

Contents

Abstract–We fabricated a bipolar field-effect transistors based on graphene and analyzed their performance. A field effect transistor includes a P-type semiconductor substrate as a back gate, graphene sheet is used as the channel material in device with transferring graphene sheet from Cu substrates to target substrates, source and drain electrodes formed at a distance 6 μm, and junctions between the source and drain electrodes and the semiconductor region are formed as an insulated area including a Schottky barrier. When the device was tested at room temperature, it exhibited V-shaped ambipolar transport properties with the minimum conductivity at around VGS∼1 V, charge neutrality point (CNP) where the electrons and holes are equal in density, from p-type region to n-type region. We have used biological receptor with a field effect transistor based on graphene to fabricate sensor for achieving high sensitivity and selectivity that can detect explosive substances such as TNT. The transport property changed compared to that of the FET made by intrinsic graphene, that is, the Dirac point position moved from positive Vg to negative Vg, indicating the transition of graphene from p-type to n-type after annealing in TNT, and our results show the bipolar property change of GFET with the TNT concentration and the possibility to develop a robust, easy-to-use, and low-cost TNT detection method for performing a sensitive, reliable, and semi-quantitative detection in a wide detection range. The results suggest that our method is fast, facile, and substrate independent.

Abstract–As a clean, pollution-free and inexhaustible source of energy, solar energy is the ideal choice for power generation. However, the present solar power efficiency is low. Hence, this paper designed a single-chip AT89C51 solar photovoltaic panel tracking control system in order to improve the efficiency of solar energy. When the solar panel is perpendicular to the sun ray, it receives the maximum amount of sunlight, but the direction of the sunlight varies with the seasonal and weather changes. At present, most solar panels are fixed and cannot follow the sun in real time. In order to increase the solar radiation per unit area of solar photovoltaic panels, we designed a solar tracking control system which enabled the photovoltaic panels to rotate and follow the movement of the sun like three-dimensional (3-D) hemispheres to improve the overall power generation situation. The system can achieve maximum sunlight and energy concentration and reduce power costs with fewer solar photovoltaic panels, with research significance.

Abstract–The aim of this study is designing a quantitative model to evaluate the efficiency of similar and homogeneous decision-making units through the development of a mathematical model called data envelopment analysis (DEA) so that it gives more precise figures for efficiency of decision making units than the current DEA models. According to the importance of the electricity industry and its importance, the subject of this thesis is the electricity distribution sector in Iran. In order to answer the main questions of this research, the methods of determining the multicollinearity of variables (using the index VIF (Variance Inflation Factor)) and Principle Component Analysis, linear and nonlinear estimates and expansion of the DEA model in a non-linear form model were used.

Abstract–In this paper, a new structure is proposed for a six-bit DMTL phase shifter in which the number of micro-electro mechanical system (MEMS) switches is reduced from 63 to 29. This is done through designing three different kinds of MEMS switches, which are capable of doing different phase shifts, instead of using identical switches. The reduction of the number of switches results in decreasing the die-size of the phase shifter and as a result in amount of loss and the production cost. In order to match the proper impedance along CPW line, all three kinds of the MEMS switches have been designed so that their impedances in up and down states are identical. The structure is calculated and simulated at 16 GHz using HFSS and COMSOL softwares. According to calculation and simulation results, for all phase states, the return loss is better than –11.4 dB and maximum phase error is 1.7 °. Although three different structural switches are used, the pull-in voltages and switching times are all identical. The total structure size is $1.6 \times 21\,\mathrm{mm}^2$ and the surface micromachining process is proposed for the phase shifter fabrication.

Abstract–Virtual instruments have gained a great development as age advances. Based on a brief review of the development history of virtual instruments, this study introduced the structures and operation rules of virtual instruments and summarized the testing of muscle group strength in physical exercise. Pulling dumbbell in a prone position was tested using virtual instruments. Experimental data were collected in a time-sharing and multi-channel way. The experiments results were displayed by front panels and analyzed. Finally, the role of the virtual instruments in the testing was evaluated. It was found that, the application of virtual instruments simplified the experimental operation, improved the precision of the results, reduced the experiment cost and promoted the scientific development of sports cause. Virtual instruments are bound to develop better in the near future as they adapt to the trend of the times.

