Авторска справка за научните приноси на трудовете и за цитиранията

На д.м.н. Йорг Копиц,
Институт по математика, Природо-математически факултет,
Университет Потсдам

за участие в конкурс за доцент в област на висше образование 4. Природни науки, математика и информатика, професионално направление 4.5. Математика, по научна специалност Алгебра и теория на числата (Алгебрични структури)

Общият брой на научните ми публикации до момента е 67 (*виж Приложение 1 или List_publications_all.pdf*), като от тях представени за конкурса са 16 *(виж Приложение 2 или List_publications_konkurs.pdf)* и те не повтарят тези, с които съм придобил научната степен „доктор на математическите науки".

Класификацията на научните публикации по тип издания е както следва:

Тип издание	**Брой**
Реферирани списания с импакт фактор	8
Реферирани списания без импакт фактор	8

От представените за конкурса научни публикации 2 са самостоятелни, 12 – с един съавтор и 2 – с двама съавтори. Участието на всички съавтори е равноправно.

Представените за конкурса научни публикации могат да се разделят тематично в следните направления:

I. Transformation semigroups – публикации 1, 2, 3, 4, 5, 6, 7, 9, 10, 11, 12, 13, 14, 16.
II. Clones – публикация 8.
III. Varieties of semigroups – публикация 15.

Общият брой на забелязаните цитирания (без самоцитирания) е 59 *(виж Приложение 3 или List_citations.pdf)*.

Представените за участие в конкурса научни публикации и техните приноси са описани по-долу в обратен хронологичен ред.

(1) Koppitz, J. and Musunthia, T., *Maximal subsemigroups of some semigroups of order-preserving mappings on a countably infinite set*, Forum Mathematicum (2016), DOI: 10.1515/forum-2015-0093.

Abstract

All maximal subsemigroups of the semigroup On of all order-preserving mappings on an n-element chain are already known. But semigroups of order-preserving transformations on any infinite linearly ordered set have been poorly studied. It seems extremely unlikely that there is a complete description in any sense of the maximal subsemigroups of the semigroup of all order-preserving transformations on an infinite linearly ordered set. In this paper, we give a full characterization of the maximal subsemigroups of the semigroup of all injective order-preserving transformations on the set of natural numbers and integers, respectively. Moreover, we give a complete description of all maximal subsemigroups of the semigroup of all bijective order-preserving transformations on the set of integers.

(2) Tinpun K. and Koppitz, J., *Relative Rank of the Finite Full Transformation Semigroup with Restricted Range*, Acta Math. Univ. Comenianae Vol. LXXXV, No. 2(2016), 347–356.
Zbl 06609705

Abstract

The rank of a semigroup is the minimal size of a generating set for this semigroup. If the rank of a semigroup is no natural number, then the notation of rank provides us with no information. In such a case one can use the concept of a relative rank modulo a subset of the semigroup. The rank of the semigroup T(X,Y) of all mappings on the set X with range in a subset Y of X has a large size. We determine the relative rank of T(X,Y) modulo two subsemigroups of T(X,Y) in this paper. The first one is the set of all transformations in T(X,Y), whose restriction to Y is a bijection. The other one is the set of all order-preserving transformations in T(X,Y), whenever X is a finite set. Both subsemigroups of T(X,Y) were already studied by several authors. This paper uses these well studied transformation semigroups to provide a “smaller” relative rank of T(X,Y).

(3) Tinpun K. and Koppitz J., *Generating sets of infinite full transformation semigroups with restricted range,* Acta Sci. Math. (Szeged) 82(2016), 55-63.

Abstract

The semigroup T(X) of all mappings on a set X is well studied in Semigroup Theory, whenever X is finite. But this is not more true if X is infinite. This paper gives a contribution for an improvement of this situation. We study the relative rank of the semigroup T(X,Y) of all transformations in T(X) with range in Y, whenever Y is a subset of X (where X is infinite). The relative rank of a semigroup S modulo a subset A of S is defined to be the minimal size of a set B such that A and B generates S. The relative ranks of various well known semigroups have been calculated by other authors. In this paper, we calculate the relative rank of T(X,Y) (where X is infinite) modulo the set E(X,Y) of all idempotent elements in T(X,Y) as well as modulo the semigroup S(X,Y) of all transformations in T(X,Y), whose restriction to Y is a bijection on Y. If X and Y have different cardinality, then the relative rank of T(X,Y) modulo E(X,Y) und S(X,Y), respectively, is infinite. Here the relative rank gives us no information. But the relative rank will be two in both cases, whenever X and Y have the same cardinality (that means not that X and Y are identical). This observation leads to the question for minimal relative generating sets of T(X,Y), i.e. we are looking for minimal subsets of T(X,Y), which together with E(X,Y) (and S(X,Y), respectively) generates T(X,Y). This paper answers this question. It provides a characterization of all two-element relative generating sets of T(X,Y) modulo E(X,Y) as well as modulo S(X,Y).

