

In the Name of God



Malek Ashtar University of Technology

Hydrophysics

Vol. 9, No. 2 2023

ISSN:2476-7131

Online ISSN:2476-7468

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Web: www.hydrophysics.ir

Email: hydrophysics@mut.ac.ir

www.hydrophysics.ir

Hydrophysics is indexed in:

ISC:www.isc.gov.ir

SID:www.sid.ir

Magiran:www.magiran.com

Google scholar:

<https://scholar.google.com/>

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Layout Designer: Negare pub



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Depth measurement of the northeastern coast of Antarctica using remote sensing technology (case study: Prydz Bay)

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Received: 16 May 2024

Accepted: 4 Aug 2024

Abstract:

Remote sensing, due to its high ability to collect information in a short time, is a suitable solution for estimating water depth in coastal areas. This issue is of particular importance in Antarctica due to its unknown nature and lack of accurate data. The purpose of this research is to measure the depth of the northeast coast of Antarctica using remote sensing technology (case study: Prydz Bay). To conduct this research, Sentinel-2A images were used and the images were processed in ENVI and GIS software, and the stump model was used for depth measurement. The results for bathymetry showed that the depth of the beaches of Prides Bay is between 100 and 500 meters, which generally around Prydz Bay has an average depth of 50 to 100 meters. Also, the shallowest part of Prydz Bay is located along the coastline and the deepest part is located in the northern part of the Indian Ocean with a depth of 500 meters. Also, the analysis of Sentinel-2A images showed that the material of the beach structure of Prydz Bay is rocky and rocky, and most of the research stations were established by Australia and China.

Keywords: Installation, Meteorological device, sensor, air pressure.

The potential of the hybrid support vector regression model for predicting river sediment discharge (Case Study: Keshkan-Lorestan River)

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Received: 11 Nov 2024

Accepted: 30 Nov 2024

Abstract:

Providing a robust and reliable prediction model for river sediment discharge is essential for several environmental and geomorphological perspectives, including water quality, riverbed engineering sustainability, and aquatic habitats. This research developed a new hybrid intelligence based on the support vector regression model approach to predict river sediment discharge. For this purpose, in this research, two optimization algorithms including firefly and gray wolf were used to model the sediment discharge of the river. To model, the statistics and information of the Kashkan River hydrometric station located in Lorestan province were used as a case study in 7 combined scenarios of input parameters in 1993-2023. To evaluate the performance of the models, the evaluation criteria of correlation coefficient, root mean square error, mean absolute value of error, and Nash Sutcliffe coefficient were used. Also, to analyze the results of the models, the time series chart, Boxplot, and Taylor were used. The results showed that the combined scenarios in the studied models improved the model's performance. Also, the results of the evaluation criteria showed that the support vector regression model-firefly has a correlation coefficient of 0.970, the root mean error rate (ton/day) is 0.145, the mean absolute error value (ton/day) is 0.080 and the coefficient Nash Sutcliffe has 0.980 in the validation stage. Overall, the results showed that the use of intelligent models based on the support vector regression approach can be an effective approach to river engineering sustainability.

Keywords: Kashkan, support vector regression, suspended sediments, modeling.

Modeling of water fronts in the Makran coast

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Accepted: 8 Dec 2024

Abstract:

Modeling of water fronts in the northern Indian Ocean and Makran coast is an important feature that investigates and predicts the changes of water fronts in this region. Modeling of water fronts in the northern Indian Ocean by using salinity and temperature data helps to depict the geographical and temporal patterns of the movement of the fronts and is used as an advanced and research tool in this field. This paper presents a comprehensive modeling of Indian Ocean waters related to the formation of water masses and temperature and salinity fronts. In this modeling, Delft3D next-generation models are used, and the surface and subsurface levels of water in the study area have been investigated. The results of this study show the formation of several important fronts in the studied area. One of these fronts is formed along the coast of Makran and is limited to the surface layer of water. The other front is located in the west of the Oman Sea and can be the outflow of warm and salty water from the Persian Gulf to the Gulf of Oman. The extent of this front in the cold season of the year covers the entire area of the western Gulf of Oman at a depth of 200 to 300 meters, but in the warm season of the year, it is mostly located in the surface layer of the sea, and as we go deeper, it is located on the south coast. takes the west is limited. Another important front is located on the border between the Indian Ocean and the Sea of Oman, which is more intense in the southern part and near Ras Al Hadd. Among the harvested water fronts, the fronts formed along the coasts of Makran have the most intensity in the surface layer, and the other fronts are mostly in the subsurface (more than 100 meters deep) because they are affected in the surface layer. they take Mixing and current cycles that exist in this area are reduced horizontally.

Keywords: Makran coasts, temperature profile, water fronts, Oman Sea, salinity profile.

