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MATHEMATICAL, PHYSICAL, AND ENGINEERING SCIENCES

PSEUDO-LEXICOGRAPHIC AND ANTI-LEXICOGRAPHIC ORDERINGS OF PERMUTATIONS AND SOME ALGORITHMS

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Let S={1,2,...,n} and let μ be a permutation of S. Moreover, let $S\mu = \{x \in S \backslash x\ \mu \neq x\}$ be the set of elements of S moved the permutation μ. Define μ_i, $1 \leq i \leq n-1$ to be cycles of length $l = i + 1$ such that $S\mu_i \subset S\mu_{i+1}$. Then $\left\{\prod_{i=1}^{n-1} \mu_i^{d_i} | 0 \leq d_i \leq i\right\}$ generates S_n, the symmetric group n symbols. Moreover, each permutation generated by $\prod_{i=1}^{n-1} \mu_i^{d_i}$ can be indexed by x and represented by π_x, where $x = \sum_{i=1}^{n-1} i!\, d_i$ and $0 \leq x \leq n! - 1$. Define $<$ to be a linear ordering of the permutations π_x, such that π_α presence π_b precedes whenever $a < b$. Let σ_i and α_i be special cycles defined by

$$\sigma_i(x) = \begin{cases} x, & x < n\text{-i} \\ x+1, & n-i \leq x \leq n-1 \\ n-i, & x = n \end{cases}$$

and

$$\alpha_i(x) = \begin{cases} x+1, & 1 \le x < i+1 \\ 1 & , \quad x = i+1 \\ x & , \quad x > i+1 \end{cases}$$

respectively. Then the linear ordering < shall be called *pseudo-lexicographic* ordering if $\pi_x = \prod_{i=1}^{n-1} \alpha_i^d i$, *i.e.*, if $\pi_x = \prod_{i=1}^{n-1} \sigma_i^d i$, i.e., if $\mu_i = \sigma_i$ and *anti-lexicographic* ordering if $\pi_x = \prod_{i=1}^{n-1} \sigma_i^d i$, i.e., if $\mu_i = \alpha_i$.

Algorithms based on these permutation ordering schemes can be easily developed.

FINITE INVERTIBLE LOOPS OF THE COSET PRODUCT TYPE

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A finite *invertible loop* is one in which every element has a unique inverse. The class of all finite invertible loops includes Moufang loops, IP loops, pseudogroups, and groups. This paper shows that every Lagrangian invertible loop $(L; \diamond)$with a non-trivial normal subsystem Z has a unique coset decomposition with respect to Z and is a coset *product* of the form $(L; \diamond) = (E;*)\ X\ (C;\Phi)$, where $(E;*)$ is a loop and $(C;\Phi)$ is a multi- $\varnothing$ system such that $(C;\varnothing_{ij})$ is a quasigroup-type system for every operation $\varnothing_{ij} \subset \Phi$. The analysis of invertible loops as coset products is a useful tool in the study of their structures. This has been applied in the construction and analysis of finite pseudogroups like the Octonion loop (which is associated with the non-associative division algebra of Cayley numbers) and related structures.

Keywords: invertible loop, Moufang loop, pseudogroup, coset product

LATIN SQUARE COMPOSITION OF FACTORABLE GROUPS AND LOOPS

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All factorable finite groups have Cayley tables that are built up of two classes of Latin square blocks: the **cylic** and **Klein** blocks. Using these basic blocks, we can easily construct all known factorable groups like the *symmetric, alternating, dihedral,* and *dicylic* groups. Similarly, we can also construct factorable *loops* like *pseudogroups* with desired properties.

Keywords: finite loops, latin square, cyclic blocks, Klein blocks

CONSTRUCTION OF A FAMILY OF POWER ASSOCIATIVE PSEUDOGROUPS OF ORDER $n=2m$ WITH NORMAL SUBSYSTEMS OF ORDER m

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A pseudogroup $(P;*)$ is not an associative invertible loop. Furthermore, it is called *power associative (PA)* if for element a in P, and any integers m and n, then $a^m * a^n = a^{m+n}$. Although this identity is always true for any associative system, this is not always so for non-associative systems like pseudogroups. In this paper, a family of PA pseudogroups was constructed using the *block product method.* The generating systems used was the cycle group C_2 of order 2 and the multi-Φ of order $(m:4)$, where $C = \{1,2,\ldots,m\}$ and $\Phi = \{\varnothing_{ij} \mid i,j = 1,2\}$. The elements of Φ were defined as: (i) $\varnothing_{11}$ is an operation for a cyclic group of order m; (ii) $\varnothing_{12}$ is a quasigroup operation of order m with left identity element, (iii) $\varnothing_{21}$ is a quasigroup operation of order m with right identity element; and (iv) $\varnothing_{22}$ is a quasigroup operation such that for all x in C, $x\varnothing_{22}\,x = 1$ and $x\varnothing_{22}y = x\varnothing_{11}y^{-1}$. All members of this family had a normal subsystem of order m.

