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Title:

A study of micro-scale solder bump geometric shapes using minimizing energy approach for different solder materials

Journal:

Ain Shams Engineering Journal, Volume 13, Issue 6, November 2022.

Document Type:

Article

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Abstract:

Demand for more interconnection joints between semiconductor devices can be realized with solder bump technology. Surface tension and density are usually material properties related factors that affect solder bump geometric shape. Therefore, to cope with this fast-changing microarchitecture design in semiconductor technology, a better understanding of the solder bump geometric shape is needed. This study used a static equilibrium force approach to integrate the surface tension and gravitational energy into the solder energy content. Surface Evolver software was used to perform calculations and deliver the final solder bump shape. Perfect agreement with less than 10 % comparison between previous studies and the current Surface Evolver results was found. According to statistical analysis using SPSS, the maximum width of solder shape is closely related to the surface tension. In contrast, the maximum standoff is highly correlated with the solder density. By changing the solder volume, the solder bump changes from standard flip-chip bump to Cu pillar bump with consistency in maximum width to maximum standoff height ratio of 1.5. This study shows that the bumping technology can produce various sizes of solder bumps to meet new electronic packaging requirements.

Title:

Air Conditioning System Comfort Level and Power Consumption Monitoring Device with RF-Based Wireless Sensor Modules and Android Mobile Application

Journal:

Advanced Structured Materials, Volume 169, 2022.

Document Type:

Book Chapter

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Abstract:

Nowadays, electric consumption especially in Malaysia has increased over the years caused by the usage of air conditioning (AC). Conventional AC remote devices are unable to monitor the actual comfort index of the building and the power consumption that has been used of the system by using Android mobile applications. Knowing the actual comfort index and power consumption is necessary for the user to come up with strategies to use the AC system economically. Besides, conventional AC remote devices do not have temperature and humidity sensors that can monitor the comfort index and power consumption. Users do not know the actual comfort level and power consumption, thus causing discomfort and maybe waste of energy. To overcome these problems, an air conditioning system comfort level and power consumption monitoring device with RF-based wireless sensor modules and Android mobile application were produced. Indoor air quality (IAQ) and predicted mean vote (PMV) are the types of comfort index that have been used to measure the comfort level. In this project, the methods used for completing the project of monitoring the air conditioning system by using the predicted mean vote (PMV) algorithm. PMV has six parameters, which are the air temperature, mean radiant temperature, clothing insulation, metabolism rate, relative air velocity and relative air humidity. This monitoring system can monitor various variables at the same time such as the indoor temperature, outdoor temperature, relative temperature, relative humidity, PMV and power consumption. With a monitoring system, the energy consumption can be minimized while retaining the comfort level. In this project, a monitor box, wireless humidity sensor box and wireless temperature sensor box were produced. This research elaborates on the entire process of hardware design. It also discusses the software developed for monitoring parameters such as the power consumption using a mobile phone. The AC system can be better monitored and controlled with the developed tool in this project.

Title:

Influence of bone marrow characteristic and trabecular bone morphology on bone remodelling process with FSI approach

Journal:

Proceedings of the Institution of Mechanical Engineers, Part L: Journal of Materials: Design and Applications

Document Type:

Article

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Abstract:

While doing daily physiological activities, the trabecular bone will experience a certain amount of deformation which leads to the bone marrow movement. The movement can affect the bone remodelling process and the properties of the bone itself. The bone marrow plays a role as a hydraulic stiffening of the trabecular structure. However, previous studies analysed on trabecular bone and bone marrow separately, which is not considered as the actual condition. Thus, it is crucial to consider combine analyses of the bone marrow with the trabecular structure simultaneous. The aim of this study is to investigate the effect of bone marrow on the mechanical environment and the structure of trabecular bone during normal walking loading. Hence, this study used the Fluid-Structure Interaction (FSI) approach as a finite element method to discover the effect of bone marrow to the trabecular structure and vice versa. The findings show the shear stress value along normal walking phase was found in a range of 0.01–0.27 Pa which is sufficient to regulated cell response minimally. This study provides insight into understanding the related mechanobiological responds towards supply of nutrients onto bone cells.

Title:

The Tendency of Nature towards Hexagon Shape Formation due to Minimizing Surface Energy

Journal:

International Journal of Integrated Engineering, Volume 14, Issue 1, 2022.

