear and convex operators from L_p spaces to L_p spaces that preserve both minoring and majoring stochastic bounds. We shall see how these extension theorems are applied within the context of pricing in mathematical finance. We discuss in fact the concept of a pricing system, which is in fact a family of such operators that has to preserve some reasonable conditions, including the time-consistency to guarantee that the fundamental economic criteria of the non-arbitrage principle is maintained. Various properties and form of pricing operators are presented. This talk is based on a series of works with various co-authors: Sergio Albeverio (U. Bonn), Jocelyne Bion-Nadal (CNRS Ecole Polytechnique), Inga B. Eide (now at Finanstilsynet), Yuri Rozanov (CNR Milano).

Paul Arne Østvær *(Parallell fredag 14.00-14.45, "Dræggen 3")*:
$\mathbf{A}^1$-CONTRACTIBLE VARIETIES

Motivic homotopy theory gives a way of viewing algebraic varieties and topological spaces as objects in the same category, where homotopies are parametrised by the affine line. In particular, there is a notion of $\mathbf{A}^1$-contractible varieties. Affine spaces are $\mathbf{A}^1$-contractible by definition. The Koras-Russell threefold KR defined by the equation

$$x + x^2y + z^2 + t^3 = 0$$

in $\mathbf{A}^4$ is the first nontrivial example of an $\mathbf{A}^1$-contractible smooth affine variety. We will discuss this example in some detail, and speculate on whether one can use motivic homotopy theory to distinguish between KR and $\mathbf{A}^3$.

HENVISNINGER

[1] A. Dubouloz, J. Fasel: Families of $\mathbb{A}^1$-contractible affine threefolds, Algebr. Geom. 5, 1-14 (2018).
[2] M. Hoyois, A. Krishna, P. A. Østvær: $\mathbb{A}^1$-contractibility of Koras-Russell threefolds, Algebr. Geom. 3, 407-423 (2016).
[3] F. Morel, V. Voevodsky: $\mathbf{A}^1$-homotopy theory of schemes, Inst. Hautes Études Sci. Publ. Math. 90, 45-143 (2001).

Andrii Bondarenko *(Parallell fredag 14.00-14.45, "Dræggen 7")*:
EXTREME VALUES OF THE RIEMANN ZETA FUNCTION

We prove that for every $c < 1$ there exists arbitrarily large T with

$$|\zeta(1/2 + iT)| > \exp\left(c\sqrt{\log T \log\log\log T / \log\log T}\right).$$

This improves classical results by Montgomery, Balasubramanian-Ramachandra, and Soundararajan. We will discuss the main components of the proof: Soundararajan's resonance method, multiplicative functions, and convolution formulas for the Riemann zeta function.

HENVISNINGER

[1] A. Bondarenko, K. Seip, Large greatest common divisor sums and extreme values of the Riemann zeta function, Duke Math. J., Vol. 166, **9** (2017), 1685–1701.

Inga Berre *(Parallell fredag 14.00-14.45, "Dræggen 8")*:
MATHEMATICAL AND NUMERICAL MODELING OF SUBSURFACE PROCESS-STRUCTURE INTERACTION

The subsurface is characterized by heterogeneous structures and discontinuities that highly affects dynamic hydraulic, thermal, chemical and mechanical processes. At the same time, these processes affect the structure of the medium. This talk presents mathematical and numerical modeling approaches to simulate process-structure interaction, focusing on challenges related to the complexity of fractured subsurface formations. The nature of the fractures, as discontinuities in the medium in the form of narrow zones with orders of magnitude size to width ratio, calls for particularly designed approaches in mathematical and numerical modeling. Special attention is given to simulation of subsurface flow and transport as well as the triggering of microearthquakes and fracture deformation due to fluid injection in naturally fractured reservoirs.

Sofia Tirabassi *(Parallell fredag 15.00-15.45, "Dræggen 3")*:
DERIVED CATEGORIES OF ENRIQUES AND BIELLIPTIC SURFACES IN POSITIVE CHARACTERISITC

Derived categories were introduced by Verdier in the 60's in his doctoral thesis, written under the supervision of A. Grothendieck. The main goal of the construction was that of extending Serre duality to a relative setting. Nowadays they are a widely used tool in the investigation of the geometry of smooth projective varieties, as well as that of their moduli spaces of sheaves.

However, many of the techniques used in the study of the derived categories have a trascendental nature as they rely heavily on Hodge theory. The more algebraic setting of varieites definded over fields of positive characteristic is still widely unexplored.

