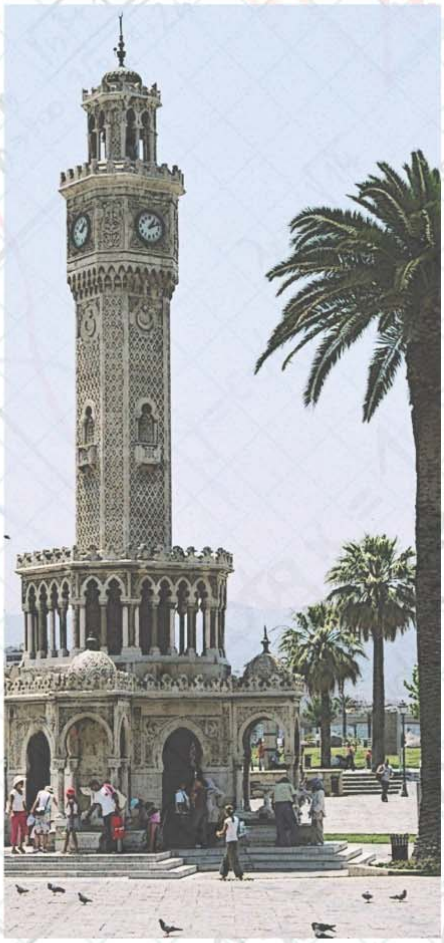
YAŞAR ÜNİVERSİTESİ

İZMİR MATEMATİK GÜNLERİ

26-27 HAZİRAN 2018



İzmir Matematik Günleri, öncelikli olarak lisansüstü öğrencilerin bir araya gelerek akademik fikir alışverişinde bulunmaları, tez konularını birbirlerine tanıtmalarını ve alanında uzman bilim insanlarından konularındaki açık problemler hakkında geri dönüşler alarak yeni fikirler üretmelerini hedefleyen bir çalıştaydır.

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Abstract Book

İzmir Mathematics Days 2018

June 26-27, 2018

Organized by

Yaşar University

İzmir, Turkey

Preface

İzmir Mathematics Days is organized in order to bring the graduate students in mathematics together and exchange their academic ideas. The workshop also aims to give feedbacks to mathematics graduate students about their research and introduce some open problems by the expert academicians. The workshop will be organized by Yaşar University in June 26-27, 2018.

The workshop language is not strict. Students can give their presentations in their education language.

Scientific and Organizing Committees

Committtes

Scientific Committee

- Prof. Dr. Oktay Pashaev (İzmir Institute of Technology)
- Prof. Dr. Engin Büyükaşık (İzmir Institute of Technology)
- Prof. Dr. Emine Mısırlı (Ege University)
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- Dr. Cem Çelik (Dokuz Eylül University)

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Generalized Complex Numbers and Integrable Systems

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In this talk, first I am going to introduce generalized complex numbers and give the relation to known standard complex numbers and other types which parabolic and hyperbolic complex numbers are. Second, I explain what the integrable systems and their Lax representations by differential geometrical problem of curve motion in special spaces. This way, several soliton equations were derived with all integrable structure. Then I will discuss the geometric properties of complex numbers in that given integrable system and I will rewrite the integrable system by using complex numbers. In Literature NLS equation was formulated by complex analysis. Thus, I will discuss derivation of curve motion in Minkowski $2+1$ space and the Resonant NLS soliton equations and new formulation of resonant soliton equations by hyperbolic complex analysis would be discussed.

This work is supported by TUBITAK grant 116F206.

Algorithms on the Farey Tree

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The Farey tree is an infinite binary tree containing all rational numbers in $[0,1]$ in an ordered way. It is constructed level by level by using Farey mediant sum, that is $\frac{a}{b} \oplus \frac{c}{d} = \frac{a+c}{b+d}$. The rationals $\frac{a}{b}, \frac{c}{d}$ are called consecutive if $|ad-bc| = 1$. The Farey mediant of each pair of $\frac{a}{b}$ and $\frac{c}{d}$ is consecutive to both of them. On the other hand, for a consecutive ordered triple $\left(\frac{a}{b}, \frac{a+c}{b+d}, \frac{c}{d}\right)$ there is a unique geodesic ideal triangle in the upper half plane whose vertices are at these rational numbers. By using these ideal triangles one makes a tessellation of the upper half space. This tessellation corresponds to the action of the modular group $\mathrm{PSL}_2(\mathbb{Z})$ on the upper half plane.

