NonCommutative Rings
and
their Applications, IV

ABSTRACTS

Checkable Codes from Group Algebras to Group Rings

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Abstract

A code over a group ring is defined to be a submodule of that group ring. For a code C over a group ring RG, C is said to be checkable if there is $v \in RG$ such that $C = \{x \in RG : xv = 0\}$. In [1], Jitman et al. introduced the notion of code-checkable group ring. We say that a group ring RG is code-checkable if every ideal in RG is a checkable code. In their paper, Jitman et al. gave a necessary and sufficient condition for the group ring $\mathbb{F}G$, when $\mathbb{F}$ is a finite field and G is a finite abelian group, to be code-checkable. In this paper, we generalize this result for RG, when R is a finite commutative semisimple ring and G is any finite group. Our main result states that: Given a finite commutative semisimple ring R and a finite group G, the group ring RG is code-checkable if and only if G is π'-by-cyclic π; where π is the set of noninvertible primes in R.

Keywords: Group rings, Semisimple rings, $\mathcal{A}$-by-$\mathcal{B}$ groups, Checkable codes.

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On Internally Cancellable Rings

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Abstract

Recall that a ring R is called internally cancellable if every regular element of R is unit-regular. In this talk we give some new characterizations of internally cancellable rings.

Keywords

Internal cancellation, unit regular element, idempotent stable range one.

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On Symmetrized Weight Compositions

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Abstract

In 2009, J. Wood [**?**] proved that Frobenius bimodules have the extension property for symmetrized weight compositions. Later, in [3], it was proved that having a cyclic socle is sufficient for satisfying the property, while the necessity remained an open question.
Here, landing in Midway, a partial converse is proved, a pseudo-injective module alphabet ${}_RA$ has the extension property for symmetrized weight compositions built on $\mathrm{Aut}_R(A)$ is necessarily having a cyclic socle.

Keywords Pseudo-injective modules, Annihilator Weight, Extension Property.

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Self-Dual $\mathbb{Z}_2\mathbb{Z}_2[u]$-linear Codes

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Abstract

In this paper, we study self-dual codes over $\mathbb{Z}_2^r \times R^s$ where $R = \mathbb{Z}_2 + u\mathbb{Z}_2 = \{0, 1, u, u+1\}$ is the ring with four elements, $u^2 = 0$ and r, s are positive integers. We introduce Type I and Type II self-dual $\mathbb{Z}_2\mathbb{Z}_2[u]$-linear codes and also we give some examples of self-dual separable and non-separable $\mathbb{Z}_2\mathbb{Z}_2[u]$-linear codes for each type.

Keywords

$\mathbb{Z}_2\mathbb{Z}_2[u]$-linear Codes, Self-Dual Codes, Type I Codes, Type II Codes.

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Rings of Morita Contexts which are Maximal Orders

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Abstract

Let $T = \begin{pmatrix} R & V \\ W & S \end{pmatrix}$ be a ring of Morita context which is a prime Goldie ring with its quotient ring $\begin{pmatrix} Q(R) & Q(V) \\ Q(W) & Q(S) \end{pmatrix}$. We define the notion of an (R, S)–maximal module in $Q(V)$ and that of an (S, R)–maximal module in $Q(W)$ from order theoretical point of view and give some necessary and sufficient conditions for T to be a maximal order in terms of (R, S)–module V and (S, R)–module W. In case T is a maximal order, we explicitly describe the structure of v-T-ideals. These results are applied to obtain necessary and sufficient conditions for T to be an Asano order or a Dedekind order.

Keywords: Maximal orders, Asano orders, Dedekind orders, Morita contexts, Dedekind prime rings.

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Existence conditions for self-dual skew codes defined over finite fields.

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Abstract

Conditions on the existence of self-dual θ-codes defined over a finite field $\mathbb{F}_q$ are studied for θ automorphism of $\mathbb{F}_q$. When $q \equiv 1 \pmod 4$ it is proven that there always exists a self-dual θ-code in any dimension and that self-dual θ-codes of a given dimension are either all θ-cyclic or all θ-negacyclic. When $q \equiv 3 \pmod 4$, there does not exist a self-dual θ-cyclic code and a necessary and sufficient condition for the existence of self-dual θ-negacyclic codes is given.