Extracting the hydroacoustic types of the Gulf of Oman based on ARGO data and introducing a new method to identify these types

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Received: 21 Sep 2024

Accepted: 16 Oct 2024

Abstract:

Due to the absence of any model of hydroacoustic types, it is necessary to use the data of the past few years and provide a model in the Gulf of Oman. In this research, the region is divided into five parts and the field data recorded in the ARGO database is used, and for the first time, a new model for naming hydroacoustic types is presented. It was observed that the highest density of profiles obtained from ARGO data is related to the southwestern part of the Gulf of Oman and the lowest is related to the waters north and northeast of Ras al-Had. It was also concluded that the average of the dominant hydroacoustic types formed from March to May are negative, and as a result, the surface channel is often not formed. We found that the trend of changes in sound channel depth is increasing in almost all regions from June to February next year. In addition, the monthly comparison of the depth of the surface channel presented the result that the surface channel is deeper in areas 2, 1 and 3, which are closer to the coastlines. In the comparison of the effect of latitude and longitude on hydroacoustic types, we found that profiles are more affected by changes in longitude. In addition, in most of the depths of the waters near the Strait of Hormuz, the speed of sound increases due to the increase in temperature and salinity of the waters coming from the Persian Gulf.

Keywords: hydroacoustic types, Sound at Sea, ARGO data, Sound speed profile, Gulf of Oman.

The effect of duct cross-section on the reduction of noise produced by marine propellers using numerical and laboratory methods

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Received: 18 Oct 2024

Accepted: 1 Dec 2024

Abstract:

Ship noise emission has many environmental impacts and its reduction can reduce or eliminate some of these harmful effects. Hence, recognizing noise-generating source and investigating noise reduction techniques is the first step in eliminating these harmful effects. Studies show that ship propeller is one of the main commercial ship noise-generating sources. The duct placement around the propeller is one of the well-known solutions for reduction noise eliminated from marine propeller. In this paper, we first investigate mathematical equations of noise emission in far field. In the following, a basic geometry was introduced for ducted propeller and necessary numerical calculations were done to estimate SPL at a certain distance from the propeller (by using FWH equations). The measured SPL emitted from the propeller in CFD approach (solving the FWH) shows 28% reduction for ducted propeller in comparison with the propeller without the duct. In experimental approach (after removing the ambient noise) shows 37% reduction for ducted propeller in comparison with the propeller without the duct.

Keywords: Ship noise emission, Ducted Propeller, FWH equation, Daubechies wavelet formulation, Numerical solution, Experimental test.

Design of a two-dimensional photonic crystal-based optical encoder for marine communication systems

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Accepted: 23 Nov 2024

Abstract:

Marine communication systems have always faced challenges such as signal attenuation, wave interference, and bandwidth limitations. The use of photonic crystals as a platform for implementing optical encoders in communication systems has attracted the attention of researchers due to the unique features of these structures, such as precise light guiding and dispersion control. Optical encoders are circuits used in the design of optical processors. To reduce the size of optical devices, it is essential to design small-scale logic circuits. In this study, a 2×4 all-optical encoder based on two-dimensional photonic crystals is designed and simulated. The simple structure of this optical encoder enables its use in integrated optical circuits. Due to its small-scale structure and the use of defect pathways, the encoder's transmission delay is reduced, resulting in an increased data bit rate. The transmission delay obtained for this proposed encoder is less than 90 femtoseconds. Another feature of this proposed optical encoder is that the optical output power in the logic "0" state is very low, which increases the contrast ratio.

Keywords: All-optical encoder, Two-dimensional photonic crystal, contrast ratio.

Assessment of underground water resources in western Iran using GRACE and GRACE-FO satellite observations from 2002 to 2021

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Accepted: 7 Oct 2024

Abstract:

The study of temporal changes in local groundwater storage is essential to understand the characteristics and manage the optimal use of these vital resources. Today, the use of GRACE satellite data and then GRACE-FO to estimate the monthly changes of the underground water level are widely used. In this article, using the data of GRACE and GRACE-FO satellites, the monthly changes of the underground water level in the western regions of Iran in the period from 2002 to 2021 have been obtained. The results show a decrease of -1.17 ± 0.15 cm per year in the level of underground water in the western region of Iran, as well as a decrease of -1.28 ± 0.19 cm per year in the total level of water resources, which includes surface water, underground water, water equivalent to snow, soil moisture It was observed in the west of Iran. The precipitation model was also evaluated using TRMM satellite data, which has a correlation of 0.16 with water reserves observed by GRACE and GRACE-FO satellites.

Keywords: Groundwater Quality, Caspian Sea Coast, Artificial Intelligence Hybrid Model, Babolsar Piezometric Well.