Keywords: pseudogroups, quasigroup, loop power associative

ASSESSMENT OF INFLUENTIAL OBSERVATIONS IN MAXIMUM LIKEHOOD FACTOR ANALYSIS

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The present paper deals with the analysis of influential observations in maximum likelihood factor analysis. This study is the continuation of the paper of Tanaka and Odaka (1989a, b) who proposed methods of sensitivity analysis in principal component analysis (PFA). The main objective here is to investigate the influence or a small change of data on the result of the analysis. To do this, the theoretical influence functions $I(x; LL^T)$ and $I(x; \Delta)$ for the common variance matrix $T=LL^T$ and the unique variance matrix Δ respectively were derived. To assess the influential observations, some influence measures like the Euclidean norm of $\Delta^{(1)}$ and two scaled norms such as D_{us} and D_{ms}, a quantity similar to the so-called Cook's distance were used in the analysis. Some numerical examples are shown to illustrate the present procedure and a comparison is illustrated with case of principal factor analysis.

Keywords: influencial observations; influence function; maximum likelihood; factor analysis; Euclidean norm; scale; scale-invariant, unique variance matrix; common variance matrix.

PREDICTION OF SEDIMENT MOVEMENT IN LINGAYEN GULF: AN EVALUATION OF APPROACHES AND IMPLICATIONS TO COASTAL STABILITY

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Understanding of the movement of sediments along coastal areas can help in predicting the possible consequences of human activities. It is essential in forecasting shoreline stability, as well as the movement and fate of pollutants entering the coast. However, the importance of sediment transport within the nearshore, hereby referred to as the region between the surf zone and the shoreline, is oftentimes overlooked. Furthermore, numerical circulation models, intended for the offshore regions.

This study established the nearshore and offshore sediment dispersal in Lingayen Gulf using geomorphic and sedimentologic-based parameters. We then compared the results with modeled circulation and wave refraction patterns and dispersal trends defined by remotely-sensed data. The predominant nearshore sediment transport was deduced from geomorphic-based parameters such as splits and deltas, and changes in shoreline position derived from the time series analysis of maps and remotely-sensed images. The net offshore sediment dispersal trends were derived using the granulometry of bottom sediments in the upper 20 cm of the bay floor combined with changes in water depths.

Results indicate a southward transport of sediments along the eastern coast as indicated by the assymetry of Bauang and Aringay River Deltas and growth of the Damortis spit. Utilizing similar features, this continued to a dominantly westward transport direction along the bayhead coast with possible shifts of littoral cells as reflected by changes in the assymetry and direction of mouth bar spits during certain periods. The predominant direction of longshore current suggested by the wave refraction models were consistent with the above results. Trends of deposition in the offshore, defined by changes in water depths and sediment distribution indicate a net northward transport of sediments from Agno and Bued-Patalan Rivers. In a Landsat image, the sediment plumes of the rivers were noted on top of the depositional trends.

In general, there is poor correlation between the sediment dispersal derived from geomorphologic data and remotely-sensed images with water circulation predicted by numerical models. The use of regional winds, depth-integration and absence of tidal influence in the simulations could be the cause of the above disparity.

Keywords: sediment movement, Lingayen gulf, coastal stability, Agno river, shoreline changes, water depth changes, longshore current, geomorphologic indicators, nearshore, offshore

CHANGES IN WATER AND SHORELINE POSITIONS AND THEIR IMPLICATIONS TO SEDIMENT DISPERSAL AND SEDIMENTATION RATES IN MANILA BAY

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Despite the heavy use of Manila Bay and its coasts for fisheries, domestic, industrial purposes, studies addressing the consequences of human modifications along the coastal zone and the potential fate of pollutants entering Manila Bay are few, if not lacking. This study addresses this need.

