

The restricted Burnside problem for Moufang loops

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(Received 20 April 2020; revised 14 June 2021; accepted 7 April 2021)

Dedicated to the memory of Peter Plaumann

Abstract

We prove that for positive integers $m \geq 1$, $n \geq 1$ and a prime number $p \neq 2, 3$ there are finitely many finite m -generated Moufang loops of exponent p^n .

2020 Mathematics Subject Classification: 20N05 (Primary); 17D10 (Secondary)

1. Introduction

A loop U is called a *Moufang loop* if it satisfies the following identities:

$$((zx)y)x = z((xy)x) \text{ and } x(y(xz)) = (x(yx))z.$$

In this paper we solve the restricted Burnside problem for Moufang loops of exponent p^n , $p > 3$.

THEOREM 1. *For an arbitrary prime power p^n , $p > 3$, there exists a function $f(m)$ such that any finite m -generated Moufang loop of exponent p^n has order $< f(m)$.*

For groups this assertion was proved by E. Zelmanov ([20, 21]). For Moufang loops of prime exponent it was proved by A. Grishkov [6] (if $p \neq 3$) and G. Nagy [15] (if $p = 3$).

[†]Corresponding author

Restricted Burnside Problem

Louis Halle Rowen



Restricted Burnside Problem:

The Restricted Burnside Problem Michael Vaughan-Lee, 1990 In 1902 William Burnside wrote A still undecided point in the theory of discontinuous groups is whether the order of a group may not be finite while the order of every operation it contains is finite Since then the Burnside problem in different guises has inspired a considerable amount of research One variant of the Burnside problem the restricted Burnside problem asks whether for a given r and n there is a bound on the orders of finite r generator groups of exponent n This book provides the first comprehensive account of the many recent results in this area By making extensive use of Lie ring techniques it allows a uniform treatment of the field and includes Kostrikin's theorem for groups of prime exponent as well as detailed information on groups of small $3, 4, 5, 6, 7, 8, 9$ exponent The treatment is intended to be self contained and as such will be an invaluable introduction for postgraduate students and research workers Included are extensive details of the use of computer algebra to verify computations [The Restricted Burnside Problem for Groups of Exponent \$p\$](#) John Bishop Gordon, 1964 **On the Restricted Burnside Problem and Theorems Like Sanov's** Eugene F. Krause, 1963 *The Restricted Burnside Problem for Prime Exponent* John Richard Peyton, 1973 [Around Burnside](#) A.I. Kostrikin, 2012-12-06 Perhaps it is not inappropriate for me to begin with the comment that this book has been an interesting challenge to the translator It is most unusual in a text of this type in that the style is racy with many literary allusions and witticisms not the easiest to translate but a source of inspiration to continue through material that could daunt by its combinatorial complexity Moreover there have been many changes to the text during the translating period reflecting the ferment that the subject of the restricted Burnside problem is passing through at present I concur with Professor Kostrikin's Note in Proof where he describes the book as fortunate I would put it slightly differently its appearance has surely been partly instrumental in inspiring much endeavour including such things as the paper of A I Adian and A A Razborov producing the first published recursive upper bound for the order of the universal finite group $B(d, p)$ of prime exponent the English version contains a different treatment of this result due to E I Zelmanov M R Vaughan Lee's new approach to the subject and finally the crowning achievement of Zelmanov in establishing RBP for all prime power exponents thereby via the classification theorem for finite simple groups and Hall Higman settling it for all exponents The book is encyclopaedic in its coverage of facts and problems on RBP and will continue to have an important influence in the area *On Varieties Arising from the Solution of the Restricted Burnside Problem* Pavel Shumyatsky, 2001 **Proceedings of the International Conference on Algebra 2010** Wanida Hemakul, Sri Wahyuni, Polly Wee Sy, 2012 This volume is an outcome of the International Conference on Algebra in celebration of the 70th birthday of Professor Shum Kar Ping which was held in Gadjah Mada University on 7-10 October 2010 As a consequence of the wide coverage of his research interest and work it presents 54 research papers all original and referred describing the latest research and development and addressing a variety of issues and methods in semigroups groups rings and modules lattices and Hopf Algebra The book also