Determination of vessel unit number in river transportation

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Accepted: 8 Dec 2024

Abstract:

Until recently, barges have been able to travel to Ahvaz without any problems. Considering the dredging of the Karun River, it is clear that river transportation must be organized. The optimal number of vessels and navigation equipment required for carrying cargo in the Karun River has been investigated in this research. At the beginning of the research, the limited studies that have been done for economic transportation in Karun have been analyzed. Then, three pessimistic, probable and optimistic values have been assumed for the annual load carried by the river. Then, various proposed vessels for transportation from Arvand and Bahman Shir routes and from different sources (Mahshahr or Khorramshahr to Ahvaz and vice versa) and all types of navigation equipment have been examined. The number and types of vessels needed for river transport of different tonnages were analyzed economically. In the studies, attention has been paid to the amount of sediment required for the dimensions of the waterway channel, possible navigation speeds, factors reducing the navigation speed such as monsoon winds, dust and drought, and other variables. Finally, the specifications of the required navigation equipment have been determined and the number of floats required for the river traffic from Bandar Imam, Bahman Shir, Ahvaz to transport 0.5, 1, 2, 4 and 8 million tons of goods (iron ore) respectively equal to 5, 10, 20, 34 and 67 devices are estimated. The practical and optimal result of this research is the use of 7 vessel units with the proposed dimensions intended to carry 0.7 million tons of goods in the target year of 2046.

Keywords: Number of vessels, river navigation, the Karun River.

Estimating the rate of erosion, sedimentation and SDR in the Ilam Dam Watershed

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Received: 16 May 2024

Accepted: 24 Jun 2024

Abstract:

The increasing destruction of natural resources, improper use of land, land use change, development of residential areas and environmental pollution, cause waste of natural resources and soil degradation. Due to the emergence of such issues, planning and management for the proper land use, preservation and restoration of resources and paying attention to watershed-oriented strategies seem essential. In this study, which was conducted with the aim of investigating the erosion and sedimentation situation in the Ilam Dam watershed, first, the land use map of the study area was prepared using Landsat 8 satellite images of 2020. Then, RUSLE model was used to calculate erosion and sedimentation in different land uses. In addition, the amount of sediment delivery ratio (SDR) was calculated based on different models and SDR was equal to 0.88 and Williams and Berndt's method was introduced as the best method to calculate SDR in the study area. Based on the results of the RUSLE model, the average erosion and sedimentation of the Ilam dam watershed was estimated as 28.01 and 24.65 tons per hectare per year, respectively.

Keywords: Erosion and Sediment, Land use, SDR, Ilam dam watershed.

Reliability analysis of a pipe containing high pressure and temperature moving gas

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Received: 9 Oct 2024

Accepted: 24 Nov 2024

Abstract:

Reliability science is based on statistics and probability, and the possibility representation of healthiness of the product. Understanding the likeliness of health or deterioration of the product is very valuable. Hence, in recent years reliability engineering has become very important for researchers and designers. Nowadays one of the most important parameters in the industry is high reliability products and this is because of its direct link to the user's health and well-functioning industrial products. Working with systems that have a low reliability are very dangerous. The oil and gas are very important industries and one of the most important elements in the installation of a refinery are pipes. Hence, in this study the dynamic stress and reliability analysis of a piping under gas with high pressure and temperature will be discussed. Therefore, the finite element and Monte-Carlo methods were used to compute stress and reliability in the pipe with high pressure and temperature. In order to verify this presented code and its results were compared with ANSYS software and other existing results.

Keywords: Oil and Gas Industries, Pipe, Reliability, High Pressure and Temperature, Dynamic Stress Analysis.

Laboratory investigation of the effect of the number and distance of lateral obstacles in the control of density current

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Received: 27 Oct 2024

Accepted: 1 Dec 2024

Abstract:

Density current control is a set of structural and non-structural measures that cause deviation, block and reduction of its flow. In this study, lateral plates were used as a structural measure to control the flow of salty density current. These plates were placed in one, two, and three rows with a relative height of 0.5, 1, and 1.5 times the height of the density current body and three installation angles of 30, 60, and 90 degrees, and 9 tests were considered as flume blocking plates. In addition to the flow head control, the changes in the profile of the density current body were also investigated and compared with the control condition, which was the test without installing obstacles. The greatest reduction in flow head discharge in the case of three rows of obstacles was at a relative height of 1.5 times the height of the body with an installation angle of 60 degrees, which reduced the flow front discharge by 97%. The results showed that the decrease in the concentration of the density current due to the installation of lateral plates will lead to a decrease in the concentration of the body in all sampling depths compared to the case without installation of obstacles.

Keywords: Density current control, Lateral plates, Body concentration profile, Density current head.