In this presentation we will focus on Enriques surfaces and bielliptic surfaces defined over algebraically closed fields of characteristic bigger than 3. We will show that in this particular case an equivalence between the derived categories will imply an isomorphism between the varieties. This result was know to hold for complex Enriques and bielliptic thanks to the work of Bridgland–Maciocia. The results here presented are joint work with K. Honigs and M. Lieblich.

Mats Ehrnström *(Parallell fredag 15.00-15.45, "Dræggen 7")*:
TRAVELLING WATER WAVES WITH LOCALISED VORTICITY

We give a short background and discuss recent success in establishing the existence of solutions to the water wave problem with exponentially decaying vorticity. These are two-dimensional stationary waves in a finite-depth body of water beneath vacuum. An external gravitational force acts in the bulk, and the effects of surface tension are felt on the air-sea interface.

Our approach involves modelling the corresponding stream function as a spike-like solution to a singularly perturbed elliptic PDE. We turn to complex variables, perturb the unknown stream-function to fit the free-surface boundary condition, and perform a geometrical shift of the centre of the spike as to find parameter values at which non-trivial solutions bifurcate. Our tools involve harmonic and functional analysis, as well as very precise integral estimates (since the singularly perturbed problem makes everything exponentially small) to handle the almost non-invertibility of the problem. In the end, a family of deep-water solitary-wave solutions is found.

This talk is based on joint work with Samuel Walsh (University of Missouri) and Chongchun Zeng (Georgia Tech).

Karsten Trulsen *(Parallell fredag 15.00-15.45, "Dræggen 8")*: Freake bølger i likevekts og ikke-likevekts bølgefelt

Dynamikken til havbølger er ofte godt beskrevet som en Gaussisk prosess. Freake bølger er bølger som er overraskende store i forhold til hva man skulle forvente ut fra rådende bølgeforhold. Typiske kriterier for at en bølge er freak er at kamhøyden er større enn fem standardavvik til overflatehevningen eller at bølgehøyden er større enn åtte standardavvik til overflatehevningen [4], disse kriteriene brukes i praksis på tidsserier av 20 minutters varighet for bølgeforhold tilsvarende de man finner i Nordsjøen.

Ikkelineær bølgedynamikk kan øke forekomsten av freake bølger langt utover Gaussisk statistikk. Modulasjonsustabilitet av et uniformt bølgetog [2] ble derfor tidlig antatt å kunne generere freake bølger, for eksempel via "pustere" [5]. Tilsvarende ustabilitet kan også virke på et irregulært bølgefelt som er i likevekt [1]. Man forventet at et kriterium for modulasjonsustabilitet av irregulære likevekts bølgefelt, såkalt "Benjamin–Feir Index" (BFI), kunne brukes som et kriterium for økt forekomst av freake bølger [7].

I praksis har BFI vist seg å fungere dårlig som varslingskriterium for freake bølger [3], de har nemlig vist seg å være en utfordring når modulasjonsustabilitet ikke forekommer.

Nyere aktivitet ved Matematisk institutt ved Universitetet i Oslo søker å beskrive forekomst av freake bølger i situasjoner med ikkeliner dynamikk uten modulasjonsustabilitet. Et eksempel er likevekts bølgefelt bestående av kryssende sjø [8, 9]. Et annet eksempel er ikke-likevekts bølgefelt i inhomogene omgivelser [6].

Henvisninger

[1] Alber, I. E. 1978 The effects of randomness on the stability of two-dimensional surface wavetrains. *Proc. R. Soc. Lond.* A **363**, 525–546.

[2] Benjamin, T. B. & Feir, J. E. 1967 The disintegration of wave trains on deep water. *J. Fluid Mech.* **27**, 417–430.

[3] Bitner-Gregersen, E. M. & Gramstad, O. 2016 Rogue waves — Impact on ships and offshore structures. *Tech. Rep.* 05–2015. DNV-GL.

[4] Dysthe, K., Krogstad, H. E. & Müller, P. 2008 Oceanic rogue waves. *Annu. Rev. Fluid Mech.* **40**, 287–310.

[5] Dysthe, K. B. & Trulsen, K. 1999 Note on breather type solutions of the NLS as models for freak-waves. *Physica Scripta* **T82**, 48–52.

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[9] Trulsen, K., Nieto Borge, J. C., Gramstad, O., Aouf, L. & Lefèvre, J.-M. 2015 Crossing sea state and rogue wave probability during the Prestige accident. *J. Geophys. Res. Oceans* **120**, 7113–7136.