(4) Koppitz, J., *Separation of On from its proper subsemigroups by a single identity*, Semigroup Forum 91, No. 1(2015), 128-138.
Zbl 133420053 (Reviewer: Volodymyr Mazorchuk)
Impact factor 2015: 0,642

Abstract

This paper combines Semigroup Theory and Universal Algebra. In 1994, R. Pöschel et al. have constructed a single identity that fails the semigroup Tn of all mappings on an n-element set, but holds in every proper subsemigroup of Tn. We say that such an identity separates Tn from its proper subsemigroups. R. Pöschel et al. have given the problem of the existence of a single identity that separates the semigroup On of all order-preserving mappings on an n-element chain from its proper subsemigroups. In this paper, we have solved this problem. We constructed a single identity separating the semigroup On from its proper subsemigroups, for each natural number n greater or equal two.

(5) Lekkoksung, N. and Koppitz, J., *A Note on finite generated subsemigroups of T(X,Y)*, Math. Appl. 4(2015), 25-30.

Zbl 133220063

Abstract

The following well known result by W. Sierpinski (proved by S. Banach) has given the motivation for this paper: Any countable subset of the set (semigroup) T(X) of all mappings on an infinite set X is contained in a two-generated subset of T(X). This result has an immediate but strong consequence for the calculation of the relative rank of T(X) modulo a subset A, i.e. for the calculation of the minimal size of a subset B of T(X) that together with A generates T(X): The relative rank of T(X) modulo a subset of T(X) is either uncountable or at most two. This statement can fail if we consider the relative ranks of proper subsets of T(X). We consider the well studied semigroup T(X,Y) of all transformations in T(X) whose range lies in Y, whenever Y is a subset of X. It is to expect that the result depends from the choice of the subset Y. In fact, we have proved that any uncountable subset of T(X,Y) is contained in a three-generated subsemigroup of T(X,Y) if and only if either X and Y have the same cardinality or Y is uncountable with a cardinality less than the cardinality of X. A couple of months after publication, we have improved this result. We have verified that under the mentioned conditions for Y, any countable subset of T(X,Y) is contained in a two-generated subsemigroup.

(6) Koppitz, J. and Musunthia, T., *Maximal Subsemigroups containing a particular semigroup*, Mathematica Slovaca 64 (2014), 1369-1380.
Zbl 06440080
Impact factor 2014: 0,409

Abstract

Let X be an infinite set. It seems almost impossible to classify all maximal subsemigroups of the semigroup T(X) of all mappings on X. Therefore, it is usefully to classify maximal subsemigroups of T(X) containing a given set. The maximal subsemigroups of T(X) containing all bijections on X were determined about 10 years ago. Later, other authors classified the maximal subsemigroups of T(X) containing a stabilizer, done for several types of stabilizers. In this paper, we first consider a countable infinite set X and subsemigroups W such that there is a finite set U being a relative generator of T(X) modulo W, i.e. U and W together generate T(X). For all of such W´s, we characterize the maximal subsemigroups of T(X) containing W. Moreover, we give a proof of the classification theorem for all maximal subsemigroups of T(X) containing all bijections, except of the completeness, since independently we proved this part whilst of the original work(s). In particular, we give a direct proof in the setting of Semigroup Theory. The original one is in the setting of Universal Algebra. There are five maximal subsemigroups of T(X) containing all bijections on X.

For such maximal subsemigroups U, we determine the maximal subsemigroups of T(X) containing the dual set of U, i.e. the set T(X)\U.

(7) Jende, A., Koppitz, J. and Musunthia, T., *The subsemigroups of the full transformation semigroup* Tn *in the ideal K(n,2) satisfying* $x^k = x$, Southeast Asian Bulletin of Mathematics 38(2014), 369-382.
Zbl 131320059

Abstract

This paper deals with an ideal of the semigroup Tn of all mappings on an n-element set. An ideal of Tn consists of all transformations in Tn having at most a fixed natural number many elements in the range. In this paper, we study the ideal K(n,2) of all transformations in Tn having at most two elements in the range and its subsemigroups. On the other hand, semigroups satisfying $x = x^k$ for some natural number k greater or equal two are locally finite and of particular interest. Let us consider a subsemigroup S of K(n,2) satisfying $x = x^k$. Then one obtains that S is a band or S is coregular (i.e. it satisfies $x = x^3$) by simple calculations. In this paper, we give a complete description of all maximal subsemigroups of K(n,2) as well as all maximal subsemigroups of K(n,2) consisting entirely of idempotents (i.e. bands). Moreover, this paper provides a complete presentation of all coregular subsemigroups of T3. These presentation covers three types of semigroups.

