CONTENTS AND ABSTRACTS

RADIO ENGINEERING AND COMMUNICATION SYSTEMS

Key words: satellite radio navigation systems, spoofing clutters, inertial navigation systems, microelectromechanical sensors, Euler angles, quaternions, Kalman filter.

The solution to the problem of detecting the fact of setting up spoofing clutters to satellite radio navigation systems by comparing navigation information from consumer equipment and auxiliary inertial navigation system is considered. The aim of the work is to develop a mathematical model that implements the simulation of navigation data from each of the systems, and to compare them with decision threshold. Geometrical formulation of the problem and the algorithm to make a decision on setting up spoofing clutters are presented. Mathematical modeling has been performed for the trajectory of the object with consumer navigation equipment in ascending spiral with constant linear speed for the time interval of 120 sec length.

Key words: underwater optical wireless communication channel, optical wireless communication, free space optical channel, mathematical model, underwater communications systems.

Data transmission maximum distance in underwater wireless optical communication channel (UWOCC) with pulse-code intensity modulation (PCM) is estimated. The aim of the work is to investigate the possibility to use Reed-Solomon codes for increasing real time video data stream transmission distance, without increasing radiation power. The article presents bit error rate (BER) modeling depending on the range for various values of electrical bandwidth. The calculations were carried out for UWOCC without correcting coding, as well as with Reed-Solomon codes. The use of Reed-Solomon codes is shown to provide a gain in maximum range of not less than 38 meters with channel bandwidth of 100 MHz, not less than 32 meters with channel bandwidth of 1 GHz, and not less than 30 meters with channel bandwidth of 10 GHz. The spread in maximum length values lies in the range between 7 and 13 meters depending on electric channel bandwidth.

Key words: error-correction coding, Gaussian channel, multithreshold decoder, error propagation, symbolic code, concatenated scheme, convolutional codes, block codes, decoder complexity, throughput, Optimization Theory, self-orthogonal code, Reed-Solomon code.

Methods of simple implementation of concatenation in binary Gaussian channels based on multi-threshold decoders (MTD) for convolutional codes are considered. Cases of

application in the second stage of convolutional codes decoding for both binary and nonbinary classes, known in the Optimization Theory (OT) as symbolic, are considered. A conclusion is made about a very simple implementation and about higher efficiency characteristics of concatenated codes with MTD than those of the previous classical circuits with Viterbi algorithm (VA) and Reed-Solomon (RS) (VA-RS) codes. It is noted that all schemes with MTD have unlimited performance in hardware implementation. A very moderate increase in decoding delay is indicated in comparison with non-concatenated versions of implementation, which is determined by the absence of the need to use traditional two-dimensional concatenated structures.

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V. T. Dmitriev, P. N. Skonnikov. COMPARATIVE ANALYSIS OF ALGORITHMS FOR MULTISPECTRAL IMAGE FUSION

Key words: multispectral image fusion, local weighted summation, infrared range, objective quality index, Piella metric, image dataset, enhanced vision, rescue operations.

The article shows the relevance of the problem for multispectral image fusion during search and rescue operations. Well-known algorithms for such image fusion are considered and implemented. Based on the publicly available datasets of multispectral images a combined database including 496 pairs of images has been compiled to compare the algorithms considered. The results of image fusion using the considered algorithms are obtained. The aim is to compare the known algorithms for multispectral image in terms of objective quality indices. Comparison of fusion results was carried out by two criteria: Piella metric and combined quality index. Based on the results of the comparison, it was concluded that the best values of combined quality index for multispectral image fusion are provided by the algorithms based on local weighted summation, principal components analysis and Laplace pyramid.

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A. V. Safonova, V. I. Martynov. ADAPTIVE CONSTRUCTION ALGORITHM RADAR IMAGE TARGETS

Key words: radar image, maximum correlation algorithm, adaptive algorithm for constructing a radar image of a target, background interference, interference from water surface.

The problem of constructing a radar image of a complex target against the background of water surface is considered. The aim of the work is to develop an effective algorithm for processing radio signals against the background of interfering influences. An adaptive algorithm for constructing a radar image of a target is proposed. The advantages of the proposed algorithm for constructing a radar image of a target in the presence of background interference from water surface in comparison with maximum correlation algorithm are proved. More efficient law for the variation of algorithm adaptation parameter is found.

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MATHEMATIC AND SOFTWARECOMPUTER SYSTEMS AND COMPUTER NETWORKS

Key words: wireless technologies, wireless sensor networks, self-organizing networks, IEEE 802.15.4 WPAN protocol, coordinator, modeling, OMNET++, Castalia.

In the modern world among all network technologies the wireless technologies occupy a special place. We have the necessity to develop and implement new algorithms and protocols in wireless technologies. The main and most perspective direction in wireless systems is the design of systems for monitoring and control of object parameters. Special place in this direction is occupied by wireless sensor networks (WSN). The aim of the research is to study the protocols of wireless sensor networks and their synchronization algorithms using modern modeling environment OMNET++. The main tasks of the research are to study WSN standards, WSN protocol such as IEEE 802.15.4 WPAN and its modeling with efficiency assessment. The developed model made it possible to verify algorithms and evaluate the performance of network nodes, network bandwidth and efficient power consumption.

Key words: data mining, association rules mining, 3D2ARM algorithm, data structures, data transfer, data compression, zero-length suppression method, variable size of array values.

The aim of this work is to decrease memory volume for storage and transfer taken by three-dimensional array in distributed mining of association rules. Volume decrease is achieved due to sparse array and variable size of array element values. Array elements with non-zero values are written as a number pair: the offset from the previous element with non-zero value and the value itself. To separate numbers, one of the bits in a byte is used as a service one, to point the end of the value. The experiments have shown that this method allows file size 74 % less on average in comparison with the original array. Software in Java programming language has been developed for these experiments. The compression method together with 3D2ARM association rules algorithm can be used to develop distributed mining of association rules.

INTELLIGENT INFORMATION SYSTEMS AND TECHNOLOGIES

Key words: road traffic forecasting, radial basis function network, RBFNN, particle swarm optimization, PSO, intelligent transportation systems, ITS, line planning.

This article considers the approaches for the tasks of traffic situation forecasting and building optimal planning systems. The aim is to study and analyze problems in the field of traffic automation, carried out through a review of foreign sources devoted to the tasks and algorithms of this subject area. Various topics and approaches selection in a given area is carried out. A translation is provided-as a presentation of foreign sources.

MATHEMATICAL AND COMPUTER MODELING

SYSTEM ANALYSIS, MANAGEMENT AND INFORMATION PROCESSING

PHYSICAL ELECTRONICS AND NANOELECTRONICS

Key words: turbulence, optical signals, laser radiation, beam path, optical beam splitting.

In this work authors present computational modeling results of optical signals passage near the receiving sites made in ANSYS program complex. Laser beam is split into several filaments due to the phenomenon of turbulence. Due to the fact that uneven distribution of air refraction coefficients occurs near the receiving sites of optical signal receiving devices in the atmosphere, laser beams are split near the receiving sites. It means that requirements for the receiving sites of optical signals should be increased. To solve the problem with phenomenon of turbulence, several laser transmitters and receivers at different wavelengths should be installed in laser beam propagation installations. It increases the speed of information transfer and the reliability of the devices.

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