The predominant nearshore and offshore sediment dispersal pathways in Manila Bay, specifically off Cavite, Manila, and Pampanga, were determined by examining the depositional coastal geomorphic features, wave refraction models, changes in water depths and shoreline positions, and offshore sediment distribution patterns. Water depth changes were used to estimate the rates of sedimentation and establish lateral variations in the rates of sedimentation. High-resolution reflection seismic profiles and piston cores provided information on longer-term sedimentation. The predominant nearshore sediment drift along the eastern coast is to the northeast, along Manila to Pampanga is to the northwest, and along Bataan is to the north. Southwest sediment drift predominates along the Zapote-Kawit coast which is due to wave refraction around the Cavite Split. The flared and relatively stable river mouths fronting the northern fluvial-tidal delta plain indicate the greater importance of onshore-offshore sediment transport along this segment of the coast. Off the eastern portions of Manila Bay, waters move in a general northerly direction. Major sediment sinks occur north of the Cavite Spit and west northwest of the Pasig River mouth. Here, sedimentation rates can be as high as 9 cm/yr.

Variation in the magnitude of shallowing occurs across the three study areas; Pampanga Bay shows the least amount of shallowing while the Pasig River area shows the greatest. The apparent low rates of sedimentation in Pampanga Bay could be due to high subsidence rates in this part of Manila Bay. A general increase of sedimentation rate in the offshore direction is also indicated by the bathymetric changes. This trend implies low retention of sediments near the coast, which might be due primarily to a relative sea level rise in the bay. The seismic lines indicate that the relatively high sedimentation rates along the deeper central portions are not a recent trend. However, this long-term trend is probably controlled by the bay's morphology rather than sea level fluctuations.

Keywords: sediment dispersal, fate of pollutants, changes in shoreline position, changes in bathymetry, Manila Bay, Pampanga Bay, rate of sedimentation, sediment distribtion, Pasig Delta, Cavite Split

PATTERNS OF SEDIMENTATION, SOURCES OF SEDIMENT AND THEIR IMPLICATIONS TO LAGUNA DE BAY'S LIFE SPAN

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Laguna de Bay is used mainly for aqua-culture and is eyed as a source of domestic water for Metro Manila. This study addresses the need to understand

sedimentation processes in the lake because of its implications on the lake's overall water quality and life span.

Comparisons of an updated bathymetric map, constructed from water depth readings acquired in 1997, with 1963 and 1983 bathymetric maps which contain survey results in 1939 and 1968, respectively, reveal that the lake is diminishing. The lake's volume decreased from 2.35 x 10^9 m^3 to 2.26 x $10^9 m^3$, between 1939 and 1968, to 2.16 x 10^9 m^3 by 1997. The rate of volume decreased between 1939 and 1997, is 3.3 x $10^6 m^3$/yr. The average water depth was 2.5 m in 1939, 2.3 m in 1968, and 2.2 m in 1997, the average water depth, between 1939 and 1997, decreased at a rate of 5mm/yr.

Changes in shoreline positions, based on the comparison of the 1963 and 1983 maps, were dominated by shoreline retreat, increasing the lake's surface areas from 959 km^2 to 998 km^2, ^{210}Pb and ^{137}Cs profiles of two vibro-cores, from the central and west lobes, yielded sedimentation rates of approximately 4 cm/yr. Discrepancies with calculated sedimentation rates from bathymetric changes are attributed to subsidence, estimated to be approximately 3 cm yr. Given the shoaling rate of 5 mm/yr, a bulk density of 1.1 g/cm^3 and an 80% water content in the upper 1 m of sediment column, the sediment input is equivalent to 1.1 x 10^6 tons/yr. However, with subsidence accounted, a total sediment input of 7.7 x 10^6 tons/yr. is required. Relative to a previous estimate of watershed sediment yield, the above value is an order of magnitude higher. The discrepancy could be due to an underestimation of the watershed yield and/or unaccounted inputs from domestic, livestock, and industrial sources.

Spatial trends of net bathymetric changes and sediment distribution indicate that: shoaling, area-wise is most prominent in west and central bays; while reworking and erosion predominates the southern portions of south and west bays. The time series of bathymetric changes indicates lateral shifting of depositional and erosional zones. Silt-sized particles predominate the lake's surface sediments. However, clay is abundant in the west bay probably due to a high fine-grained sediment yield of Pasig River and to flocculation induce by seawater intrusion.

