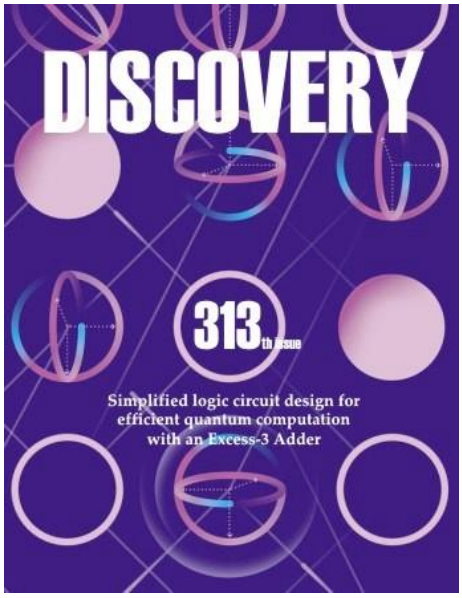
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DISCOVERY

About the Cover



Quantum computers are composed of quantum logic circuits that fulfill quantum computation based on quantum mechanics. However, during quantum computation, collapse of information in the circuits due to decoherence is a very subtle problem. In order to obtain exact computing results by preventing such decoherence, simplification of arithmetic logic circuits is important. In this work, we design a simplified Excess-3 Adder that can be available to decimal arithmetic operation. The simplification of the circuit is carried out by removing an operation line from the lately proposed circuit in this context. From a check of the logic process of arithmetic computations for numerical additions, we confirm that the circuit works well. Our circuit is robust from decoherence and consumes low electric power. (Ref: Choi JR, Song JN. Simplified logic circuit design for efficient quantum computation with an Excess-3 Adder. *Discovery*, 2022, 58(313), 58-62).

Distribution/Spread of Superbug and Potential ESKAPE-B Pathogens amongst Domestic and Environmental Activities: A Public Health Concern

Igere BE, Peter WO, Beshiru A

Potential bacterial pathogens and resistant strains continue to spread and have been implicated in diverse infections of man, animal and plants. Most of these strains have been source-track to inhabit environmental nexus and their spread has become an environmental and public health concern. This study examined the distribution/spread of superbugs and potential ESKAPE-B pathogens among domestic activities. The study was conducted particularly on two assessment clusters; determination of human subject awareness on the spread of superbugs and the laboratory isolation, characterization, antibiogram and prevalence of the various organisms in selected domestic activities sources. Data were collected using structured questionnaires while swab samples were collected from respondents irrespective of their previous activities. Swab samples were collected from vehicles seats and doors handles, classrooms chairs, offices chairs, tricycles, bicycles, toilets WC as well as gymnastic centre within the four local communities of Oghara. Swab specimens were cultured onto sterile MacConkey agar, Centrimide agar, Salmonella-Shigella agar and Mannitol salt agar on every sampling and incubated at 37^0C for 18-36 hours. Organisms observed were purified, stored on agar slants, Gram-stained and characterized using biochemical test simultaneously. The study reveals that majority of respondents in the study area do not apply appropriateness in hygienic practice which is a potential source to the spread of resistant bacteria. It was also evident that *P. aeruginosa* (21/132; 15.9%) is most prevalent in the environment including other members of the ESKAPE-B strains. Isolates show resistance phenotype as follows: Amoxicillin (100%), Ceftazidime (86.5%), Cefixime and Cefuroxime (98.1%), Ofloxacin and Ciprofloxacin (96.2%), Gentamicin (100%). Plasmid Analysis revealed that amongst 132 strains of ESKAPE-B as well as *Vibrio specie*, *Salmonella specie* and *Shigella specie* retrieved during the study, 62.9% (83/132) were shown to harbour plasmid of size ranging from 22kb to 1kb, indicating that some of the resistance observed from the antibiotic susceptibility testing were associated with resistance plasmids. Our observation has shown that the distribution and spread of these antibiotic resistant bacteria is associated with poor implementation of standard hygienic practice and poor awareness. The need for an adroit implementation and application of standard hygienic practice cannot be overemphasized.

Discovery, 2022, 58(313), 1-20

Structural, magnetic and magneto-resistive properties of sputter deposited Ni-Mn-Ga ferromagnetic shape memory thin films

Annadurai A

Ni-Mn-Ga ferromagnetic shape memory alloy thin films were deposited onto well cleaned substrates of Si (100) and glass at two different sputtering powers of 25W and 45 W in argon atmosphere at 0.015 mbar. The structural, magnetic and magneto-resistive properties of the deposited films were systematically investigated. The sputtering target $Ni_{50}Mn_{30}Ga_{20}$ (at.%) used in the present work has been prepared by vacuum induction melting technique. The prepared thin films were post-annealed at a temperature of 600^oC for 1 h in vacuum. The composition and structure of the films were studied by energy dispersive x-ray analysis and x-ray diffraction techniques. The magnetic properties were studied using vibrating sample magnetometer and a.c. magnetic susceptometer. Magneto-resistive properties were measured using four-probe set-up attached with vibrating sample magnetometer. Pristine thin films are quasi crystalline while the annealed films show good crystallinity and ferromagnetism at room temperature. It was observed that the annealed films deposited at 25 W show austenite phase whereas the films deposited at 45 W show mixed phases of both austenite and martensite. Maximum magnetic transition temperature of the films investigated was found to be 327 K which is in consistent with the results of a.c. magnetic susceptibility. The thermo-magnetic curves reflect only magnetic transition and no signature of structural transition observed. The magneto-resistive properties of the thin films are found to be isotropic with a maximum negative magneto-resistance value of -0.6% at an applied magnetic field of 2.0 Tesla.

