ABSTRACT AND REFERENCES

INFORMATION TECHNOLOGY: INDUSTRY CONTROL SYSTEMS

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A SOLUTION FOR SYNCHRONOUS INCREMENTAL MAINTENANCE OF MATERIALIZED VIEWS BASED ON SQL RECURSIVE QUERY (p. 6-17)

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Materialized views are excessively stored query execution results in the database. They can be used to partially or completely answer queries which will be further appeared instead of re-executing query from the scratch. There is a large number of published works that address the maintenance, especially incremental update, of materialized views and query rewriting for using those ones. Some of them support materialized views based on recursive query in datalog language. Although most of datalog queries can be transferred into SQL queries and vise versa but it is not the case for recursive queries. Recursive queries in the data log try to find all possible transitive closures. Recursive queries in SQL (Common Table Expression – CTE) return direct links but not transitive closures. In this paper, we propose efficient methods for incremental update of materialized views based on CTE; and then propose an algorithm for generating source codes in C language for any input SQL recursive queries. The synthesized source codes implement our proposed incremental update algorithms according to inserted/deleted/updated record set in the base tables. This paper focuses mainly on the recursive queries whose execution results are directed tree-structured data. The two cases of tree node are considered. In the first case, a child node has only one parent node and in the second case, a child node can have many parent nodes. Those two cases represent the two types of relationships between entities in real world, that are one–to–many and many–to–many, respectively. For the one–to–many relationships, the relationship data is accompanied with the records describing the child using some fields. Those fields are set as null in deleting a concrete relationship. For the many–to–many relationships, it is stored in a separate table and the concrete relationships are removed by deleting describing records from that table. Considering of enforcing referential integrity may help to reduce the searching space and therefore, help to improve the performance. However, the set of tree nodes or tree edges can be manipulated. All those combinations lead to different algorithms. The experimental results are provided and discussed to confirm the effectiveness of our proposed methods.

Keywords: materialized view; SQL recursive query; CTE; incremental update; source code generating.

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DEVELOPMENT OF INTELLIGENT DEMOGRAPHIC FORECASTING SYSTEM (p. 18-25)

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The scientific methodological and functional principles of the intelligent decision support system for the management of demographic situation based on predictions are developed. Predictions (prognosis) of the changes in the number of the population, its age-gender structure, birth, life expectancy, mortality, etc. constitute the basis of socio-economic development. Thus, the modeling of demographic processes is considered for scientifically justified decisions regarding the management of the future demographic situation. The characteristics of the process are analyzed, and the features justifying the occurrence of this process in an uncertainty and fuzzy environment are identified. A fuzzy time series model is proposed for modeling the demographic processes. The demographic prediction technique is developed on the example of prediction of the total number of population. Based on the proposed methodology, software for the demographic forecasting system is developed. The functional scheme of the system is presented, and the working principle of its blocks and their interaction are explained. The working principle of the knowledge base, which executes the analytics of predictions and identifies the predictions related to the demographic situation referring to the knowledge production model, is described. The realization of such a system can support demographers and analysts in predicting the future demographic situation and making decisions on the management of respective demographic situation.

Keywords: demographic processes, population growth, demographic forecasting method, fuzzy time series.

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DEVELOPMENT OF THE ALGORITHM OF KEYWORD SEARCH IN THE KAZAKH LANGUAGE TEXT CORPUS (p. 26-32)

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The issue of semantic text analysis occupies a special place in computational linguistics. Researchers in this field have an increased interest in developing an algorithm that will improve the quality of text corpus processing and probabilistic determination of text content. The results of the study on the application of methods, approaches, algorithms for semantic text analysis in computational linguistics in international and Kazakhstan science led to the development of an algorithm of keyword search in a Kazakh text. The first step of the algorithm was to compile a reference dictionary of keywords for the Kazakh language text corpus. The solution to this problem was to apply the Porter (stemmer) algorithm for the Kazakh language text corpus. The implementation of the stemmer allowed highlighting unique word stems and getting a reference dictionary, which was subsequently indexed. The next step is to collect learning data from the text corpus. To calculate the degree of semantic proximity between words, each word is assigned a vector of the corresponding word forms of the reference dictionary, which results in a pair of a keyword and a vector. And the last step of the algorithm is neural network learning. During learning, the error backpropagation method is used, which allows a semantic analysis of the text corpus and obtaining a probabilistic number of words close to the expected number of keywords. This process automates the processing of text material by creating digital learning models of keywords. The algorithm is used to develop a neurocomputer system that will automatically check the text works of online learners. The uniqueness of the keyword search algorithm is the use of neural network learning for texts in the Kazakh language. In Kazakhstan, scientists in the field of computational linguistics conducted a number of studies based on morphological analysis, lemmatization and other approaches and implemented linguistic tools (mainly translation dictionaries). The scope of neural network learning for parsing of the Kazakh language remains an open issue in the Kazakhstan science.