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Computational Problems in Abstract Algebra John Leech, 2014-05-17 Computational Problems in Abstract Algebra provides information pertinent to the application of computers to abstract algebra This book discusses combinatorial problems dealing with things like generation of permutations projective planes orthogonal latin squares graphs difference sets block designs and Hadamard matrices Comprised of 35 chapters this book begins with an overview of the methods utilized in and results obtained by programs for the investigation of groups This text then examines the method for establishing the order of a finite group defined by a set of relations satisfied by its generators Other chapters describe the modification of the Todd Coxeter coset enumeration process This book discusses as well the difficulties that arise with multiplication and inverting programs and of some ways to avoid or overcome them The final chapter deals with the computational problems related to invariant factors in linear algebra Mathematicians as well as students of algebra will find this book useful *Computational and Geometric Aspects of Modern Algebra* Michael D. Atkinson, Michael Atkinson, 2000-06-15 This book comprises a collection of papers from participants at the IMCS Workshop on Computational and Geometric Aspects of Modern Algebra held at Heriot Watt University in 1998 Written by leading researchers the papers cover a wide range of topics in the vibrant areas of word problems in algebra and geometric group theory This book represents a timely record of recent work and provides an indication of the key areas of future development **The Theory of Groups** Marshall Hall, 2018-01-10 This 1959 text offers an unsurpassed resource for learning and reviewing the basics of a fundamental and ever expanding area This remarkable book undoubtedly will become a standard text on group theory American Scientist **Finite and Locally Finite Groups** B. Hartley, G.M. Seitz, A.V. Borovik, R.M. Bryant, 2012-12-06 This volume contains the proceedings of the NATO Advanced Study Institute on Finite and Locally Finite Groups held in Istanbul Turkey 14-27 August 1994 at which there were about 90 participants from some 16 different countries The ASI received generous financial support from the Scientific Affairs Division of NATO INTRODUCTION A locally finite group is a group in

which every finite set of elements is contained in a finite subgroup The study of locally finite groups began with Schur's result that a periodic linear group is in fact locally finite The simple locally finite groups are of particular interest In view of the classification of the finite simple groups and advances in representation theory it is natural to pursue classification theorems for simple locally finite groups This was one of the central themes of the Istanbul conference and significant progress is reported herein The theory of simple locally finite groups intersects many areas of group theory and representation theory so this served as a focus for several articles in the volume Every simple locally finite group has what is known as a Kegel cover This is a collection of pairs G_i where $i \in I$ where I is an index set each group G_i is finite $i \in I$

Monoids And Semigroups With Applications - Proceedings Of The Berkeley Workshop In Monoids John Rhodes, 1991-03-06 The purpose of the Berkeley Workshop on Monoids was to give expository talks by the most qualified experts in the emerging main areas of monoid and semigroup theory including applications to theoretical computer science This was supplemented with current research papers The topics covered in an accessible way for the mathematical and theoretical computer community were Kernels and expansions in semigroup theory Implicit operations Inverse monoids Varieties of semigroups and universal algebra Linear semigroups and monoids of Lie type Monoids acting on trees Synthesis theorem regular semigroups and applications Type II conjecture Application to theoretical computer science and decision problems

The Concise Handbook of Algebra Alexander V. Mikhalev, G.F. Pilz, 2013-06-29 It is by no means clear what comprises the heart or core of algebra the part of algebra which every algebraist should know Hence we feel that a book on our heart might be useful We have tried to catch this heart in a collection of about 150 short sections written by leading algebraists in these areas These sections are organized in 9 chapters A B I Of course the selection is partly based on personal preferences and we ask you for your understanding if some selections do not meet your taste for unknown reasons we only had problems in the chapter Groups to get enough articles in time We hope that this book sets up a standard of what all algebraists are supposed to know in their chapters interested people from other areas should be able to get a quick idea about the area So the target group consists of anyone interested in algebra from graduate students to established researchers including those who want to obtain a quick overview or a better understanding of our selected topics The prerequisites are something like the contents of standard textbooks on higher algebra This book should also enable the reader to read the big Handbook Hazewinkel 1999 and other handbooks In case of multiple authors the authors are listed alphabetically so their order has nothing to do with the amounts of their contributions

Encyclopaedia of Mathematics Michiel Hazewinkel, 2012-12-06 This ENCYCLOPAEDIA OF MATHEMATICS aims to be a reference work for all parts of mathematics It is a translation with updates and editorial comments of the Soviet Mathematical Encyclopaedia published by Soviet Encyclopaedia Publishing House in five volumes in 1977-1985 The annotated translation consists of ten volumes including a special index volume There are three kinds of articles in this ENCYCLOPAEDIA First of all there are survey type articles dealing with the various main directions in

mathematics where a rather fine subdivision has been used. The main requirement for these articles has been that they should give a reasonably complete up to date account of the current state of affairs in these areas and that they should be maximally accessible. On the whole these articles should be understandable to mathematics students in their first specialization years to graduates from other mathematical areas and depending on the specific subject to specialists in other domains of science, engineers and teachers of mathematics. These articles treat their material at a fairly general level and aim to give an idea of the kind of problems, techniques and concepts involved in the area in question. They also contain background and motivation rather than precise statements of precise theorems with detailed definitions and technical details on how to carry out proofs and constructions. The second kind of article of medium length contains more detailed concrete problems, results and techniques.