Discovery, 2022, 58(313), 21-27

Floral bio-indicator of natural salt lick: keys for the wildlife management in mining areas

Sanath Kumar N, Sanjeet Kumar

Wildlife management & restoration of habitat is difficult in mining areas. The continuous extension of mining activities in a particular landscapes are causes for the loss of wildlife population followed by extinction in mining areas. Urgent restoration programs are needed in mining areas using different ecological aspects. Keeping the importance of restoration in mining areas, an attempt has been carried out to enumerate the ground floral species available in & around natural salt lick areas of Koira Range, Bonai Forest Division, Odisha, India. The results revealed that 27 species are enumerated from nine natural salt lick areas. The common enumerated species are *Lindernia crustacea, Lindernia ciliata, Desmodium triflorum, Eriocaulon quinquangulare* and *Murdannia nudiflora*. The present study recommends the restoration of enumerated plant species along with food species of available herbivorous including Asian Elephant to balance the ecological systems and food chain in mining areas to avoid the conflicts.

Discovery, 2022, 58(313), 28-33

Floral biology and pollination in *Diospyros chloroxylon* (Ebenaceae) and *Hybanthus enneaspermus* (Violaceae)

Venkata Ramana K, Lakshminarayana G, Solomon Raju AJ, Ch. Prasada Rao

Diospyros chloroxylon is an evergreen dry season blooming tree species. It is dioecious with male and female flowers, each possessing non-functional opposite sex organ, which is an indication that this sexual system is evolved from hermaphroditism. Male flowers provide both nectar and pollen and while female flowers provide only nectar but honey bees as exclusive foragers visit both flower sexes indiscriminately effecting cross-pollination. Ornithochory is functional in this species. *Hybanthus enneaspermus* is an annual hermaphroditic wet season herb. It is self-compatible, allogamous and autogamous. Lycaenid butterflies are involved in the functionality of allogamy while flower closure event brings about autogamy. The elaborate floral mechanism controls the occurrence of autogamy to promote allogamy.

Discovery, 2022, 58(313), 34-38

Pollination ecology of three *Ipomoea* species, *I. cairica, I. marginata* and *I. trilobata* (Convolvulaceae)

Lakshminarayana G, Umamaheswara Rao G, Venkata Ramana K, Ch. Prasada Rao, Solomon Raju AJ

Three *Ipomoea* species, *I. cairica, I. marginata* and *I. triloba* included in this study are hermaphroditic climbing or twining species, the first two species are perennials while the last one is an annual. In all three species, the flowers present stigma far above the stamens to ensure pollination, especially cross-pollination. *I. cairica* and *I. triloba* are pollinated by honey bees and stingless bees, and *I. marginata* by honey bees and a papilionid butterfly. *I. cairica* and *I. triloba* are self-incompatible and obligately outcrossing while *I. triloba* is suspected to be self-compatible but it appears to be primarily cross-pollinating as there is only rare to low fruit and seed set rate in these species. In all three species, fruit is a capsule which either dehisces or pops open while still attached to parent plant to release seeds which are disseminated either by wind or by water according to the ecological situation. *I. cairica* and *I. marginata* being perennials have the ability to propagate also by vegetative mode while *I. triloba* being an annual does not have the ability to propagate by vegetative mode.

Discovery, 2022, 58(313), 39-43

ENGINEERING

CBR correlation with index properties of natural soils of selected failed roads in southeastern Nigeria

Apata AC, Obiora IJ, Imoh UU

Poor conditions of subgrade soils have been noted as one of the major causes of pavement failures. The strength of subgrade soils are measured by their CBR values. Soil samples were collected from three different locations of total failure in Awkuzu, Ugwuoba and Arondizogu all in southeastern Nigeria. Index properties as well as the compaction characteristics of the soil were determined. The soils have more than 35% of their particles passing the No 200 BS sieve and were classified as silty-clay materials in line with AASHTO soil classification. Their liquid limits (LL) and plasticity indices (PI) fall within the ranges of 49% to 78.4% and 24% to 37.3% respectively. Therefore, they can be said to belong to the soil group A-7-5, showing that their major constituents are clayey soils which have fair to poor subgrade rating. Three-point CBR at OMC was carried out on the soils and their values ranged from 1.8% to 2%. When the CBR values were correlated with other properties of the soil, a perfect negative correlation (-1.0) existed with the OMC, strong positive correlation of 0.97 existed with the MDD while the index properties of the soils showed negative weak to moderate correlation within the ranges of -0.32 to -0.50.

