# String Rewriting Systems

* **String rewriting systems** are usually specified by:
  * Some rewriting mechanism,
  * Some base of simple (accepted) words.
* Let us introduce **two special symbols** that do not belong to our alphabet $\Sigma$:
  * ¢ left sentinel,
  * $ right sentinel.

# String Rewriting Systems

**Daniel S. Hono (II)**

**String Rewriting Systems:**

*String-Rewriting Systems* Ronald V. Book,Friedrich Otto,2012-12-06 The subject of this book is string rewriting systems It is generally accepted that string rewriting was first introduced by Axel Thue in the early part of this century In the 1960 s and early 1970 s it received renewed attention due to interest in formal language theory In the 1980 s and 1990 s it has received more interest since it can be viewed as a special case of term rewriting a subject that has become important in the study of automated deduction Today string rewriting is studied by researchers in theoretical computer science and also by researchers interested in the foundations of artificial intelligence A sketch of the way that the subject has developed is contained in Chapter 0 and the reader is advised to begin with that chapter Both authors have been active in the field and have lectured on the subject in several universities Lecture notes have been produced and dis tributed This monograph is a result of revising and rewriting those notes It represents an attempt by the authors to present the concepts that the authors consider to be most fundamental and to gather together the most useful results in such a way that they can be understood and used in studies relating to more general rewriting to automated deduction and to algo rithmic problems of algebraic structures This monograph is written for independent study by researchers in the oretical computer science or in the foundations of artificial intelligence **String-Rewriting Systems** Ronald V Book,Friedrich Otto,1998-02-18 Confluent String Rewriting Matthias Jantzen,2012-12-06 Replacement systems such as term rewriting systems tree manipulat ing systems and graph grammars have been used in Computer Science in the context of theorem proving program optimization abstract data types algebraic simplification and symbolic comput ation Replacement systems for strings arose about seventy years earlier in the area of combinatory logic and group theory The most natural and appropriate formalism for dealing with string rewriting is the notion of a semi Thue system and this monograph treats its central aspects The reduction relation is here defined firstly by the direction of the rules and secondly by some metric that yields efficient algorithms These systems are general enough to discuss the basic notions of arbitrary replacement systems such as termination confluence and the Church Rosser property in its original meaning Confluent semi Thue systems in which each and every derivation consists of finitely many steps only are called complete they guarantee the existence of unique normal forms as canonical representatives of the Thue congruence classes Each such system can be considered a nondeterministic algorithm for the word problem which works correctly without backtracking This is often conceptually simpler and more elegant than an ad hoc construction In many cases a replace ment system can be altered to a complete system by the Knuth Bendix completion method **Match-Bounded String Rewriting Systems** National Aeronautics and Space Administration (NASA),2018-06-21 We introduce a new class of automated proof methods for the termination of rewriting systems on strings The basis of all these methods is to show that rewriting preserves regular languages To this end letters are annotated with natural numbers called match heights If the minimal height of all positions in a redex is h 1 then every position in the reduct

