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Solution of subsonic rotational nonviscous flow in three-dimensional axially symmetric channels [Abstract of thesis]

Commentationes Mathematicae Universitatis Carolinae, Vol. 31 (1990), No. 1, 195--196

Persistent URL: http://dml.cz/dmlcz/106845

regular ring of cardinality $\aleph_1$, then R is a $\otimes$–ring iff R is simple and completely reducible.

In chapter 2, the notion of a Whitehead property of modules is introduced. A ring is said to be a left Ext–ring if each module has the Whitehead property. The following result is proved: a ring R is a left artinian left non–singular left Ext–ring iff $R = S$ or $R = T$ or $R = S \boxplus T$, where S is a completely reducible ring and there is a division ring K such that the ring T is Morita equivalent to the ring of all upper triangular matrices of degree 2 over K.

The main result of chapter 3 states that if R is a simple countable regular ring such that R is not completely reducible, then the assertion "every countable module has the Whitehead property" is independent of ZFC + GCH.

BEHAVIOUR OF FINITE AUTOMATA IN INFINITE ENVIRONMENT

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(27.9.1989, supervisors B.Novák, A.Pultr)

An algebraic theory of formal languages is presented. It can be locked on as a first order axiomatic theory.

The properties of the ordered monoid of all formal languages over a given set are investigated. Such an ordered monoid is called a babylon. Several types of morphisms among babylons are studied. Some of them are standard (homomorphism, substitution), others are new. A relation similar to the Galois connection is introduced; and found useful.

Systems of linear equations in babylons are considered. This leads to a theorem which generalizes both the theorem "an inverse homomorphism preserves regular languages" and the theorem "a two–way automaton accepts a regular language".

A characterization of the behaviour of the finite automaton in the Abelian group with two pebbles is given. This generalizes the folklore case the Abelian group being $\mathbb{Z}^2$.

SOLUTION OF SUBSONIC ROTATIONAL NONVISCOUS FLOW IN THREE–DIMENSIONAL AXIALLY SYMMETRIC CHANNELS

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(28.9.1989, supervisors J.Polášek, M.Feistauer, J. Citavý)

The thesis is concerned with the mathematical study of a stationary, subsonic, generally rotational flow of an ideal fluid in three-dimensional axially symmetric channels. The author formulates the physical situation as a two–dimensional boundary value problem for the stream function which satisfies a nonlinear, elliptic partial differential equation. The essence of the work lies in a profound theoretical analysis of the weak formulation of the mentioned boundary value problem supplemented by some numerical results.

The finite element method is used for the discretization, firmly linear triangular elements. Detailed investigation of the discrete problem properties leads to two

existence proofs: of an approximate solution and of a limit to the sequence formed by the approximate solutions. The limit is a solution of the boundary value problem in a weak sense, too.

Numerical realization of the discrete problem is the application of the least square method and the conjugate gradient method. Some computed results are compared with those obtained by another similar numerical model of an ideal fluid flow and with experimental data. Finally, on the basis of this comparison, the areas of the practical application of the model described are defined.

AN ERROR RECOVERY METHOD FOR TRANSLATIONS OF LL(1)-LANGUAGES

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The thesis is devoted to the study of error recovery methods for a syntactical analysis of deterministic context–free languages. It describes a new recovery method using the so–called skeletal set which is applicable to a top–down syntactical analysis of LL(1)–languages. The work contains a complete description of the method, a theoretical proof of its correctness and also all necessary algorithms for the realization of the method including their time efficiency estimates.

The starting point of this thesis is a general case of the error recovery method using the skeletal set presented by Chytil and Demner two years ago. The algorithms for the construction of recovery tables are very slow and complicated in the general case. Therefore they are not usable in practice in compilers. The creation of some important improvements of the original general method is the first result of this thesis. Using these new improvements, the process of the error recovery is more fast and simple.

The main contribution of this work is development of the recovery method for the case of LL(1)–languages. New efficient polynomial time consuming algorithms are created and described. Using our algorithms, the new error recovery method can be easily realized in compilers. The generation of all necessary recovery tables is then fully automatic.

The use of the new error recovery method in a compiler brings many advantages in comparison with other methods. The error recovery process is very fast. The syntactical analysis of correct parts in a compiled program is not delayed by our recovery method. The error messages ar very exact and intelligible. Any possibility of a compiler collapse during the syntactical analysis or announcements of non–existent syntactic errors are fully eliminated.

The next result of this thesis is the creation of some programs realizing all developed algorithms. These programs show how easy is the program realization of the new error recovery method.