Groups that are isoclinic to rings

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Abstract

Let F be a finite algebraic system F in which multiplication is denoted by juxtaposition. The *commuting probability of* F is

$$P(F) = \frac{|\{(x, y) \in F \times F \ : \ xy = yx\}|}{|F|^2},$$

where $|\cdot|$ denotes cardinality. Much has been much written on $P(G)$ where G is a finite group. Together with MacHale and Ní Shé, we previously studied $P(R)$ where R is a finite ring, making use of an associated notion of ring isoclinism.

In this talk, we compare and contrast the values attained by $P(G)$ and $P(R)$ as G and R range over certain classes of groups and rings, respectively. We show in particular that the set of values that arise for finite rings and for finite class-2 nilpotent groups are the same. Proving this involves the consideration of certain triples $T = (A, B, k)$ associated with both class-2 groups and rings. Isomorphism of such triples generalizes the previous notions of group isoclinism and ring isoclinism, and commuting probability of groups and rings is an isomorphic invariant of the associated triples.

Keywords: Commuting probability, groups, rings, isoclinism

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Some properties of n-Armendariz rings

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Abstract

In this note, for a positive integer n, we construct examples of rings which are n-Armendariz but which are not $n+1$-Armendariz. While ps-Armendariz rings are semi-commutative as well as n-Armendariz for any n, the reverse implications are not true in general. We give an example of a ring which is n-Armendariz for any n but which is not ps-Armendariz and we find conditions for which these classes of rings coincide. Further, we discuss a few more properties of n-Armendariz rings.

Keywords n-Armendariz, ps-Armendariz, semi-commutative, abelian rings .

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Gelfand-Kirillov dimension of relatively free graded algebras

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Abstract

Let us consider $A := M_n(k)$, the algebra of $n \times n$ matrizes with entries in a field k of characteristic 0. Let G be an abelian group and let us suppose A be G-graded by an elementary G-grading. Then we compute the Gelfand-Kirillov (GK) dimension of its relatively free G-graded algebra in m variables. As a consequence we compute the GK dimension of any verbally prime algebra endowed with its "canonical" $G \times \mathbb{Z}_2$-grading.

Relations induced by AC bifunctors

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Abstract

In this poster we introduce the concept of $\mathbf{R}$-torsion theories on the category of R-modules, where $\mathbf{R}$ is the relation $K(M,N) = 0$ induced by an AC (almost continuous) bifunctor. This includes as a particular case the relation $\mathcal{H}$ induced by the bifunctor $Hom_R(\_,\_)$. Thus $\mathcal{H}$-torsion theories are the usual torsion theories defined by Dickson. We study the biclosed relations with respect to $\mathcal{H}$. A special AC bifunctor is that induced by an adjoint pair of functors, which corresponds to an R-R-bimodule. We show as an example that in every semisimple artinian ring the set of all biclosed relations is a Boolean lattice of 2^{n^2} elements.

Keywords: Biclosed relations; Galois connections; Bifunctors; Adjoint functors; Torsion theories; Idempotent radicals.

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On Skew Periodic Sequences

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Abstract

Let q be a power of a prime, $\mathbb{F}_q$ the finite field of q elements and θ be the Frobenius automorphism of $\mathbb{F}_q$. Let $\mathbb{F}_q[t;\theta] := R$ the noncommutative ring of skew polynomials, and let $f(t) \in R$ with nonzero constant term. It is shown in [1] that there exists a positive integer e such that $f(t)$ (right) divides $t^e - 1$. The least such an integer is the *exponent* of $f(t)$. A concrete way for computing this exponent and some of its properties are given in the same reference. This leads naturally to the notion of *skew period of skew linear recurring sequence over finite field.*