Vehicle routing problem in road network is one of the most widely aspects of load displacement. This problem can play a very important role in efficiency of country cargo fleet transportation. This study considers the backhaul problem in vehicle routing which is one of the major subcategories of vehicle routing problem. Vehicle routing problem with backhaul is a development section in vehicle routing problems which consists of backhaul and linehaul customers. For the first time, in one of the current researches, a novel hybrid K-means and metaheuristic, based on the bio-inspired genetic optimizer is presented to solve VRPB, the Vehicle routing problems with backhaul. In the first phase of the research, customers are divided into a number of feasible groups; in the second phase, the best route is determined to visit all customers. Finally, we will use genetic algorithm to find the best possible way for constructing route within each cluster and between two clusters in two separate sets of customers. The result of algorithm performance was used to deal with a number of benchmark problems; they indicated that this method has acceptable results and is quicker in comparison with the other algorithms.

Abstract–Banking is practice or profession as old as the man existence. Banks have the duty of safeguarding money and providing valuable financial services for their customers. Granting loan is one of the main financial activities of banks, which involves huge amount of risks to the borrower and the lender. The risk of not fulfilling the obligation by the borrower on due date can put the bank on bankruptcy risk. Iranian banks face several risk and challenges that among them credit risk is the most concern of banking regulators because this risk can easily lead to bank failure. The problem of inappropriate risk management in Iranian banks is a big challenge for them. Lack of sound credit policies, structure and management make trouble for them. And also the lack of an appropriate credit risk method which can help them in managing loan providing procedure can be seen. Therefore, the credit risk management and method for Iranian banks should be researched.

Abstract–Embolism is a well-known and wide used technique for treatment of the cancerous tumors. In the conventional embolism technique, the solid materials are used for preventing the blood flow to the targeted tissues. The proposed numerical modeling of the problem is capable for simulation of the dynamic behavior of the gaseous plug inside the vein during its growth and partially collapse phases and predicts the lifetime of the gaseous plug for preventing the blood flow to the targeted tissues. This numerical model also offers three different thermodynamic processes for the growth and partially collapse phases of the gaseous plug. In the first thermodynamic process for the gaseous plug growth and partially collapse phases, it is assumed that the gaseous plug contains a constant pressure vapor. In the second thermodynamic process of the gaseous plug growth and partially collapse phases, it is assumed that the gaseous plug contains an ideal gas which undergoes a classical thermodynamic process. In the third case, a mathematical-experimental model has been employed for the simulation of the growth and partially collapse phases of the gaseous plug. Numerical results for the three different thermodynamic processes of the gaseous plug growth and partially collapse phases have been illustrated and discussed.

Abstract–The industrial design mainly aims to design products in order to meet the requirements of consumers and improve life quality. When new products are continuously presented on the market, to avoid elimination on the market, enterprises should design products to meet preferences of consumers according to different preference requirements and improve competition capability. For improved individual independence of current consumers, the product design methods are extended according to the production development theory of Kansei engineering system. This method gets the preferential images of the consumers by surveying Kansei images of products, identifies the appearance features of products by combining the qualitative description of shape decomposition with quantitative description of shape descriptive points, and finally gets mapping of psychological Kansei image of consumers and product shapes in order to guide design of further products. This research focuses on mobile phone products, aims to quantify the Kansei cognition factors of consumers for products by using the Kansei engineering, discusses relation between the consumer image and shape elements, and solves the difficulties that the Kansei factors of a person cannot be easily grasped in design. The clustering analysis method is used to select 14 groups of representative images and semantics and 8 groups of representative mobile phone samples on the first three stages of research and experiment and the mobile phone shape element table are established. The semantic differential method is used to carry out the questionnaire survey on the fourth stage. The production shape rules for the preferential image of consumers according to the quantified class I analysis results. Finally the T test results indicate that this shaping method is practicable.

Abstract–In this paper the vibration of robot arm induced by fluid flow is investigated. Considering the flexibility of robot arm and the force of around fluid, the equation of motion is obtained using the Euler-Bernoulli beam theory. The force on the arm by the fluid is applied by coupled-motion model. After extracting the differential equations, the effect of system parameters such as geometrical and mechanical characteristic of arm, the effect of fluid velocity on the dynamic response of the arm are investigated. Results show that by increasing the velocity of the fluid, the inertial forces of fluid increase and thus are not negligible. This case leads to suddenly increase in the vibration and results in weak performance of the system in the case of high velocity and in locked-in zone. Therefore, by identifying the locked-in zone, the parameters of system should be chosen in a way that the arm is not in the locked-in zone.