Document Type:

Article

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Abstract:

Nature, for instance, bubble and honeycomb, tend to form a hexagon shape naturally. The array of bubbles and honeycomb is formed by merging and sharing the common wall with the adjacent unit. Even though each of the unit shapes size may vary, the noticeable elements that built up the array are hexagons. There are many regular and irregular shapes available in nature, but the shape formation still leads to hexagon at the end of the shape evolving due to surface tension. Based on the phenomenon, this study was carried out to investigate the effect of surface tension, energy, and geometry features, which affect the tendency of hexagon formation. The study was carried out by comparing hexagon with triangle, trapezium, and square. From the result, it is found that the reduction of surface energy ranged from 10-23 percent from the initial shape. As expected, the hexagon shape is packed with the lowest surface parameter and very stable in single unit or array form by showing the lowest energy reduction. The energy content is a reflection to structure equilibrium and its stability for nature tendency.

Title:

Unsteady Falkner-Skan Flow of Hybrid Nanofluid Over a Nonlinear Moving Wedge

Journal:

Malaysian Journal of Fundamental and Applied Sciences, Volume 18, Issue 1, 28 February 2022.

Document Type:

Article

Authors:

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Abstract:

The efficient heat transfer performance of hybrid nanofluid making the fluid crucial in many industrial applications like heat exchangers, nuclear reactors, automotive cooling systems, and most manufacturing processes. This research aims to uncover the properties of an unsteady Falkner-Skan hybrid nanofluid flows over a nonlinear moving wedge with the convective boundary condition. The water-based hybrid nanofluid that is considered in this research is composite nanoparticles of alumina (Al₂O₃) and copper (Cu). The governing nonlinear partial differential equations are transformed into nonlinear ordinary differential equations by incorporating similarity variables of appropriate types. A Keller-Box method is then used to solve the transformed equations numerically. The effects of various pertinent parameters such as unsteady flow, moving wedge, and angle wedge parameters on fluid flows and heat transfer are examined and graphically presented. The moving wedge parameter has enhanced the velocity profile and the heat transfer performance of the fluid. However, an opposite tendency is observed in temperature profiles for the increment of the angle wedge parameter.

Title:

Acid Hydrolysis and Optimization Techniques for Nanoparticles Preparation: Current Review

Journal:

Applied Biochemistry and Biotechnology, Volume 194, Issue 8, August 2022.

Document Type:

Review

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Abstract:

Nanostarch is unique in that it is highly soluble, thermally stable, non-toxic and inexpensive. Hence, it is utilized in numerous well-established applications, including drug delivery, cosmetics, textiles, foods, and enhanced oil recovery (EOR). These applications take advantage of the special functions that can be achieved through modifications to the structure and properties of native starch. The most common method for the preparation of nanostarch with a relatively higher crystallinity and stability is acid hydrolysis. Technically, the properties of nanostarch are highly dependent on several factors during the hydrolysis process, such as the acid, concentration of acid, reaction time, reaction temperature, and source of starch. The production of nanostarch with desired properties requires a detailed understanding on each of the factors as they are inevitably affected the physical and chemical properties of nanostarch. Hence, it is vital to incorporate optimization technique into the production process to achieve the full potential of nanostarch. Therefore, the current review comprehensively elaborates on the factors that affect acid hydrolysis as well as the optimization techniques used in the preparation of nanostarch.

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Title:

Application of Caputo Fractional Derivatives to the Convective Flow of Casson Fluids in a Microchannel with Thermal Radiation

Journal:

Journal of Advanced Research in Fluid Mechanics and Thermal Sciences, Volume 93, Issue 1, 2022.

Document Type:

Article

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Abstract:

In this paper, the application of Caputo fractional derivative on unsteady boundary layer Casson fluid flow in a microchannel is studied. The partial differential equations which governed the problem are considered with the presence of thermal radiation. The fractional partial differential equations are transformed into dimensionless governing equations using appropriate dimensionless variables. It is then solved analytically using the Laplace transform technique which transforms the equations into linear ordinary differential equations. These transformed equations are then solved using the appropriate method, and the inverse Laplace transform technique is applied to obtain the solution in form of velocity and temperature profiles. Graphical illustrations are acquired using Mathcad software and the influence of important physical parameters on velocity and temperature profiles are analyzed. Results show that thermal radiation and fractional parameter have enhanced the velocity and temperature profiles.