Discovery, 2022, 58(313), 44-49

Assessing the Stiffness Sensitivity of Gap Graded Asphalt Concrete

Saad Issa Sarsam

Flexural stiffness of asphalt concrete is susceptible to the environment condition, binder content, and aggregates ingredients. The ability of the flexible pavement to sustain the serviceability against distresses is dependent on the stiffness of the asphalt concrete mixture. In the present assessment, the stiffness susceptibility of asphalt concrete was investigated in terms of flexural stiffness, deformation, and fatigue life. Asphalt concrete mixture was prepared using three percentages of binder content and two types of mineral filler. The asphalt concrete mixtures were subjected to roller compaction. Beam specimens were extracted from the prepared slab samples. Beam specimens were subjected to fatigue life determination under repeated flexural stresses. The specimens were tested under (20 and 0) ºC environment. It was found that mixture prepared with limestone dust filler exhibits higher flexural stiffness by 38.5 % than the mixture prepared with coal fly ash filler. The fatigue life of specimens prepared with coal flyash is higher than that of specimens prepared with limestone dust by (23.2, and 4.8) % for specimens tested at (0 and 20) ºC respectively. The fracture toughness at failure declines by (30.6, and 20) % when the testing temperature rises from (0 to 20) ºC for specimens prepared with coal flyash and limestone dust respectively. Mixture with coal fly ash exhibits higher initial stiffness when the binder content increases by 0.5 % as compared with the control mixture. However, lowering the binder content by 0.5 % is exhibits lower flexural stiffness than that of the control mixture. It was concluded that asphalt concrete mixture prepared with limestone dust is more sensitive to the variation in testing temperature and binder content than the mixture prepared with coal fly ash.

Discovery, 2022, 58(313), 50-57

TECHNOLOGY

Simplified logic circuit design for efficient quantum computation with an Excess-3 Adder

Jeong Ryeol Choi, Ji Nny Song

Quantum computers are composed of quantum logic circuits that fulfill quantum computation based on quantum mechanics. However, during quantum computation, collapse of information in the circuits due to decoherence is a very subtle problem. In order to obtain exact computing results by preventing such decoherence, simplification of arithmetic logic circuits is important. In this work, we design a simplified Excess-3 Adder that can be available to decimal arithmetic operation. The simplification of the circuit is carried out by removing an operation line from the lately proposed circuit in this context. From a check of the logic process of arithmetic computations for numerical additions, we confirm that the circuit works well. Our circuit is robust from decoherence and consumes low electric power.

Discovery, 2022, 58(313), 58-62

SOCIAL SCIENCE

The effectiveness of audio-visual on the teaching and learning mathematics in Adeyemi College of education public primary school, Ondo state, Nigeria

Famuagun KS, Akintewe BN, Olademo JOA

Education (formal or non-formal) is an absolute necessity for everybody. Teaching and learning are the essential element in education. This research investigated the effectiveness of audio-visual in teaching and learning Mathematics in Adeyemi College of Education Public Primary School Ondo, Ondo state. A total number of twenty six (26) primary one students were involved in the experiment, in which 53.8% were male and 46.2% were female approximately. The involved students were also grouped into three in respect to their ages. Data for research analysis were collected through pre-test and post test scores. T-test and Analysis of variance were used to analyze the three hypotheses stated for the research. The findings revealed that there is significant difference between the mean score of the post-test for traditional method of teaching and the audio-visual method of teaching and learning Mathematics. It was also revealed that the students' age has significant influence on their performance when exposed to the audio-visual method of teaching and learning Mathematics. However, there is no significant difference in the mean score of male students and the mean score of female students when exposed to the audio-visual method of teaching. Finally, based on the research findings recommendations were made on the need to develop relevant audio-visual aids for teaching Mathematics in primary schools.

Discovery, 2022, 58(313), 63-67

The effect of economic recession on Nigeria educational system: the way out

Awodeyi John, Emmanuel Faith Igwe, Emmanuel A

This research examines the effect of the economic turn-down on the educational system of Nigeria and the way forward. The work concentrated fully on seeking the perception of teachers on the impact economic recession has made on the educational system. The design for the study was a descriptive survey and five (5) research questions with a hypothesis guided it. The instrument for data collection was structured questionnaire which was validated by specialists in science education. The data collected were analyzed using mean, standard deviation and t-test statistical method. The findings revealed that teachers agreed to the fact that economic crisis in the country has caused a lot of harms to the educational system which could be seen from inadequate curriculum implementation, lack of resources in terms of competent manpower, facilities, and fund non-availability and could be salvaged by: making vocational subjects teaching cash-productive; boosting the students interest in 'doing' than writing; and developing entrepreneurial spirit and skills in students. Finally, conclusion and recommendations were made based on the findings.

Discovery, 2022, 58(313), 68-75