Let $S(\mathbb{F}_q)$ be the set of sequences over the finite field $\mathbb{F}_q$. The set $S(\mathbb{F}_q)$, endowed with the ordinary addition and the multiplication defined, for $f(t) = a_0 + a_1 t + \cdots + t^h \in R,\ u \in S(\mathbb{F}_q)$ and $n \in \mathbb{N}$ by :

$$(f(t).u)(n) = a_0 u(n) + a_1 \theta(u(n+1)) + \cdots + a_h \theta^h(u(n+h)),$$

is a left R-module. Let $u \in S(\mathbb{F}_q)$. Denote by I_u the annihilator of u in R. We thus have :

$$I_u = \{f \in R, \quad f.u = 0\}.$$

We say that u is a *skew linear recurring sequence* (skew LRS) over $\mathbb{F}_q$ if I_u contains a monic polynomial. Such a polynomial is called skew characteristic polynomial of u

If there exist an integer $r > 0$ such that $\theta^r(u(n+r)) = u(n)$ for $n \geq 0$, we say that u *is skew periodic* and r *is a skew period of* u. The smallest number among all the possible skew periods of u is called the *least skew period of* u.

In this work, we present some properties and examples of this new notion.

Keywords Ore extension, Finite field, Periodic sequence.

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Quaternary and binary codes as Gray images of constacyclic codes over $\mathbb{Z}_{2^{k+1}}$

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Abstract

In the 1990s it was proved in the seminal paper [1] that important families of good binary non-linear codes can be constructed from extended linear cyclic codes over $\mathbb{Z}_4$ (quaternary codes) through the Gray isometry ϕ from $(\mathbb{Z}_4^n, \delta_L)$ into $(\mathbb{F}_2^{2n}, \delta_H)$. After that some authors have extended the definition of ϕ to several clases of rings, and studied linear and cyclic properties of the images under the Generalized Gray isometry of constacyclic codes over those clases of rings (see [2, 3, 4] for example). In this work, we define an isometry φ from $(\mathbb{Z}_{2^{k+1}}^n, \delta_h)$ into $(\mathbb{Z}^{2^{k-1}n}, \delta_L)$ by means we achieve the Gray isometry $\Phi : (\mathbb{Z}_{2^{k+1}}^n, \delta_h) \to (\mathbb{F}_2^{2^k n}, \delta_H)$ defined in [2] for any finite chain ring. Then we study quasi-negacyclic properties of the images under φ and Φ of γ-constacyclic codes over $\mathbb{Z}_{2^{k+1}}$, where $\gamma \in \{1+2^k, 1+2^{k-1}+2^k\}$ and $k \geq 2$. In particular, if $k=2$ we get quaternary negacyclic and binary cyclic codes as images under φ and Φ, respectively, of negacyclic and 3-cyclic codes over $\mathbb{Z}_8$.

Keywords Gray isometry, consta-cyclic codes, quasy-negacyclic codes.

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Perfect Space-Time Block Codes from certain bicyclic Crossed Product Algebras

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Abstract

Space-Time Block Codes (STBC) are used for wireless data transmission in systems with multiple transmit- and receive antennas. The codewords of a STBC thereby correspond to matrices over the complex numbers. When choosing those codewords from an additively closed subset of such matrices, one obtains a lower bound on the error probability of the code, which is dependent on the minimal occuring determinant. This fact suggests to use Division Algebras in order to construct well performing codes. In [1] this fact, together with several other design criteria, has been combined into the notion of a *perfect* STBC, which is meant to guarantee a decent performance of the code. Perfect STBC have been constructed from Cyclic Algebras of any degree in [2] and from a crossed Product Algebra with respect to a Galois Group of type $C_2 \times C_2$ in [3]. We consider constructing STBC from bicyclic Crossed Product Algebras, i.e. Crossed Product Algebras with respect to Galois Groups of type $C_n \times C_m$ and give constructions for perfect STBC in the cases $C_2 \times C_{2^n}$, $C_4 \times C_{2^n}$ and $C_3 \times C_{3^n}$.

Keywords Space-Time Block Codes, perfect STBC, bicyclic Crossed Product Algebras.