Title:

Modeling phasmophobia (fear of ghosts) using electroencephalogram

Journal:

Indonesian Journal of Electrical Engineering and Computer Science, Volume 26, Issue 2, May 2022.

Document Type:

Article

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Abstract:

Extreme fears towards ghosts and entities are defined as phasmaphobia. Those diagnosed with phasmophobia symptoms should control their own fears to avoid phasmaphobia attack. In this work, we present the development of phasmophobia detection electroencephalogram database (PDED). PDED consists of an average of 45 minutes electroencephalography (EEG) recordings from eight electrodes situated on the frontal lobe of the brain area. A real-time fear assessment was conducted simultaneously with the EEG recording by the participant. Five different stimuli were used to induce fear in our experiment. 599 EEG epochs related to fear were extracted based on the timestamp recorded by each individual. Asymmetry relation ratio (ARR) techniques were used on these EEG to detect the presence of fear. The quality of long duration of EEG recording from PDED in recognizing fear was thoroughly presented based on ARR. In this study, 91.5% of fear emotion managed to be detected from these epochs. Using PDED, it is also proven that the changes of ARR reflected positive correlation towards the changes of the level of fear. Analysis using emotion recognition rate (ERR) curves indicated that, two electrodes, namely F7 and F8, were sufficient to recognized 88% of fear from the recordings

Title:

Development of Automatic Ladder Climbing Inspection Robot Using Extension Type Flexible Pneumatic Actuators

Journal:

International Journal of Automotive and Mechanical Engineering, Volume 19, Issue 1, 2022.

Document Type:

Article

Authors:

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Abstract:

Recently, old and dilapidated infrastructures such as bridges, chimneys and tunnels have become very serious in Japan. Inspection of the infrastructure was done by climbing the ladders that were set up. However, the inspection becomes dangerous as it is necessary to climb into very high areas and unpredictable weather and conditions. In this study, a lightweight inspection robot that can climb ladders in adverse weather conditions was proposed and tested. To grasp a ladder pillar without hurting, the wrapping motion is required. Therefore, the flexible robot arm that can grasp the ladder pillar while approaching and release it while going away was also proposed and tested. The automatic ladder-climbing inspection robot that consists of two pillar grasping flexible robot arms and a lifting robot arm was proposed and tested. The control system of the robot, driven by four on/off valves and an embedded controller, was also constructed. The ladder climbing experiment using the tested robot was carried out. As a result, it could be confirmed that the robot can climb up and down a ladder with soft gripping the ladder, and the soft robot can be also operated by using only four valves.

Title:

Development of Pipe Inspection Robot using Soft Actuators, Microcontroller and LabVIEW

Journal:

International Journal of Advanced Computer Science and Applications, Volume 13, Issue 3, 2022.

Document Type:

Article

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Abstract:

Pipeline transportation is particularly significant nowadays because it can transfer liquids or gases over a long distance, usually to a market area for use, using a system of pipes. The pipeline's numerous fittings, such as elbows and tees, as well as the various sizes and types of materials utilized, make routine inspection and maintenance challenging for the technician. Therefore, the compact and portable pipe inspection robots with pneumatic actuators are required for use in industry especially in hazardous areas. Flexible pneumatic actuators with clean and safe pneumatic energy have high mobility to move in complex pipelines. High safety features such as no oil or electrical leakage, which would be dangerous if used in an explosive environment are a major factor it is widely used nowadays. As a result, the goal of this study is to propose and present the development of pipe inspection robot that employ soft actuators and are monitored by LabVIEW for usage in a variety of pipe sizes and types. This research focuses on the movement of robots in the pipeline by proposing some important mechanisms such as sliding mechanism, holding mechanism, and bending unit to move easily and effectively in the pipeline. Experiments show that with an appropriate pneumatic pressure source of 4 bar, a flexible robot using the soft pneumatic actuator can bend and move in a 2-inch diameter pipe smoothly and efficiently. It has been discovered that the proposed mechanism may readily travel pipe corners while bending in any required direction.