The aim of this talk is to give the algorithms between two nodes of the Farey tree by using the automorphism of the continued fractions of rational numbers corresponding the path of geodesics between consecutive rationals.

On R-Projective Modules

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A right R-module M is said to be R-projective if it is projective relative to the right R-module R_R. In this talk, we shall mention about the R-projectivity of modules. In particular, we stress the relation between the class of projective modules and R-projective modules based on the question asked by Faith [1]: "When does R-projectivity imply projectivity for all right R-modules?" Additionally, we will talk about the work done by Amini et al. [3] which gives the characterization of the rings whose at right R-modules are R-projective.

References

[1] C. Faith. *Algebra II. Ring Theory, GMW 191.* Springer-Verlag, Berlin, 1976.

[2] J. Trlifaj. *Faith's problem on R-projectivity is undecidable.* https://arxiv.org/abs/1710.10465, 2018.

[3] A. Amini, M. Ershad, H. Sharif. *Rings over which at covers of finitely generated modules are projective.* Comm. Algebra. 36, 2862-2871. 2008.

Hiperbolik Geometri Üzerine

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Öklid tarafından M.Ö. 300'lü yıllarda yazılmış olan "Elementler" isimli kitapta geometrinin temel kavramları tanımlanmış, aksiyomlar ve bu aksiyomlara dayanan teoremler ifade ve ispat edilmiştir. Kapsam ve içerik bakımından bu kitap o güne kadar yazılmış en iyi kitaptır ve güncelliğini halen korumaktadır. Ancak zamanla Öklid'in aksiyomlarından beşinci postulat (paralellik postulatı olarak da bilinir) üzerine itirazlar oluşmaya başlamış ve bu durum Öklidyen olmayan geometrilerin ortaya çıkmasına zemin hazırlamıştır. Öklidyen olmayan geometriler üzerine ilk çalışmalar ise hiperbolik geometri ile başlamıştır.

Bu çalışmada hiperbolik geometrinin ortaya çıkışı, hiperbolik geometri ile Öklid geometrisi arasındaki farklar, $PSL(2,\mathbb{R})$ grubu ile hiperbolik geometri arasındaki ilişkiler ve hiperbolik metrik ile ilgili kavramlar ele alınacaktır. Bunun için öncelikle $PSL(2,\mathbb{R})$ grubu ve özellikleri hatırlatılacaktır. Daha sonra iki nokta arasındaki en kısa hiperbolik uzaklık bulunarak hiperbolik doğru parçası ve hiperbolik doğrunun tanımları yapılacaktır. Bu tanımlardan yola çıkarak hiperbolik üçgenin tanımı yapılacak ve daha sonra hiperbolik alan ve Gauss-Bonet formülleri verilecektir.

Kaynakça

[1] Jones, G. A., Singerman, D. Complex Functions an Algebraic and Geometric Viewpoint. *Cambridge University Press*, 1987.

[2] Anderson, J. W. Hyperbolic Geometry. *Springer-Verlag*, 1999.

[3] Sertöz, A. S. Öklid'in Elemanları, 27 Mart 2018 sürümü. http://sertoz.bilkent.edu.tr/elemanlar.htm

Quasicrystals

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The first observation of quasicrystal was done by Shechtman *et al.* in 1984. In this talk we introduce the basic equations of elasticity theory of quasicrystals. The dynamic equilibrium equations for $2D$-quasicrystals are obtained and these equations are written in the form of a vector partial differential equation. By applying Fourier transform these equations are reduced to a vector integral equation.

Modules of Generalized Splines

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In this talk, we introduce a generalized spline, which is a vertex labeling of an edge labeled graph G by elements of commutative R ring with identity so that the difference between the labels of any two adjacent vertices lies in the corresponding edge ideal. Then we describe the module structure of generalized splines. The main problem is when a module of generalized splines is free on arbitrary graph for a ring R. At the end, we will give some examples.

References

[1] S. Gilbert, S. Polster and J. Tymoczko. Generalized splines on arbitrary graphs. *arXiv*:1306.0801, 2013.

[2] M. Handschy, J. Melnick and S. Reinders. Integer generalized splines on cycles. *arXiv*:1409.1481, 2014.

Nabla-Kesirli Sınır Değer Problemleri Üzerine

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Bu çalışmada, ilk olarak kesirli nabla analiz ile ilgili temel tanım ve teoremlere yer verilmiştir. Daha sonra, diğer bölümlerde kullanılacak olan temel tanım ve teoremler ifade edilmiştir.