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A Practical Guide to the MacWilliams Relations

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Abstract

We shall show, in a concrete way, how to construct the generating character of Frobenius rings and how to use this in the application of the MacWilliams relations.

Keywords Codes over Rings, MacWilliams Relations, Local Rings.

Test modules for flatness

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Abstract

A right R-module M is said to be a test module for flatness (shortly: an f-test module) provided for each left R-module N, $Tor_R^1(M, N) = 0$ implies N is flat. f-test modules are flat version of the Whitehead test modules for injectivity of Trlifaj. In this paper the properties of f-test modules are investigated and are used to characterize various families of rings. The structure of a ring over which every (finitely generated, simple) right R-module is flat or f-test are investigated. Abelian groups that are Whitehead test modules for injectivity or f-test are characterized.

Keywords: Whitehead test modules; f-test modules; p-indigent modules; flat modules; fully saturated rings.

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Krull-Schmidt-Remark theorem, direct product decompositions and G-groups

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Abstract

I will begin with a historical introduction on the Krull-Schmidt-Remark-Azumaya theorem, in particular some details about the contribution of Robert Erich Remak (central automorphisms of G). Then I will quickly describe what happens for other classes of modules, in particular biuniform modules, but also for cyclically presented modules over local rings, kernels of morphisms between indecomposable injective modules, couniformly presented modules, Auslander-Bridger modules, etcetera. These are results that I have obtained in collaborations with B. Amini, A. Amini, Ş. Ecevit, M. T. Koşan, N. Girardi, ... Something can also be said for direct products of families of modules (joint paper with A. Alahmadi [1]). Then I will present the content of a paper with A. Lucchini [3] about direct-product decompositions of a group, in particular for the case of a biuniform group G. In this setting, the natural category to work in turns out to be the category G-**Grp** of G-groups [2]. In the category G-**Grp** the automorphisms of the regular G-group G (the regular object) are exactly the central automorphisms of G.

Keywords Krull-Schmidt-Remark-Azumaya theorem, Biuniform modules, Biuniform groups, G-groups.

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On R-Semisimples Semimodules

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Abstract

The notion of "simple module" in the theory of rings and modules, was generalized in different ways in the theory of semirings and semimodules, by many authors. This fact induces different kinds of the notion of semisimple semimodules. In this paper, we study the strong definition of "simple semimodule" that we denote "R-simple semimodule" and characterizes the related classe of semisimple semimodules in the category of subtractive and cancellative semimodules.

Keywords

semirings, semimodules, subtractive subsemimodules, cancellative semimodules, strongly independent semimodules, R-simple semimodules, R-semisimple semimodules.

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Biclosed relations with respect to torsion theories

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Abstract

Based on the classical definitions of torsion theories (Dickson) and biclosed relations (Domenach, Leclerc), and considering the relation $\mathcal{H}$ described by $Hom_R(M, N) = 0$, it can be defined, for each biclosed relation $\mathcal{R}$ with respect to $\mathcal{H}$, the class of $\mathcal{R}$-torsion theories, and a Galois connection on the class of idempotent radicals. The concepts of continuous and cocontinuous functor can be extended to almost continuous, almost cocontinuous functor, and AC (almost continuous) bifunctor. Every AC bifunctor induces a biclosed relation with respect to $\mathcal{H}$. In particular, biclosed relations are induced by adjoint pairs of functors on R-Mod, which correspond to R-R-bimodules. If R is a semisimple Artinian ring the set of all biclosed relations with respect to $\mathcal{H}$ is a Boolean lattice of 2^{n^2} elements.

Keywords: Biclosed relations, Torsion theories, Bifunctors, Idempotent radicals .

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Algebraic Constructions of Modular Lattices

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a joint work with

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Abstract

Lattices are sets of regularly positioned discrete points in Euclidean spaces. A lattice that is similar to its dual is defined to be a modular lattice by Quebbemann ([3]). Different methods can be applied for constructing such modular lattices. In the poster, we present some algebraic methods - more specifically, constructions of ideal lattices from number fields and quaternion algebras. There are several works in the literature describing constructions from number fields e.g. cyclotomic fields ([1]) or linear codes combined with quadratic fields ([2]). Our current research focuses on generalising these results to quaternion algebras.