(8) Koppitz, J. and Supaporn, W., *Category Equivalences of Clones of Operations Preserving Unary Operations*, Comptes rendus de l´Acadèmie bulgare des Sciences Tome 66, No. 2(2013), 177-184.
Zbl 131318009 (Reviewer: Ivan D. Chipchakov)
Impact factor 2013: 0.198

Abstract

The set Clone(A) of all clones on a given set A forms a lattice. This lattice is complete described by E. Post for the case that A has two elements. The description of the lattice Clone(A) for sets A with more than two elements is a still open problem. This paper contributes to the investigation of the structure of the lattice Clone(A) for finite sets A with more than two elements. Our approach is the concept of category equivalence of clones. This concept bases on the better known concept of category equivalence of varieties. We consider clones of the form PolA(Q), where PolA(Q), is the set of all operations on A, preserving a set Q of unary relations on A, i.e. a set Q of subsets of A. First, we show that any clone C on a set B is of the form PolB(Q), for a suitable set Q of

unary relations on B, if there is a set A and a set R of unary relations on A such that C is isomorphic to PolA(R). The main purpose of this paper is to present an algorithm which provides for a given clone of the form PolA(Q) a category equivalent clone with a base set of smallest size. For the case that Q contains at most two elements (i.e. two unary relations on A), we give an explicit description of all such clones with smallest base set. Any such base set has at most three elements, depending from the choice of A and Q. For the general case, we give necessary and sufficient conditions such that a clone of the form PolA(Q) is category equivalent to a clone on a set with exactly one missing element from A. This gives a constructive algorithm, which reduces the size of the base set of a given clone keeping the category equivalence. Since A is finite, that procedure terminates. Finally, we characterize all sets A, such that a clone of the form PolA(Q) is a clone with a base set of smallest size.

(9) Dimitrova, I., Fernandes, V.H. and Koppitz, J., *The maximal subsemigroups of semigroups of transformations preserving or reversing the orientation on a finite chain*. Publications Mathematicae Debrecen 81, No. 1-2(2012), 11-29.
Zbl 125720061
Impact factor 2012: 0,322

Abstract

In this paper, we consider two semigroups of transformations and their subsemigroups, namely the semigroup OPn of all orientation-preserving transformations and the semigroup ORn of all orientation-preserving or -reversing transformations on an n-element linearly ordered set (also called chain). First, we consider OPn and its ideals. The semigroup OPn is two-generated, namely by a suitable bijection in OPn and an orientation-preserving transformation with rank n - 1. We give a complete characterization of all maximal subsemigroups of OPn. Some of them are isomorphic to the maximal subsemigroups of the group of the first n non-negative integers. Further, we study the ideals of OPn. We found a description of all maximal subsemigroups of the ideals of OPn and provide two generating sets for the ideals. The second part of this paper deals with the semigroup ORn and its ideals. This semigroup is three-generated, namely by a suitable bijection in ORn, an orientation-preserving transformation, and an orientation-reversing transformation, both of rank n - 1. We give again a complete characterization of the maximal subsemigroups of ORn. Some of them are isomorphic to the maximal subsemigroups of the Dihedral Group Dn of order n. Some generating sets for the ideals of ORn are given, and finally, we give a complete classification of the maximal subsemigroups of the ideals in ORn.

(10) Dimitrova, I. and Koppitz, J., *On the Monoid of All Partial Order-preserving Extensive Transformations*, Communications in Algebra 40(2012), 1821-1826.
Zbl 124720070
Impact factor 2012: 0,356

Abstract

The set POEn of all partial order-preserving extensive transformations on an n-element chain forms a minoid, which has arisen in Language Theory. This paper investigates algebraic and rank properties of POEn. We show that POEn is a semiband, i.e. it is generated by its idempotent elements. Moreover, we show that the idempotents in POEn with rank n - 1 are indecomposable in POEn. We obtain that the rank of POEn coincides with the idempotent rank of POEn (i.e. with the minimal size of a set of idempotents which generates POEn). It is 2n. In the second part of this paper, we consider the maximal subsemigroups of POEn. There are exactly 2n ones, namely POEn without exactly one idempotent with rank greater than n - 2. Finally, we give a complete description of the maximal subsemigroups of POEn. There are exactly 2n ones, too.