The developed algorithm involves solving one of the problems of effective semantic analysis of the text in the Kazakh language.

Keywords: keyword, Porter algorithm, semantic analysis, neural network.

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PATTERNS IN FORMING THE ONTOLOGY-BASED ENVIRONMENT OF INFORMATION-ANALYTICAL ACTIVITY IN ADMINISTRATIVE MANAGEMENT (p. 33-42)

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A new paradigm of the formation of the environment of informational-analytical activity in administrative management based

on ontologies was proposed. It was shown that application of this approach makes it possible to formalize domain area and structure the information necessary for analytical activity. It was established that the use of ontological descriptions in the technological chain of analytical activity ensures dynamic formation for the analysis of the respective sets of the criteria based on the use of the properties of concepts of the domain areas, by which appropriate decisions are made. It is noted that the process of solving an analytical problem may represent a certain sequence of ordered tautologies, each of which inherits all the properties of the concepts that make up the tautology that directly precedes it. In turn, this sequence determines the set of possible taxonomies as functional components of the operational environment of informational-analytical activity. To support the work of an analyst, it is proposed to apply the hierarchies of ontologies from the upper level to the subject ontologies, including the intermediate level of the ontology core. The ontology core is expanding through ontological linking of ontology classes to such information resources as classifiers. Correctness and adequacy of such decision is proved by the use of this paradigm to solve the problem of administrative monitoring of socio-economic development of the regions of a country from the state level to local self-government.

Keywords: informational-analytical system, management body, administrative management, information resources, ontology, taxonomy, classifier.

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IMPLANTATION OF INDEXING OPTIMIZATION TECHNOLOGY FOR HIGHLY SPECIALIZED TERMS BASED ON METAPHONE PHONETICAL ALGORITHM (p. 43-50)

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When compiling databases, for example to meet the needs of healthcare establishments, there is quite a common problem with the introduction and further processing of names and last names of doctors and patients that are highly specialized both in terms of pronunciation

and writing. This is because names and last names of people cannot be unique, their notation is not subject to any rules of phonetics, while their length in different languages may not match. With the advent of the Internet, this situation has become generally critical and can lead to that multiple copies of e-mails are sent to one address. It is possible to solve the specified problem by using phonetic algorithms for comparing words Daitch-Mokotoff, Soundex, NYSIIS, Polyphone, and Metaphone, as well as the Levenshtein and Jaro algorithms, Q-gram-based algorithms, which make it possible to find distances between words. The most widespread among them are the Soundex and Metaphone algorithms, which are designed to index the words based on their sound, taking into consideration the rules of pronunciation. By applying the Metaphone algorithm, an attempt has been made to optimize the phonetic search processes for tasks of fuzzy coincidence, for example, at data deduplication in various databases and registries, in order to reduce the number of errors of incorrect input of last names. An analysis of the most common last names reveals that some of them are of the Ukrainian or Russian origin. At the same time, the rules following which the names are pronounced and written, for example in Ukrainian, differ radically from basic algorithms for English and differ quite significantly for the Russian language. That is why a phonetic algorithm should take into consideration first of all the peculiarities in the formation of Ukrainian last names, which is of special relevance now. The paper reports results from an experiment to generate phonetic indexes, as well as results of the increased performance when using the formed indexes. A method for adapting the search for other areas and several related languages is presented separately using an example of search for medical preparations.

Keywords: fuzzy match, phonetic rule, phonetic algorithm, Metaphone, Ukrainian last name.

