Review Article

Junying Guo and Xiaojiang Guo*

Semiprimeness of semigroup algebras

Abstract: Abundant semigroups originate from p.p. rings and are generalizations of regular semigroups. The main aim of this paper is to study the primeness and the primitivity of abundant semigroup algebras. We introduce and study $\mathcal{D}^*$-graphs and Fountain matrices of a semigroup. Based on $\mathcal{D}^*$-graphs and Fountain matrices, we determine when a contracted semigroup algebra of a primitive abundant semigroup is prime (respectively, semiprime, semiprimitive, or primitive). It is well known that for any algebra $\mathcal{A}$ with unity, $\mathcal{A}$ is primitive (prime) if and only if so is $M_n(\mathcal{A})$. Our results can be viewed as some kind of generalizations of such a known result. In addition, it is proved that any contracted semigroup algebra of a locally ample semigroup whose set of idempotents is locally finite (respectively, locally pseudofinite and satisfying the regularity condition) is isomorphic to some contracted semigroup algebra of primitive abundant semigroups. Moreover, we obtain sufficient and necessary conditions for these classes of contracted semigroup algebras to be prime (respectively, semiprime, semiprimitive, or primitive). Finally, the structure of simple contracted semigroup algebras of idempotent-connected abundant semigroups is established. Our results enrich and extend the related results on regular semigroup algebras.

Keywords: semigroup algebra, semiprimitive algebra, semiprime algebra, locally ample semigroup, primitive abundant semigroup, complete quiver

MSC 2020: 20M25, 16S36

1 Introduction

The primitivity and the primeness are important properties in the theory of algebras. Let $\mathcal{A}$ be an algebra over a field K. It is well known that if $\mathcal{A}$ is semisimple as a right $\mathcal{A}$-module, then it must be semiprimitive (semiprime), but not every semiprimitive (semiprime) algebra is semisimple. In particular, if $\mathcal{A}$ is a finite dimensional algebra over a field, then $\mathcal{A}$ is semisimple if and only if it is semiprimitive (semiprime).

It is well known that the class of semiprimitive semigroup algebras has contributed to solutions of various difficult problems. For example, in [1], a semiprimitive semigroup algebra was used to answer a question of Kegel [2]: whether every ring must be nil if it is the sum of two nil or locally nilpotent subrings? The semiprimitivity of inverse semigroup algebras over a field has been investigated (see [3]). It is shown that a finite inverse semigroup algebra over a field is semisimple if and only if the group algebra of each of its maximal subgroups is semisimple (see [4,5]). In [6], Domanov proved that if F is a field and S is an inverse semigroup such that $F[G]$ is semiprimitive for each maximal subgroup G of S, then $F[S]$ is semiprimitive. This result is also true by replacing F by an arbitrary commutative ring R with unity and replacing $F_0[S]$ by $R_0[S]$ if we let S have a zero element [7, Theorem 4.2]. These results have been generalized to rings faithfully graded by inverse semigroups (see [8–10] and [11, Section 4.3]). Recently, Ji [12], and Ji and Luo [13]

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Semigroup Algebras

Robert R. Redfield

Semigroup Algebras:

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understanding of the structure of special classes of rings The aim of this book is to introduce the reader to some modern developments in Lie algebras quantum groups Hopf algebras and algebraic groups non commutative algebraic geometry representation theory of finite groups and cohomology the structure of special classes of rings **Semigroups and Automata** Uno Kaljulaid,2006 This volume provides a selection of previously published papers and manuscripts of Uno Kaljulaid an eminent Estonian algebraist of the last century The central part of the book is the English translation of Kaljulaid s 1979 Candidate thesis which originally was typewritten in Russian and manufactured in not so many copies The thesis is devoted to representation theory in the spirit of his thesis advisor B I Plotkin representations of semigroups and algebras especially extension to this situation and application of the notion of triangular product of representations for groups introduced by Plotkin Through representation theory Kaljulaid became also interested in automata theory which at a later phase became his main area of interest Another field of research concerns combinatorics Besides being an outstanding and most dedicated mathematician Uno Kaljulaid was also very much interested in the history of mathematics In particular he took a vivid interest in the life and work of the great 19th century Dorpat Tartu algebraist Th Molien Kaljulaid was also very interested in teaching and exposition or popularization of mathematics Some of his more popular scientific papers were published in an Estonian language journal Matemaatika ja Kaasaeg Mathematics and Our Age Among them there is a whole series of papers about algebraic matters culminating in a brilliant elementary although partly rather philosophical essay devoted to Galois theory Another such series is his excellent essay of Diophantine Geometry in various installments followed by his loge to another of his teachers Yu I Manin It is believed that the inclusion of these papers here will make it more interesting for beginners and perhaps even contribute to attracting young people to mathematics *Semigroups Of Matrices* Jan Okninski,1998-07-31 This book is concerned with the structure of linear semigroups that is subsemigroups of the multiplicative semigroup Mn K of n n matrices over a field K or more generally skew linear semigroups if K is allowed to be a division ring and its applications to certain problems on associative algebras semigroups and linear representations It is motivated by several recent developments in the area of linear semigroups and their applications It summarizes the state of knowledge in this area presenting the results for the first time in a unified form The book s point of departure is a structure theorem which allows the use of powerful techniques of linear groups Certain aspects of a combinatorial nature connections with the theory of linear representations and applications to various problems on associative algebras are also discussed

Symbolic Computation: Solving Equations in Algebra, Geometry, and Engineering Edward L. Green,2001 This volume presents the proceedings from the research conference Symbolic Computation Solving Equations in Algebra Analysis and Engineering held at Mount Holyoke College USA It provides an overview of contemporary research in symbolic computation as it applies to the solution of polynomial systems The conference brought together pure and applied mathematicians computer scientists and engineers who use symbolic computation to solve systems of equations or who

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