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Abstract Index

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DOA Signal Identification Based on Amplitude and Phase Estimation for Subarray MIMO Radar Applications

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The overlapped equal subarray transmit radar, which is also known as the Subarray Multiple-Input Multiple-Output radar, utilizes the key advantages simultaneously of both types of multi-antenna radar, i.e., the phased array and MIMO radars, so that it is able to detect multiple targets even though it has a radar cross section (RCS) of a weak or small target. In this paper, it is proposed to develop a parameter estimation approach called amplitude and phase estimation (APES). This approach provides improved resolution to the estimation of the amplitude and direction of arrival (DoA) of the target reflection signal on the radar compared to the existing conventional estimation methods such as least squares (LS). The formulation of the APES method on this radar is based on the tested parameters such as DoA and RCS and continuously being evaluated. The results show that the performance of the APES method of this radar can detect targets very precisely when the number of subarrays (M) is greater than the number of detection targets (P), precisely M > P. For the results of DoA and RCS accuracy from the APES method, this radar is more accurate than the LS when testing the angular resolution between the two targets, an angle resolution of 2° is obtained for the APES method which is superior to the LS with an angle resolution of 5.8°. In these conditions, the APES method is able to accurately distinguish between two targets while the LS method is only able to detect one target.

Keywords: amplitude and phase estimation, MIMO, overlapped equal subarray transmit, phased array, radar.

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The Optical Characteristics of 20 Watt Far-UVC Light and Its Application for Disinfection Chamber

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The far-ultraviolet C (UVC) light has been used recently as an alternative disinfection system to deactivate the novel coronaviruses that cause coronavirus disease (COVID-19) without introducing any health damage to humans. We investigate that the far-UVC light from far-UVC excimer lamps (BEST 20 Watt) is a promising candidate for a far-UVC disinfection system to prevent human-to-human transmission of COVID-19. The optical characterization of far-UVC excimer lamps was examined. The maximum irradiance of the far-UVC excimer lamps is 219 nm, which is known to have antimicrobial capabilities on microorganisms, including coronaviruses. We propose a design of a disinfection chamber system based on eight 219 nm far-UVC excimer lamps which are attached vertically about 35 cm to each other, and the irradiation angle was installed at the angle of approximately 120° in order to optimize the irradiation of far-UVC light to a human body. For microorganism inactivation at a distance of around 10 cm from the human body, 219 nm far-UVC excimer lamps require less than 5 seconds of irradiation time and the required intensity of 840 $\mu W/cm^2$ at a low dose of 3000 $\mu J/cm^2$. We recommend that our proposed disinfection chamber can be used for humans and applied in public areas

to decrease the spread of COVID-19 without any adverse health effect.

Keywords: COVID-19, disinfection chamber, far-UVC, optical characteristics

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Comparison of Different Models to Estimate Global Solar Irradiation in the Sudanese Zone of Chad

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Sustainable future development relies on solar radiation, which is the main source of renewable energy. Thus, in this article, the monthly average global solar irradiation of four sites in the Sudanian zone region of Chad is estimated using different empirical models. The data used in this study were collected at the General Directorate of Meteorology of Chad. The reliability and accuracy of six models estimating global solar radiation were validated and compared by statistical indicators identifying the most accurate model. The results obtained show that the Allen model has the best performance for the Moundou site (5.760 kWh/m²/d, R2=0.843), the Angstrom Prescott model for the Sarh sites (5.658 kWh/m²/d, R2=0.805) and Pala (5.793 kWh/m²/d, R^2=0.889), the Sabbagh model for the Bongor site (5.657 kWh/m²/d, R^2=0.888). These models are validated against NASA data. The results show that the Sudanian zone of Chad has good solar potential and is therefore suitable for possible exploitation.

Keywords: renewable energy, empirical models, statistical indicators, solar radiation, Sudanese zone

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Cooperative Line Formation Control of Multi-Agent Systems Based on Least Squares Estimation

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In this paper, we consider the problem of multi-agent systems where each agent aims to establish a line formation in a distributed manner. In constructing an efficient line formation, finding a line with the closest total distance from every agent is essential. We propose a formation control using least squares estimation (LSE) performed by each agent with only the local information that consists of the corresponding agent's and neighbors' positions. Each agent calculates the local cost function, which is the squared distance from the LSE line to the related agent's and its neighbors' positions. Our goal is to minimize the global cost function, which is the sum of these local cost functions. To achieve this, we employ distributed optimization to the global cost function of the overall system using the subgradient method performed by each agent locally. We evaluate our proposed method using numerical simulation, and the result complies with our goal of this paper.