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DEVELOPMENT AND RESEARCH OF THE INVARIANT AUTOMATIC CONTROL SYSTEM OF ANGULAR SPEED OF DIESEL ENGINE (p. 51-56)

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The increase in the independence of motor-vehicle engines from the influence of external loading on the engine shaft due to the improvement of the dynamic parameters of the elements of the automatic control system of angular speed is investigated. Research of dynamic parameters of the diesel engine is carried out by simulation . An invariant (combined) simulation model of the automatic control system of the diesel engine was developed and investigated and an automated

control system of a self-propelled earthmover with the use of modern hardware was developed. The investigation of the invariant ACS of engine angular speed, which provides the optimum regardless of external disturbances ; was continued by including the compensating element in the automatic control system. The recovery time of the steady-state value of engine angular speed under load is reduced by about 7 times, and the magnitude of angular speed drop is approximately 6 times. An algorithmic block diagram of the combined invariant ACS of engine angular speed is developed taking into account the influence of the compensating device for the case when the disturbing action is exponential and which takes into account the operation of the device of limiting the maximum permissible value of disturbance.

Keywords: simulation model, transfer function, compensating element, scraper, diesel engine, engine angular speed, earthmoving machine.

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PREDICTION OF SPOT WELDING PARAMETERS USING FUZZY LOGIC CONTROLLING (p. 57-64)

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The Resistance Spot Welding (RSW) represents one of the most important welding processes. The resistance spot welding quality depends on the process parameters like welding current, electrode force and welding time and their chosen levels. In this work, the experimental part is validated by the simulation part, where the last will be used later for predicting the results for new data with a very acceptable percentage of accuracy. This study presents an experimental work of the resistance spot welding for two similar sheets of Austenitic Stainless Steels (AISI 304) that are intended to be held together in one point by the pressure of the electrodes, with high magnitude of electrical current to be applied, where the resistance spot welding parameters (welding current and welding time) are changeable to show each of the parameter's action on the welded material properties (The Maximum Shear Load that the metal can be subject to besides The Nugget Zone Diameter of the welded contact area). The experimental work in this study delivers genuine and important data that will be the basis for the Fuzzy Logic Controller (FLC), which will be set up then. The Artificial Intelligence (which is presented by the fuzzy logic controller) role is to predict the optimal welded material parameters for any given resistance spot welding parameters, and to discover the probability of expulsion, failure, or breaking in the welding process before it takes place or happens, where in this study, the FLC predicted the optimum value of the maximum shear load for RSW, which occurs at the welding time 20 cycle and the welding current 8 KA, while the estimated optimum value of the Nugget Diameter by FLC for RSW is found at welding time 20 cycle and welding current 8 KA.

This prediction will save the metal parts and the electrodes of welding, besides saving the cost and the effort.

Keywords: Resistance Spot welding (RSW), Austenitic Stainless Steels (AISI 304), Fuzzy Logic Control (FLC).

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DEVISING A PROCEDURE FOR THE SYNTHESIS OF ELECTROMECHANICAL SYSTEMS WITH CASCADE-ENABLED FRACTIONAL-ORDER CONTROLLERS AND THEIR STUDY (p. 65-71)

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An approach to the synthesis of automatic control circuits has been proposed, based on a fractional characteristic polynomial, which makes it possible to ensure the desired quality of a transition process under condition for implementing a certain structure of the fractional controller, which depends on the transfer function of a control object. The use of fractional desirable forms extends the range of possible settings of fractional-order controllers in the synthesis of circuits for electrical-mechanical systems, ensures better quality of transients compared to the full-order controllers, and thereby improves the efficiency of synthesized systems. Based on the obtained results of research, it becomes possible to recommend, in order to adjust the circuits for electromechanical systems, using the proposed fractional desirable forms that could meet the desired requirements to the systems of control over electromechanical systems. Construction of electromechanical systems on the principle of control with sequential correction has a significant advantage over other systems, owing to the simplicity of setting each contour, as well as a possibility to implement control coordinate constraints. A procedure for the structural-parametric synthesis of fractional-order controllers has been devised, on condition of their cascading switching in multi-circuit electromechanical systems; the synthesis algorithm of fractional-order controllers for appropriate control circuits has been given. We have synthesized an electromechanical system with cascade switching of controllers by applying the improved method of the generalized characteristic polynomial to choose the structure and parameters of fractional-order controllers and applying the desired form of fractional order. A two-circuit system of subordinate regulation has been considered as an example, in which a control object is the electric drive "thyristor transducer (converter) – engine (motor)". The influence of the synthesized fractional-order controllers on dynamic properties of the electromechanical system "thyristor transducer – engine" has been examined. Our study has shown a possibility to implement the cascading activated controllers for the electromechanical systems where the contours with the transfer full- and fractional-order functions are combined, as well as for systems with fractional-order contours only.

Keywords: electromechanical system, fractional-order controllers, synthesis, fractional-order transfer functions.

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