Keywords Lattice, Modular lattice, Number Field, Quaternion Algebra.

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Ore localizations of nearrings

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Abstract

For an arbitrary group G, written additively but not necessarily abelian, we denote by $M_0(G)$ the set of all zeropreserving maps from G into itself. Under the pointwise addition defined as follows: for any $f, g \in M_0(G)$ the map $f + g\colon G \to G$ is given by $(f + g)(x) = f(x) + g(x)$ for every $x \in G$, the set $M_0(G)$ is a group. The map composition is another binary operation on $M_0(G)$ which makes $M_0(G)$ a semigroup with unit. Moreover, the right distributive condition is always fulfilled, while even if the group G is abelian, $f \circ (g + h)$ and $f \circ g + f \circ h$ may not be the same as f is not a group endomorphism. This algebraic structure $(M_0(G), +, \circ)$ is a classic example of a nearring (more precisely, a zerosymmetric right nearring with unit). Another classic example of a nearring is the set of all homogeneous maps of any module over a ring. Abstractly, we define a nearring to be a set N of no fewer than two elements together with two binary operations, the addition and multiplication, in which: (1) N is a (not necessarily abelian) group with respect to the addition, (2) N is a semigroup with unit with respect to the multiplication, (3) the multiplication in N is right distributive over the addition, and (4) $n0 = 0n = 0$ for every $n \in N$. The nearring theory started in 1905 when Dickson investigated the independence of the axioms of a field. For a deeper discussion of nearrings we refer the listeners to [1, 2, 4, 5].

According to a definition introduced by James A. Graves and Joseph J. Malone in [3], the nearring of right quotients of a nearring N with respect to a multiplicatively closed set $S \subseteq N$ is a nearring N_S together with an embedding $\phi\colon N \hookrightarrow N_S$ for which: (1) $\phi(s)$ is invertible in N_S for every $s \in S$, and (2) every element of N_S may be expressed in the form $\phi(n)\phi(s)^{-1}$ where $n \in N$ and $s \in S$. The authors proved that if S is a multiplicatively closed set of both left and right cancellable elements in a nearring N then the nearring of right quotients N_S exists if and only if N satisfies the right Ore condition with respect to S. Their construction is analogous to the classical right ring of quotients. The left analogue of the notion of a nearring of right quotients in the sense of Graves and Malone was defined similarly. Unfortunately, as pointed out by Carlton J. Maxson, the Ore construction does not hold for a nearring of left quotients in the sense of Graves and Malone ${}_SN$, because a substitute for the left distributive condition in N is necessary for the addition in ${}_SN$ to be well defined.

Our main purpose is to redefinition of the notion of a nearring of left quotients in such a way that it is a generalization of the notion of a left ring of quotients, and for which the Ore construction holds. Then we determinate the necessary and sufficient conditions for the existence of a nearring of left quotients.

Keywords

Nearrings of quotients, Ore localizations.

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Codes over Infinite Family of Algebras

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a joint work with

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Abstract

In this talk, we will show some properties codes over the ring $B_k = \mathbb{F}_p[v_1, \ldots, v_k]/(v_i^2 = v_i, \forall i = 1, \ldots, k)$, which is a generalization of the ring A_k defined in [1]. These rings, form a family of commutative algebras over finite field $\mathbb{F}_p$. We first discuss about the form of maximal ideal and characterization of automorphisms for the ring B_k. Then, we define certain Gray map which can be used to give a connection between codes over B_k and codes over $\mathbb{F}_p$. Using the previous connection, we give a characterization for equivalence of codes over B_k and Euclidean self-dual codes. Furthermore, we give generators for invariant ring of Euclidean self-dual codes over B_k through Mac Wiliams relations of Hamming weight enumerator for such codes.

Keywords: Gray map, equivalence of codes, Euclidean self-dual, Hamming weight enumerator, MacWiliams relation, Invariant ring.