Keywords: LSE, formation control, distributed optimization, multi-agent systems.

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Mineral Mapping on Hyperspectral Imageries Using Cohesion-based Self Merging Algorithm

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Recently, hybrid clustering algorithms gained much research attention due to better clustering results and are computationally efficient. Hyperspectral image classification studies should be no exception, including mineral mapping. This study aims to tackle the biggest challenge of mapping the mineralogy of drill core samples, which consumes a lot of time. In this paper, we present the investigation using a hybrid clustering algorithm, cohesion-based self-merging (CSM), for mineral mapping to determine the number and location of minerals that formed the rock. The CSM clustering performance

was then compared to its classical counterpart, K-means plus-plus (K-means++). We conducted experiments using hyperspectral images from multiple rock samples to understand how well the clustering algorithm segmented minerals that exist in the rock. The samples in this study contain minerals with identical absorption features in certain locations that increase the complexity. The elbow method and silhouette analysis did not perform well in deciding the optimum cluster size due to slight variance and high dimensionality of the datasets. Thus, iterations to the various numbers of k-clusters and m-subclusters of each rock were performed to get the mineral cluster. Both algorithms were able to distinguish slight variations of absorption features of any mineral. The spectral variation within a single mineral found by our algorithm might be studied further to understand any possible unidentified group of clusters. The spatial consideration of the CSM algorithm induced several misclassified pixels. Hence, the mineral maps produced in this study are not expected to be precisely similar to ground truths.

Keywords: clustering, hyperspectral, mineral mapping, cohesion-based self-merging.

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Comparison of Classification of Birds Using Lightweight Deep Convolutional Neural Networks

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Environmental scientists often use birds to understand ecosystems because they are sensitive to environmental changes, but few experts are available. To make it easier to recognize bird species, an automatic system that can classify bird species is needed. There are lots of models to choose from, but some models require very high computational data when training data, reducing training time can result in less wasted electrical energy so that it can have a good effect on the environment. For this reason, it is necessary to test a model that has a small complexity in training time, whether it can produce good performance. Based on the number of neural network models available, this study will classify using the EfficientNet, EfficientNetV2, MobileNet, MobileNetV2, and NasnetMobile models to determine whether these models can have good performance. From the research results, all the models tested have good performance with an accuracy between 95% - 97%. The MobileNetV2 model has the less efficiency with the smallest training time while maintaining good performance.

Keywords: railway system, FMCW radar, collision avoidance, clutter removal, 2D-CFAR, RPCA.

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Electronic and Thermoelectric Properties on Rutile SnO_2 Under Compressive and Tensile Strains Engineering

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SnO_2 has the potential to be an environmentally friendly thermoelectric material. To obtain the optimum properties of this material, strain engineering is used to investigate the electronic and thermoelectric properties. In this study, we used compressive and tensile strains with -5%, -2%, 0%, 2%, 5%, and 10% in three schemes; they are triaxial (ε_{abc}), biaxial (ε_{ab}), and uniaxial (ε_c)strains. All model structures are calculated based on density functional theory (DFT) with several exchange-correlation functionals. The presented results show that strain engineering enhances the Seebeck coefficient for a compressive strain parameter since the energy gap between the conduction and valence band increased due to the strong covalent bonding at the conduction band. From several comparisons in bandgap and thermoelectric properties calculation between PBEsol and PBE0, this study suggests that PBE0 is effectively used to calculate the energy gap. Meanwhile, for thermoelectric properties, PBEsol gave the best-estimated value. In addition, this study explained that the largest or the smallest bandgap could be achieved by varying strain simply on the c-axis as the optimum manipulation of the SnO_2 structure. Furthermore, this paper also revealed that the simulation strategy could be determined from the desired result, whether to enhance the Seebeck coefficient or the electrical conductivity by manipulating the ab-axis and c-axis, respectively.

Keywords: strain, DFT, exchange-correlation, thermoelectric, bandgap.

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