will get height h 1 In a match bounded system match heights are globally bounded Using recent results on deleting systems we prove that rewriting by a match bounded system preserves regular languages Hence it is decidable whether a given rewriting system has a given match bound We also provide a sufficient criterion for the abence of a match bound The problem of existence of a match bound is still open Match boundedness for all strings can be used as an automated criterion for termination for match bounded systems are terminating This criterion can be strengthened by requiring match boundedness only for a restricted set of strings for instance the set of right hand sides of forward closures Geser Alfons and Hofbauer Dieter and Waldmann Johannes Langley Research Center NASA CR 2003 212685 NIA 2003 09 **Decision Problems for String Rewriting Systems** Robert Cremanns,1997 *On LM-systems and Forward Closed String Rewriting Systems* Daniel S. Hono (II),2018 <u>Match-Bounded String Rewriting Systems</u> Alfons Geser,Nasa Technical Reports Server (Ntrs),Et Al,2013-07 We introduce a new class of automated proof methods for the termination of rewriting systems on strings The basis of all these methods is to show that rewriting preserves regular languages To this end letters are annotated with natural numbers called match heights If the minimal height of all positions in a redex is h 1 then every position in the reduct will get height h 1 In a match bounded system match heights are globally bounded Using recent results on deleting systems we prove that rewriting by a match bounded system preserves regular languages Hence it is decidable whether a given rewriting system has a given match bound We also provide a sufficient criterion for the abence of a match bound The problem of existence of a match bound is still open Match boundedness for all strings can be used as an automated criterion for termination for match bounded systems are terminating This criterion can be strengthened by requiring match boundedness only for a restricted set of strings for instance the set of right hand sides of forward closures **Algebraic Engineering - Proceedings Of The First International Conference On Semigroups And Algebraic Eng And Workshop On For** Chrystopher L Nehaniv,Masami Ito,1999-05-14 There is algebraic structure in time computation and biological systems Algebraic engineering exploits this structure to achieve better understanding and design In this book pure and applied results in semigroups language theory and algebra are applied to areas ranging from circuit design to software engineering to biological evolution *Sequentially-closed and Forward-closed String Rewriting Systems* Yu Zhang (Ph. D. in computer science),2020 *Termination Proofs for String Rewriting Systems Via Inverse Match-Bounds* National Aeronautics and Space Administration (NASA),2018-06-21 Annotating a letter by a number one can record information about its history during a reduction A string rewriting system is called match bounded if there is a global upper bound to these numbers In earlier papers we established match boundedness as a strong sufficient criterion for both termination and preservation of regular languages We show now that the string rewriting system whose inverse left and right hand sides exchanged is match bounded also have exceptional properties but slightly different ones Inverse match bounded systems effectively preserve context free languages their sets of normalized strings and their sets of immortal strings are effectively

regular These sets of strings can be used to decide the normalization the termination and the uniform termination problems of inverse match bounded systems We also show that the termination problem is decidable in linear time and that a certain strong reachability problem is deciable thus solving two open problems of McNaughton s Butler Ricky Technical Monitor and Geser Alfons and Hofbauer Dieter and Waldmann Johannes Langley Research Center NASA CR 2004 213032 NIA 2004 02

**Words, Languages And Combinatorics - Proceedings Of The International Conference** Masami Ito,1992-01-27 The topics included in this proceedings cover both mathematics and computer science They include Codes Free Monoids Transformation Semigroups Automata Formal Languages Word Problems Orders and Combinatorics Attention is paid to the algebraic theories of codes and rewriting systems which are the key subjects that combine these two fields The number of papers in the proceedings exceeds 45 and all papers have been refereed **String Rewriting Systems and Associated Finiteness Conditions** S. McGlashan,2002 *Advances in Algorithms, Languages, and Complexity* Ding-Zhu Du,Ker-I Ko,Ronald V. Book,1997-02-28 This book contains a collection of sixteen survey papers on recent developments in algorithms formal languages and computational complexity These are the three areas in which Professor Ronald V Book has made significant contributions and the objective of the editors and the contributors is to honor Professor Book on his sixtieth birthday Audience Researchers and graduate students with interests in design and analysis of algorithms in language theory and in computational complexity **Deleting String Rewriting Systems Preserve Regularity** Dieter Hofbauer,Johannes Waldmann,2003 *Thue congruences and complete string rewriting systems* Matthias Jantzen,1985 **TAPSOFT** ,1991

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Decoding **String Rewriting Systems**: Revealing the Captivating Potential of Verbal Expression

In a time characterized by interconnectedness and an insatiable thirst for knowledge, the captivating potential of verbal expression has emerged as a formidable force. Its capability to evoke sentiments, stimulate introspection, and incite profound transformations is genuinely awe-inspiring. Within the pages of "**String Rewriting Systems**," a mesmerizing literary creation penned by a celebrated wordsmith, readers set about an enlightening odyssey, unraveling the intricate significance of language and its enduring impact on our lives. In this appraisal, we shall explore the book is central themes, evaluate its distinctive writing style, and gauge its pervasive influence on the hearts and minds of its readership.

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