Encyclopaedia of Mathematics M. Hazewinkel, 2013-12-01 *Graduate Algebra: Noncommutative View* Louis Halle Rowen, 2008. This book is an expanded text for a graduate course in commutative algebra focusing on the algebraic underpinnings of algebraic geometry and of number theory. Accordingly the theory of affine algebras is featured, treated both directly and via the theory of Noetherian and Artinian modules and the theory of graded algebras is included to provide the foundation for projective varieties. Major topics include the theory of modules over a principal ideal domain and its applications to matrix theory including the Jordan decomposition, the Galois theory of field extensions, transcendence degree, the prime spectrum of an algebra, localization and the classical theory of Noetherian and Artinian rings. Later chapters include some algebraic theory of elliptic curves featuring the Mordell-Weil theorem and valuation theory including local fields. One feature of the book is an extension of the text through a series of appendices. This permits the inclusion of more advanced material such as transcendental field extensions, the discriminant and resultant, the theory of Dedekind domains and basic theorems of rings of algebraic integers. An extended appendix on derivations includes the Jacobian conjecture and Makar-Limanov's theory of locally nilpotent derivations. Gröbner bases can be found in another appendix. Exercises provide a further extension of the text. The book can be used both as a textbook and as a reference source.

Advances in Algebra and Combinatorics - Proceedings of the Second International Congress in Algebra and Combinatorics K. P. Shum, 2008. This volume is a compilation of lectures on algebras and combinatorics presented at the Second International Congress in Algebra and Combinatorics. It reports on not only new results but also on open problems in the field. The proceedings volume is useful for graduate students and researchers in algebras and combinatorics. Contributors include eminent figures such as V. Artamonov, L. Bokut, J. Fountain, P. Hilton, M. Jambu, P. Kolesnikov, Li Wei and K. Ueno.

Algebra and Number Theory Martyn R. Dixon, Leonid A. Kurdachenko, Igor Ya. Subbotin, 2010-09-27. Explore the main algebraic structures and number systems that play a central role across the field of mathematics. Algebra and number theory are two powerful branches of modern mathematics at the forefront of current mathematical research and each plays an increasingly significant role in different branches of mathematics from geometry and topology to computing and

communications Based on the authors extensive experience within the field Algebra and Number Theory has an innovative approach that integrates three disciplines linear algebra abstract algebra and number theory into one comprehensive and fluid presentation facilitating a deeper understanding of the topic and improving readers retention of the main concepts The book begins with an introduction to the elements of set theory Next the authors discuss matrices determinants and elements of field theory including preliminary information related to integers and complex numbers Subsequent chapters explore key ideas relating to linear algebra such as vector spaces linear mapping and bilinear forms The book explores the development of the main ideas of algebraic structures and concludes with applications of algebraic ideas to number theory Interesting applications are provided throughout to demonstrate the relevance of the discussed concepts In addition chapter exercises allow readers to test their comprehension of the presented material Algebra and Number Theory is an excellent book for courses on linear algebra abstract algebra and number theory at the upper undergraduate level It is also a valuable reference for researchers working in different fields of mathematics computer science and engineering as well as for individuals preparing for a career in mathematics education

New Horizons in pro- p Groups Marcus du Sautoy, Dan Segal, Aner Shalev, 2012-12-06 A pro p group is the inverse limit of some system of finite p groups that is of groups of prime power order where the prime conventionally denoted p is fixed Thus from one point of view to study a pro p group is the same as studying an infinite family of finite groups but a pro p group is also a compact topological group and the compactness works its usual magic to bring infinite problems down to manageable proportions The p adic integers appeared about a century ago but the systematic study of pro p groups in general is a fairly recent development Although much has been dis covered many avenues remain to be explored the purpose of this book is to present a coherent account of the considerable achievements of the last several years and to point the way forward Thus our aim is both to stimulate research and to provide the comprehensive background on which that research must be based The chapters cover a wide range In order to ensure the most authoritative account we have arranged for each chapter to be written by a leading contributor or contributors to the topic in question Pro p groups appear in several different though sometimes overlapping contexts

Unveiling the Energy of Verbal Art: An Mental Sojourn through **Restricted Burnside Problem**

In a global inundated with displays and the cacophony of instantaneous communication, the profound energy and mental resonance of verbal artistry frequently fade into obscurity, eclipsed by the regular onslaught of noise and distractions. Yet, set within the musical pages of **Restricted Burnside Problem**, a charming function of fictional brilliance that impulses with raw thoughts, lies an memorable journey waiting to be embarked upon. Composed by a virtuoso wordsmith, this interesting opus guides visitors on an emotional odyssey, softly exposing the latent potential and profound impact stuck within the complex internet of language. Within the heart-wrenching expanse of the evocative examination, we can embark upon an introspective exploration of the book is key themes, dissect their fascinating publishing fashion, and immerse ourselves in the indelible impact it leaves upon the depths of readers souls.

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