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Lattices of Annihilators in Commutative Algebras

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Abstract

In this talk K will be a field and A an associative K-algebra with $1 \neq 0$. If $X \subseteq A$ is a subset then let $L(X)$ be the left annihilator of X in A.

It is well known that the set $\mathfrak{I}_l(A)$ of all left ideals in A, ordered by inclusion, is a complete modular lattice. The set $\mathfrak{A}_l(A)$ of all left annihilators in A is a subset of $\mathfrak{I}_l(A)$. This subset is a complete lattice, but need not be a sublattice of $\mathfrak{I}_l(A)$ (see [3, 5]). During NCRA III conference the following result was presented (see [1]):

Theorem 1 ([1])**.** *For every lattice L there exists a noncommutative algebra A_L, such that L is a sublattice in $\mathfrak{A}_l(A_L)$.*

In this talk we are going to present similar result, but for commutative algebras. As a consequence we have

Theorem 2 ([2])**.** *There exists no nontrivial lattice identity satisfied in lattices of annihilators of all commutative, finite dimensional K-algebras.*

Keywords Lattice, Annihilator, Contracted semigroup algebra.

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Rings whose nilpotent elements form a Wedderburn radical subring

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Abstract

Let R be an associative ring (not necessarily with identity), and let $N(R)$ denote the set of nilpotent elements of R. The set $N(R)$ can provide important information on the structure of the ring R. For instance, if $N(R) = \{0\}$ (i.e., if R is a reduced ring), then R is a subdirect product of domains. In this talk we will discuss properties of rings R for which the set $N(R)$ is a subring. Special attention will be paid to the class of rings R such that $N(R)$ is a Wedderburn radical subring of R. This class includes many important types of rings (e.g., the rings whose lattice of right ideals is distributive).

Keywords Nilpotent elements, Wedderburn radical, Distributive rings.

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Modules which satisfy ACC on annihilators

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Abstract

Given two submodules K, L of a module M, in [1] is defined the product $K_M L$. With this product are defined semiprime (prime) submodules and semiprime (prime) modules [4], [4]. We focus on semiprime submodules and modules, I will present some general results about this modules. Also, I will introduce the definition of left annihilator submodule. It will be shown that a module which satisfies ascending chain condition on left annihilators has finitely many minimal primes submodules. We prove that there exist a bijective correspondence between minimal primes submodules of M and isomorphism class representatives of indecomposable injective modules which are $\chi(M)$-trosionfree. In this context appear Goldie modules (defined in [2]) as examples of modules with ACC on annihilators.

Keywords: Semiprime Module, Prime submodule, Left annihilator, Goldie Module. .

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On strongly prime and one-sided strongly prime submodules

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a joint work with Prof. Dr. Sanh Nguyen Van

Abstract

In this talk, we study the classes of strongly prime and one-sided strongly prime submodules. Some properties of strongly prime and one-sided strongly prime submodules are investigated.

Keywords: Strongly prime submodules, one-sided strongly prime submodules, one-sided strongly prime right ideals, Cohen theorem.

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Space-time Codes
from Quotients of Division Algebras

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Abstract

Central simple division algebras have been used in the context of coding theory, for designing space-time codes, or codes for multiple antenna systems. After recalling briefly how central simple division algebras can be used to design codes, we will focus on coding applications which involve the study of quotients of central simple division algebras. We are interested in two types of results: (1) structural results which attempt at classifying the different quotients obtained, and (2) constructive results, which involve the study of codes over skew-polynomial rings, as introduced by Boucher and Ulmer.

Keywords Central Simple Algebras, Skew Polynomial Rings, Space-Time Coding.

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Secret Sharing Schemes Obtained from Some Special Codes

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Abstract

Secret sharing schemes have found applications in specific cryptography [2]. These schemes offer a way to protect the secret key by distributing shares to participants. Many methods have been developed over the last decades [4, 6]. One of these methods is based on exploring the minimal codewords in a linear code [5]. But determining the minimal codewords of a code is very challenging and difficult problem in general [1, 3]. In this study, we characterize minimal codewords of a special class of cyclic codes that have generators as Fibonacci polynomials over finite fields. Also, we determine access structures of these codes which are crucial to secret sharing.