$1 < \mu \leq 2$, x'ler $\mathbb{N}_{a-1}^{b}$'de tanımlı çözümler, $b - a \in \mathbb{N}_2$ ve $h : \mathbb{N}_{a+1}^{b} \times \mathbb{R}_+ \to \mathbb{R}$ olmak üzere

$$-\nabla_{a^*}^{\mu} x(t) = h(t, x(t-1)), \quad t \in \mathbb{N}_{a+2}^{b}$$
$$\gamma x(a) - \beta \nabla x(a) = 0$$
$$\gamma x(b) + \delta \nabla x(b) = 0$$

sınır değer problemi ele alınarak bu problem için Green fonksiyonu araştırılmış ve onunla ilgili bazı özellikler verilmiştir. Daha sonra bu sınır değer probleminin Green fonksiyonunun sınırları belirlenmiş ve çözümünün tekliğiyle ilgili bazı teoremler verilmiştir. Son olarak bu problem için Lyapunov eşitsizliği ispatlanmıştır.

Cobordisms of G-Framed Manifolds

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Manifolds and cobordisms have been a subject of great interest since 1950's. In this talk, we will discuss more structured manifolds, where the structure is defined via group representations. Let M be a smooth oriented n-dimensional manifold and G be finite group. Given a map $\xi : BG \to BO$, a normal G-framing on M is a homotopy class of a map $\nu : M \to BG$, for which $\xi \circ \nu$ classifies the stable normal bundle. A manifold with a normal G-framing is called G-framed manifold. A G-framed cobordism between G-framed manifolds M_0 and M_1 is an $(n+1)$-manifold W with a G-framing $w : W \to BG$, such that $\partial W = M_0 \amalg M_1$ and $w|_{M_i} : M_i \to BG$ is the G-framing on M_i for $i = 0, 1$. If such a cobordism exists, then M_0 and M_1 are called G-framed cobordant. This is an equivalence relation and the set of equivalence classes form an abelian group Ω_n^G, called G-framed cobordism groups. There is a generic way to compute cobordism groups by means of stable homotopy theory. For $\xi : BG \to BO$, there is an associated Pontrjagin-Thom construction, $M\xi$, whose stable homotopy groups gives the cobordism groups. We study G-framed manifolds and their cobordisms in the case when $\xi : BG \to BO$ is the stabilization of a representation bundle. We will discuss some methods (that use spectral sequences for $M\xi$) to compute Ω_n^G and present some of the results for $G = \mathbb{Z}/p$ for lower dimensions.

This work is supported by TUBITAK Grant 117F085.

The Gravity Driven Free Surface Flow Caused by the Removal of a Vertical Cylinder from Water and Collapse of Cavity

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The gravity driven potential flow that results from the collapse of a vertical cylindrical cavity of circular cross sections surrounded by a liquid region is studied. We consider the case when the cavity has the same depth as the fluid and the fluid region lies outside of the cylindrical cavity extending to infinity in radial direction. The leading order outer solution is derived by applying asymptotic analysis using a small parameter that represents the short duration of the stage. Here, we show that, as the radius and the center of the cavity approaches infinity, the problem reduces to the classical two-dimensional dam break problem solved by Korobkin and Yilmaz. We also demonstrate that the singularity of the radial velocity at the bottom circle is of logarithmic type. The methods applied in these computations are expected to be helpful in the analysis of gravity-driven flow free surface shapes.

Bäcklund Transformations of Nonlinear Partial Differential Equations

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In this study, we studied the Bäcklund transformations of nonlinear partial differential equations. We showed that one can derive new solutions from the known solutions by using these transformations with the superposition formulas obtained via the permutability conditions of the equations. Bäcklund transformations were introduced by Bäcklund [1] and Bianchi [2] in the 1880's. Within this context we reviewed the well known application of the Bäcklund transformation to the Korteweg-de Vries (KdV) equation [3].

Key words and phrases: Bäcklund transformation, Permutability condition, Superposition formula, Korteweg-de Vries equation.

References

[1] Bäcklund A. V., *Zur theorie der partiellen differential gleichungen erster ordnung*, Math. Ann., 17, 285–328, **1880**.

[2] Bianchi L., *Sulla trasformazione di Bäcklund per le superficie pseudesferiche*, Rend. Acad. Naz. Lincei, 1, 3-12, **1892**.