(11) Dimitrova, I. and Koppitz, J., *Coregular Semigroups of full Transformations*, Demonstratio Mathematica Vol. XLIV, No. 4(2011), 739-753.
Zbl 123920076

Abstract

An element a of a semigroup S is called coregular if there is an element b in S with the property aba = bab = a. The semigroup S is called coregular if all its elements are coregular. Coregular semigroups belong to the well studied class of completely regular semigroups. Further, coregular semigroups are characterized by the identity $x = x^3$, i.e. a semigroup is coregular if it satisfies $x = x^3$. In this paper, we characterize all coregular subsemigroups with at most three elements of the semigroup Tn of all mappings on an n-element set. Such semigroups are bands. So, we have provided a characterization of all bands with at most three elements. Moreover, the semigroup OEn of all order-preserving extensive transformations on an n-element chain is well studied. The same holds for the monoid En of all extensive transformations on an n-element chain. We provide a description of all subsemigroups of En, which are bands. On the other hand, we give a presentation of all maximal subsemigroups of OEn, which are bands.

(12) Dimitrova, I. and Koppitz, J., *On the maximal regular subsemigroups of ideals of order-preserving or order-reversing transformations*, Semigroup Forum 82(2011), 172-180.
Zbl 121320065
Impact factor 2011: 0,730

Abstract

The first part of this paper deals with the ideals of the semigroup On of all order-preserving transformations on an n-element set and its ideals. An ideal K(n,r) is the collection of all transformations in On with a rank at most r. The semigroup On as well as its ideals are regular semigroups. This suggests the question for the regular subsemigroups of On and its ideals. We give a complete description of all maximal regular subsemigroups of the ideals K(n,r). There are two types of maximal regular subsemigroups of K(n,r). In the second part of this paper, we study the regular subsemigroups of the semigroup ORn of all order-preserving or order-reversing transformations on an n-element chain. The ideals K0(n,r), consisting of all transformations in ORn with a rank at most r, are also regular. We determine all maximal regular subsemigroups of K0(n,r).

(13) Dimitrova, I. and Koppitz, J., *On some Anti-inverse Transformation Semigroups*, Comptes redndus de I`Académie bulgare des Sciences, Tome 63, No. 6(2010), 793-798.
Zbl 121620054
Impact factor 2010: 0,219

Abstract

An element of a semigroup S is called anti-inverse if there is an element b in S such that aba = b and bab = a. The semigroup S is called anti-inverse if all its elements are anti-inverse. Anti-inverse semigroups belong to the well investigated class of regular semigroups. In this paper, we study anti-inverse subsemigroups of the semigroup Tn of all mappings on an n-element set. First, we present a description of the anti-inverse subsemigroups of Tn. Then for any *J*-class J of the semigroup Tn, we describe all anti-inverse subsemigroups, which are covered by J. We illustrate our results by four examples, i.e. we consider four subsemigroups of Tn and give a more explicit description of the anti-inverse semigroups, which are covered by some *J*-class of some of that four subsemigroups in consideration. As examples serve the following well-studied semigroups: The semigroups On and OPn of all order-preserving and of all orientation- preserving, respectively, transformations as well as the semigroups ORn and OPRn of all order-preserving or -reversing and of all orientation-preserving or -reversing, respectively, transformations on an n-element chain.

(14) Dimitrova, I. and Koppitz, J., *The maximal subsemigroups of the ideals of some semigroups of partial injections,* Discussiones Mathematicae General Algebra and Applications 29, No. 2(2009), 153-167.
Zbl 119820054

Abstract

In this paper, we study the structure of the semigroups IOn and IMn of all order-preserving and all monotone (i.e. order-preserving or order-reversing) partial transformations on an n-element chain. Both ones are subsemigroups of the important semigroup of all partial transformations on an n-element set. The maximal subsemigroups of IOn where already classified by other authors. This paper arises the natural question for the maximal subsemigroups of the ideals of IOn as well as of IMn. For each ideal of IOn, we characterize the maximal subsemigroups and calculate the number of all of them. Note, a proper ideal of IOn consists of all partial transformations in IOn with rank at most r for a suitable natural number r < n, denoted by I(n,r). In the second part of this paper, we show first that the *J*-class of IMn, consisting of all partial transformations with rank r, generates the ideal I(n,r), namely by the order-preserving partial transformations with rank r and an order-reversing partial transformation with rank r. Then we give a complete description of the maximal subsemigroups of the ideals of IMn. For a given ideal of IMn, there are three types of maximal subsemigroups, where the number of all of the maximal subsemigroups is easy to calculate. Additional, we give a classification of the maximal subsemigroups of IMn.