Acknowledgment: This research is supported by The Scientific and Technological Research Council of Turkey, Project No: 114F388.
Keywords: Fibonacci polynomials, Minimal codeword, Secret Sharing Scheme.

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Essential idempotents and minimal Cyclic Codes

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Abstract Let $\mathbb{F}_q$ be a finite field with q elements and m a positive integer. The cyclic codes of length m over $\mathbb{F}_q$ can be viewed as ideals in the group algebra $\mathbb{F}_q C_m$, where C_m denotes a cyclic group of order m. More generally, an *abelian code* over $\mathbb{F}_q$ is any ideal in the group algebra $\mathbb{F}_q A$ of a finite abelian group A. These codes were introduced independently by S.D. Berman [2] and MacWilliams [3].

Since in the case when $char(\mathbb{F}) \not| \, |A|$ the group algebra $\mathbb{F}A$ is semisimple and all ideals are direct sums of the minimal ones, it is only natural to study minimal abelian code - or - equivalently, primitive idempotents - and these has been done by several authors.

In this talk, we use the concept of *essential idempotent*, which was first considered in [1], and use it to prove that every minimal abelian, non-cyclic, code is a repetition code. Also, we can prove that every minimal abelian code is equivalent to a minimal cyclic code of the same length.

This is joint work with R. Ferraz and G. Chalom.

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Codes and noncommutative stochastic matrices

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a joint work with S. Lavallée, D. Perrin, V. Retakh

Abstract

Given a matrix over a skew field whose row sums are equal to 1, we give formulas for a row vector fixed by this matrix. The same techniques are applied to give noncommutative extensions of probabilistic properties of codes.

Keywords Stochastic matrices, codes, eigenvectors, quasi-determinants.

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Polynomials defining many units.

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Abstract

Let P be a polynomial in one variable and let g be a group element of order n. We say that P defines a unit in order n if $P(g)$ is a unit of the group of integral group ring of the group generated by g with integral coefficients. Marciniak and Sehgal introduced the notion of generic unit and give a characterization of them. A generic unit is a monic polynomial P with integral coefficients such that there is a positive integer D such that P defines a unit in order n for every n coprime with D. Obviously a generic unit defines units in infinitely many orders. We prove a converse of this result. More precisely we prove that if P is a polynomial with integral coefficients, non-necessarily monic, such that P defines units on infinitely many units then $P = \pm Q$, for Q a generic unit.

Some Results on nth order differentials

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Abstract

Let R be a commutative k-algebra where k is an algebraically closed field of characteristic zero. We have the following exact sequence

$$0 \to I \to R \otimes_k R \stackrel{\varphi}{\to} R \to 0$$

where φ is defined as $\varphi(\sum_{i=1}^{n} a_i \otimes b_i) = \sum_{i=1}^{n} a_i b_i$ for $a_i, b_i \in R$ and I is the kernel of φ. Note that $\ker \varphi$ is generated by the set

$$\{1 \otimes r - r \otimes 1 : r \in R\}.$$

The $R-$module $\frac{I}{I^{n+1}}$ is called the universal module of nth order derivations and is denoted by $\Omega_n(R)$.

In this talk, we prove that the Betti series of the universal module of order n is rational under some conditions.

Keywords

Universal Module, Betti Series, Minimal Resolution.

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Mappings between R-tors and other lattices

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Abstract

The study of rings and their categories of modules may be approached by investigating any of a variety of associated lattices. Among some of the lattices that have proved useful for this purpose are R−tors the lattice of hereditary torsion theories, R−pr the big lattice of preradicals and some of its sublattices, and the lattice of fully invariant submodules of a fixed module, of which an important particular case is the lattice of two-sided ideals of a ring.

The aim of this work is to characterize those situations in which some of these lattices associated to a ring are isomorphic. Accordingly, several mappings between them are defined. All of these are fairly canonical, such as the torsion part, evaluation at the ring, generation and cogeneration of hereditary torsion theories, or left multiplication by a two-sided ideal. Some consequences of their being lattice isomorphisms are also shown.