[3] Drazin P. G., Johnson R. S., *Solitons: An Introduction*, Cambridge University Press, Cambridge, **1996**.

İkinci-Mertebe Doğrusal Diferensiyel Denklemlerin Salınımı

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Bu konuşmada, diferensiyel denklemlerin genel teorisinden bahsedilerek kualitatif teorinin (salınım ve kararlılık teorilerinin) önemi belirtildikten sonra p negatif değerli olmayan bir sürekli fonksiyon olmak üzere

$$y''(t) + p(t)y(t) = 0, \quad t \in [t_0, \infty)$$

biçiminde verilen ikinci-mertebe diferensiyel denklemin salınım kuramını geliştiren makalelerden bahsedilecektir.

Kaynakça

[1] W.B. Fite. Concerning the zeros of the solutions of certain differential equations. *Trans. Amer. Math. Soc.*, 19(4):341–352, 1918.

[2] E. Hille. Non-oscillation theorems. *Trans. Amer. Math. Soc.*, 64:234–252, 1948.

[3] A. Kneser. Untersuchungen über die reellen nullstellen der integrale linearer differentialgleichungen. *Math. Ann.*, 42(3):409–435, 1893.

[4] Z. Opial. Sur les intégrales oscillantes de l'équation différentielle $u'' + f(t)u = 0$. *Ann. Polon. Math.*, 4:308–313, 1958.

[5] J.C.F. Sturm. Mémoire sur les équations différentielles linéaires de second ordre. *J. Math. Pures Appl.*, 1:106–186, 1836.

[6] D.W. Willett. On the oscillatory behavior of the solutions of second order linear differential equations. *Ann. Polon. Math.*, 21:175–194, 1969.

[7] A. Wintner. On the non-existence of conjugate points. *Amer. J. Math.*, 73:368–380, 1951.

[8] J.R. Yan. Oscillatory properties of second-order differential equations with an "integralwise small" coefficient. *Acta Math. Sinica*, 30(2):206–215, 1987.

Numerical Methods for Nonlocal Problems

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In this thesis, numerical methods for nonlocal problems with local boundary conditions from the area of peridynamics are studied. These novel operators that satisfy local boundary conditions were proposed as an alternative to the original nonlocal problems which uses nonlocal boundaries. Peridynamic theory is reformulation of continuum mechanics by integral equations which has some advantages over traditional partial differential equations. In peridynamic theory, a point can interact with other points within a certain distance which is called horizon and indicated by the parameter δ. In this thesis, we are particularly interested in the roles of the parameter δ in numerical methods for the novel problems. More precisely, we aim to show its roles in condition number, discretization error and convergence factor of multigrid method.

Kaleidoscope of Quantum Coherent States and Units of Quantum Information

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The binary number system in classical computations is related with bits as a units ofclassical information. The quantum analog of these bits are qubits, as a units of quantum information. In the position representation of integer numbers, the decimal, the septimal and other representations of the numbers are known and the question is how to construct corresponding units of quantum information. For qubit states of photons in coherent states, this construction is based on the Schrödinger cat states. Here we propose the kaleidoscope of coherent quantum states, as superposition of Glauber coherent states, related with regular n-polygon symmetry and the roots of unity. First we treat in detail the trinity states and the quartet states as descriptive for qutrit and ququat units of quantum information with base 3 and 4. Normalization formula for these states requires introduction of specific combinations of exponential functions with mod 3 and mod 4 symmetry, which are known also as generalized hyperbolic functions. We show that these states can be generated for an arbitrary n by the Quantum Fourier transform. They can provide in general, qudit unit of quantum information, determined by arbitrary base n. Relations of our states with quantum groups and quantum calculus with base q as a root of unity are discussed.

This work is supported by TUBITAK Grant 116F206.

Krull Schmidt Remak Azumaya Theorem

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The decomposition of modules into indecomposable summands is in the center of module theory. In this talk, we will prove the Krull-Schmidt-Remak-Azumaya (KSRA) Theorem which gives an answer to the decomposition problem. The proof of KSRA theorem is making use of the exchange property, and we apply this theorem to some important classes of modules. Finally, we will mention some open questions in this literature.

References

[1] A. Facchini. *Module Theory Endomorphism Rings and Direct Sum Decompositions in Some Classes of Modules.* Birkhäuser, 1998.