(15) Koppitz, J., *All Reg-solid varieties of commutative semigroups*, Semigroup Forum 78, No. 1(2009), 148-156.
Zbl 117220042 (Reviewer: Mikhail Volkov)
Impact factor 2009: 0,597

Abstract

Each semigroup word w in two variables, say x1 and x2, generates a binary associative operation wS on a semigroup S. This new semigroup (S; wS) is called derived semigroup from S under w. A variety of semigroups is called solid if it contains with each semigroup S also the derived semigroups of S, under all semigroup words in {x1, x2}. The complete lattice of all solid varieties was complete classified by L. Polak. A variety is called regular-solid if it contains with any semigroup S also the derived semigroup of S under any semigroup word built up by both variables x1 and x2. In this paper, we classify all regular-solid varieties of commutative semigroups. In particular, we determine the greatest regular-solid variety VRC of commutative semigroups.

We prove that the subvariety lattice of VRC coincides with the complete lattice of all regular-solid varieties of commutative semigroups. It is known that VRC has to be the join of a locally nilpotent variety and a variety generated by monoids. We give an identity base for both varieties. The latter one is the variety of all semilattices. Finally, we provide an identity base for all of the regular-solid varieties of commutative semigroups.

(16) Dimitrova, I. and Koppitz, J., *On the Maximal Subsemigroups of Some Transformation Semigroups*, Asian-European Journal of Mathematics Vol.1, No. 2(2008), 189-202.
Zbl 114620045

Abstract

This paper deals with two transformation semigroups, namely with the semigroup On of all order-preserving transformations and with the semigroup Mn of all monotone (i.e. order-preserving or order-reversing) transformations on an n-element chain. The maximal subsemigroups of On as well as of Mn are already determined by other authors. We are asking for the maximal subsemigroups of the ideals of On and Mn, respectively. This paper gives a complete description of these ones. There are three types of maximal subsemigroups of On and two types of maximal subsemigroups of Mn. Further, we show that there is a one-to-one correspondence between the maximal subsemigroups of any ideal of On and the maximal subsemigroups of a corresponding ideal of the semigroup of transformations on an n-element set. The latter ones were already determined by other authors. A further interesting result in this paper shows that the ideals of Mn are generated by the *J*-classes.

Научноизследователска дейност:

1. Участия с доклади в международни научни форуми *(виж Приложение 4 или Conferences.pdf)*
Участвал съм с доклади на над 40 международни конференции.

2. Участия в програмни и организационни комитети *(виж Приложение 5 или Organizing_committees.pdf)*
- член на програмния комитет на 5^{th} International Conference FMNS - 2013 (Mathematics section), Blagoevgrad 2013;
- член на организационния комитет на Workshop on General Algebra: **№82** (2011), **№77** (2009), **№69** (2005), **№67** (2004), **№65** (2003).

3. Участия в редколегии на научни издания *(виж Приложение 6 или Editors.pdf)*
Член на научната редколегия на списанията:
- Asian-European Journal of Mathematics, World Scientific, Singapore;
- Discussiones Mathematicae, General Algebra and Applications, Poland.

4. Ръководство и участие в проекти *(виж Приложение 7 или Projects.pdf)*
- ръководител на един международен проект, 2009 г.;
- член на 4 международни проекта, 2016 г., 2009 г., 2008 г. и 1996 г.

5. Четени лекции и семинари в чуждестранни университети *(виж Приложение 8 или Lectures_abroad.pdf)*
Изнасял съм лекции по покана в Университета в Лисабон (Португалия), в Бърно (Чехия), в Сегед (Унгария) и в Благоевград (България).

6. Рецензии в реферирани списания, книги, монографии и др.
Писал съм редовно рецензии за международни реферирани списания.

Преподавателска дейност

Преподавателската ми дейност е изцяло в Университета в Потсдам, Германия. Водил съм лекционни курсове по 11 различни дисциплини и семинарни упражнения по 8 различни дисциплини *(виж Приложение 9 или Lectures_Potsdam.pdf)*. Бил съм научен ръководител на 5 успешно защитили докторанти, които работят като доценти и асистенти в различни университети. В момента съм научен ръководител на двама докторанти *(виж Приложение 10 или PhD_students.pdf)*.

28.01.2017 г. Изготвил:
Потсдам /д.м.н. Йорг Копиц/