Keywords Torsion theories, prerradicals, lattice morphisms,

References

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On reversible codes and their Applications

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Abstract

In this talk, we review studies on reversible codes. The first results for reversible codes appear on cyclic codes over finite fields. Later, studies on reversible codes over rings have been of much interest. The interest on such codes is mainly due to their natural advantageous structure. The most important applications of such codes appear on DNA codes. In this talk, we will go over recent findings on reversible codes and their applications to DNA codes

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Every abelian group is the class group of a simple Dedekind domain

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Abstract

The class group of a Dedekind prime ring R is the kernel of the split epimorphism udim: $K_0(R) \to \mathbb{Z}$. A classical result of Claborn states that every abelian group is the class group of a commutative Dedekind domain. Among noncommutative Dedekind prime rings, apart from PI rings, the simple Dedekind domains form a second important class. We show that every abelian group is the class group of a noncommutative simple Dedekind domain. This solves an open problem stated by Levy and Robson in their recent monograph on hereditary Noetherian prime rings.

Keywords: simple Dedekind prime rings, class groups.

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Dualilty Preserving Gray Maps: (Pseudo) Self-dual Bases and Symmetric Bases

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Abstract

Given a finite ring A which is a free left module over a subring R of A, two types of R-bases are defined which in turn are used to define duality preserving maps from codes over A to codes over R. Both types are illustrated with skew cyclic codes which are codes that are A-submodules of the skew polynomial ring $A[X;\theta]/(X^n - 1)$. There exists criteria for a skew cyclic code over A to be self-dual. With this criteria and a duality preserving map, many self-dual codes over the subring R can easily be found.

Keywords

Codes over Rings, Self-Dual Codes, Trace Orthogonal Basis, Symmetric Basis, Codes over Noncommutative Rings.

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Matrix coefficient realization theory of noncommutative rational functions

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Abstract

One of the main reasons why noncommutative rational functions, i.e., elements of the universal skew field of fractions of a free algebra, are so inaccessible, is their lack of a canonical form. For rational functions defined at 0 this can be compensated by using realizations, which originated in automata theory and systems theory. The aim of this talk is to present a realization theory that is applicable to any noncommutative rational function and is adapted for studying its finite-dimensional evaluations. Using these matrix coefficient realizations we can measure the complexity of noncommutative rational functions, describe their singularities and assert size bounds for the rational identity testing problem.

Keywords: Noncommutative rational function, realization, rational identity testing, extended domain.

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Linear codes from the axiomatic viewpoint

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Abstract

In this series of lectures I will discuss linear codes defined over fi- nite rings and modules. The emphasis will be on several foundational theorems and some of their consequences. Characters, group homomorphisms from the additive group of a ring or module to the multiplicative group of nonzero complex numbers, are at the heart of proofs of the MacWilliams identities and the MacWilliams extension theorem for the Hamming weight. These proofs work over finite Frobenius rings because the character module is free. The axiomatic approach to linear codes due to Assmus and Mattson is used to interpret the MacWilliams extension theorem as the injec-tivity of a certain linear transformation W. An analysis of W in the context of matrix module alphabets yields two main results: a con- verse of the MacWilliams extension theorem for the Hamming weight and a description of how badly things go wrong in the absence of the Frobenius condition. Here are the topics I plan to discuss:

- generating characters
- MacWilliams identities
- MacWilliams extension theorem for the Hamming weight and converse
- MacWilliams extension theorem for other weights
- one-weight and relative one-weight linear codes
- isometries of additive codes
- self-duality for linear codes over modules
- simplicial complexes coming from linear codes

On radicals of differential polynomial rings

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joint works with

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Abstract

Over the past few years, new results have appeared on radicals of differential polynomial rings $R[x;\delta]$, where δ is a derivation of a ring R. Most of them concerns the relationship between some radicals of a given ring R and some radicals of the differential polynomial ring $R[x;\delta]$. During the talk we will show these new facts and we will present the questions that arise in this area.

Keywords: Differential polynomial rings, radicals of rings.

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