Generalized Golden-Fibonacci Calculus and Applications

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In the present talk the Golden-Fibonacci calculus is developed and several applications of this calculus are obtained. The calculus is based on the Golden derivative as a finite difference operator with Golden and Silver ratio bases, which allowed us to introduce Golden polynomials and Taylor expansion in terms of these polynomials. The Golden binomial is introduced and its expansion in terms of Fibonomial coefficients is derived. We show that Golden binomials coincide with Carlitz' characteristic polynomials. By defining higher order Golden Fibonacci derivatives, related with powers of golden ratio, we developed the higher order Golden Fibonacci calculus. The higher order Fibonacci numbers, higher Golden periodic functions and higher Fibonomials appear as ingredients of this calculus. By using Golden-Fibonacci exponential function, we introduce the generating function for new type of polynomials, the Bernoulli-Fibonacci polynomials and study their properties.

This work is supported by TUBITAK Grant 116F206.

Apollonius Representation and Geometry of Qubit States

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Alternative representation of circles, determined by the ratio of distances from two symmetric points was discovered by Apollonius from Perge. Here we apply this representation for description of units of quantum information as qubits. The Apollonius representation for qubit states, determined by symmetric qubit states with respect to generalized circles in complex plane is proposed. The Shannon entropy, concurrence, Cayley hyperdeterminant and fidelity between symmetric states in Apollonius representation are constant along Apollonius circles. These circles become integral curves for entanglement characteristics as distances, areas, volumes and inner product metrics. Hydrodynamic and geometric interpretation of concurrence in terms of stream function and conformal metric is developed.

This work is supported by TUBITAK Grant 116F206.

The Characters of the Infinite Symmetric Group

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In this talk, we present the characters of the infinite symmetric group. We mention about A. Okounkov's approach in the proof of Thoma's theorem and we give details of his proof.

q-discrete Analogue of Hirota-Miwa Equation

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In this work we introduce q-discrete analogue of Hirota-Miwa equation which is a unification of q-difference equations and analyze the applicability of Hirota Direct Method on a generalized q-difference soliton equation. This equation is written in Hirota bilinear form which is a roof for various q-discrete type of equations equipped with their q-soliton solutions. From this unified equation, we can construct q-deformed Hirota bilinear forms of KdV, Toda and sine Gordon equations. Also the importance of this work is to write q-analogues of Toda, sine Gordon and KdV equations from their bilinear forms which recover the continuous equations.

Key words and phrases: Integrability, q-soliton solutions, q-difference KdV equation, q-difference Toda equation, q-difference Sine-Gordon equation, Hirota direct method

Unitary Irreducible Representations of The Infinite Symmetric Group

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In this talk, we present the classification of all irreducible unitary representations of the infinite symmetric group given by Lieberman theorem. We shall introduce the terminology and notions of the representation theory of the infinite symmetric group.

References

[1] G.I. Olshansky. *Unitary Representations of The Infinite Symmetric Group: A Semigroup Approach.* VNIPIISTROMSIR'E, Moscow.

h-D'alembert Problems and Solutions

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In this work, we study on lattice numbers. We present lattice differential, lattice derivatives (i.e. h-derivative), product and quotient rules for h-derivatives. We show the differences and similarities between h-calculus and ordinary calculus. We present h-binomial and its properties, h-Taylor series, h-antiderivative and related properties of h-analysis. We present discrete binomials, h-exponential functions, h-trigonometric and h-hyperbolic functions. As an application, we introduce discrete wave equations in other words, h-D'Alembert problems and construct h-D'Alembert solutions. We end up with related examples.

Ayrık Logaritma Problemi Üzerine

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G bir grup $g \in G$ olmak üzere h, g ile üretilen alt grubun bir elemanı olsun.

$$g^m = h$$

olacak biçimdeki m tamsayısının bulunması problemine G grubu için "ayrık logaritma problemi" denir. Ayrık logaritma problemi, şifreleme işlemlerinde, kriptografik yapılarda anahtar değişimi işlemlerinde özellikle Diffie-Hellman probleminde ve belli bir çıktıya sahip fonksiyonlarda (hash fonksiyonları) kullanılır.

Bu çalışmada bölümünde ayrık logaritma problemi, bu probleme dayanan ve simetrik şifreleme yöntemini kullanarak oluşturulan Diffie-Hellman anahtar değişimi ve bu yöntemin de kullanıldığı şifrenin güvenliği daha fazla olan El-gamal açık anahtar kriptosistemleri ele alınacaktır. Bununla birlikte ayrık logaritma problemi için bir çarpışma algoritması örneği olan Shanks'in bebek adımı-dev adımı algoritması tanımlanacaktır. Bu algoritmada çok fazla veri depolandığından daha az veri depolayan Pollard'ın algoritması ele alınacaktır. Daha sonra eliptik eğriler ve eliptik eğriler üzerinde toplama işlemi kavramları tanımlanacaktır. Böylece eliptik eğriler üzerinde Diffie-Hellman anahtar değişimi ve El-gamal açık anahtar kriptosistemleri ele alınarak eliptik eğri kriptolojisi oluşturulacaktır.

Kaynakça

[1] J.H. Silverman. *The Arithmetic of Elliptic Curves.* Graduate Texts in Mathematics, Springer, 2009.

[2] J. Hostein, J. Pipher and J.H. Silverman *An Introduction to Mathematical Cryptography.* Springer, 2008.

[3] L.C. Washington. *Elliptic Curves: Number Theory and Cryptography.* CRC Press, 2003.

On Some Proper Classes

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The characterization of N-domains, that is, the commutative domains such that neatness and $\mathcal{P}$-purity coincide, has been given by Làszlò Fuchs: they are the commutative domains where every maximal ideal is projective (and so necessarily finitely generated in the commutative domain case). We prove that if R is a commutative ring where every maximal ideal is projective and finitely generated, then neatness and $\mathcal{P}$-purity coincide. Conversely, we show that if R is a commutative ring where neatness and $\mathcal{P}$-purity coincide and if R has zero socle, then every maximal ideal of the ring R is projective and finitely generated.

Modeling the Dynamics of HIV-1 Decline in Patients on Protease Inhibitor Monotherapy on Time Scales

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The dynamics of HIV-1 infection in vivo have been scrutinized by different mathematical models. In this study, we propose alternative discrete models to one of the early models of the dynamics of HIV-1 introduced by Perelson et al. and given as a system of first order differential equations. Our main goal is to compare these mathematical models including the model of Perelson et al. when the unit of time is in days and in hours. To reach our goal, we first generalize the model of the interaction of the immune system with HIV-1 on a nonempty closed subset of real numbers and find an alternative discrete model departing from the generalization. Then, we derive unique solutions to these mathematical models to retrieve the total concentration of plasma virions. For the comparison, we estimate the parameters, i.e., the virion clearance rate and the rate of loss of infected cells and calculate Adjusted R-squared values by fitting these mathematical models to experimental data.

Key words and phrases: time scales, HIV, dynamic equations, difference equations, differential equations, systems, mathematical modeling.

Well-Posedness of the Fourth Order Nonlinear Schrödinger IBVP in Sobolev Spaces

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We study the local and global wellposedness of the initial-boundary value problem for the biharmonic Schrödinger equation on the half-line with inhomogeneous Dirichlet-Neumann boundary data. First, we obtain a representation formula for the solution of the linear nonhomogenenous problem by using the Fokas method (also known as the *unified transform method*). We use this representation formula to prove space and time estimates on the solutions of the linear model in fractional Sobolev spaces by using Fourier analysis. Secondly, we consider the nonlinear model with a power type nonlinearity and prove the local wellposedness by means of a classical contraction argument. Global wellposedness of the defocusing model is established up to cubic nonlinearities by using the multiplier technique and proving hidden trace regularities.

B-Splines and Divided Differences

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B-splines are piecewise polynomials whose pieces fit together smoothly at the joins, and divided differences are a basic tool in interpolation and approximation by polynomials and in spline theory. They are directly involved in the definition of B-splines. Our main purpose in this talk is to express two formulas. In the first formula, B-splines are constructed from the divided difference operator. In the second formula, the divided difference operator is built by integration with the B-splines.

Key words and phrases: B-splines, divided differences.

References

[1] G.M. Phillips and P.J. Taylor. *Theory and Applications of Numerical Analysis.* 2nd Edition, Academic Press, London, 1996.

[2] R. Goldman. *Pyramid Algorithms: A Dynamic Programming Approach to Curves and Surfaces for Geometric Modeling.* The Morgan Kaufmann Series in Computer Graphics, Elsevier Science, 2002.

[3] C. De Boor. *A Practical Guide to Splines.* Springer-Verlag, Vol. 27, New York, 1978.

[4] C. De Boor. Divided differences. *arXiv*:math/0502036, 2005.

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