Keywords: sediment, bathymetry, subsidence, sediment distribution, Laguna de Bay, shoreline change, sediment input, rate of sedimentation, bathymetric change, lake surface area

SUBSIDENCE AND THE WORSENING FLOOD PROBLEM IN PAMPANGA AND BULACAN

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Towns within the Pampanga delta, from the provinces of Pampanga and Bulacan, have experienced floods that appear to have worsened through time. Deforestation and constriction of channel ways due to siltation and construction of fish pens have been suspected as the culprits. In this paper, we will present the initial results of our work that examines the contribution of subsidence to the flooding problem.

Anecdotal accounts of long-time residents indicate that the floods have become more frequent, higher, and that the waters now recede at a much slower rate. The accounts also indicate that flooding within the coastal towns and adjacent river systems are caused not only by rains but also by tides, and indication that subsidence plays a major role in the worsening problem of floods. In the southwestern parts of Pampanga, some sites now frequently inundated by tides were never reached by tides 30 to 40 years ago. In addition, emergence of water wells, an indicator of subsidence, was commonly observed. The rates of subsidence, based on the emerged well pipes and level of flooding, are estimated to be 3 cm/yr. Prior to the eruption of Mt. Pinatubo, the rates were slightly lower.

Besides flooding, sea water incursion affecting the quality of agricultural lands as well as ground water is another consequence of subsidence. Perhaps, this is the reason for the massive conversion of agricultural lands into fishponds. Ongoing work is aimed at mapping the trend of rates of subsidence, and identifying the causative agents. The results of this study are essential for long-term development plans within the Pampanga delta plain.

Keywords: subsidence, Pampanga delta, Pampanga, Bulacan, groundwater withdrawal, floods, saltwater intrusion, sea level rise, Pinatubo eruption, siltation

UTILIZATION OF LOCAL RAW MATERIALS FOR WHITE EARTHEN WARES AND PORCELAIN BODIES MANUFACTURING

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Whiteware refers to a glazed or unglazed ceramic body which is commonly white and of fine textures. Most of the raw materials used in the manufacture of whiteware bodies in the Philippines are imported despite the presence of raw materials in the country.

White clay from Solsona Feldspar from Pagudpud in Ilocos Norte, and lahar or rice hull ash were used as the main components in the formulation of the following ceramic bodies: sanitary wares, floor tiles, normal porcelain bodies, porcelain bodies and bone china. The materials were beneficiated to remove the magnetic impurities. Test bars were made based on 25 formulations in accordance with the general empirical formula for whiteware bodies and the tri-axial diagram. The test bars were fired at 950°C, 1000°C and 1050°C and the following properties were determined: color, fired shrinkage, total shrinkage, water absorption, porosity, and modulus of rupture.

The results of the test indicate that for sanitary ware body, the 48:30:22 clay:feldspar:rice hull ash formulation was the best, while the formulation 48:27:25 clay:feldstar:lahat body was the best for normal porcelain bodies. The results of the test for porcelain white wares and bone china did not pass the standards. The bodies were tested for glaze compatibility and the resulting glazed bodies were found to be acceptable.

Keywords: clay, earthen wares, feldspar, porcelain, whitewares

PROTEIN HYDROPEROXIDES: PROTEIN DAMAGE INDUCED BY PEROXYNITRITE

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Exposure of proteins to agents such as activated neutrophils, hypochlorous acid, hydroxyl and peroxyl-free radicals can result in the formation of protein hydroperoxides. Protein hydroperoxides can oxidize physiological reductants such as ascorbate and their decomposition can lead to the formation of other free radicals. These findings suggest that protein hydroperoxides, when generated *in vivo,* could cause biological damage, hence the need to find biologicval oxidants capable of inducing the formation of protein hydroperoxides.

Results of this study show that peroxynitrite, a biological oxidant formed by the reaction between superoxide and nitric oxide-free radicals, can induce the formation of protein hydroperoxides. Using the tri-iodide assay, BSA and other protein exposed to peroxynitrite at neutral pH tested positive for the presence of hydroperoxide groups. The newly-formed reactive moieties were attached to the protein and their identity as the hydroperoxide group was confirmed by their reaction with GSH-NaBH4, 2-mercaptoethanol and ascorbate, compounds known to react with hydroperoxides. The yield of BSA hydroperoxides was higher at slightly acidic to neutral pH than at alkaline pH. Presence of metal chelators such as DTPA, EDTA, and NTA did not reduce the yield of BSA hydroperoxide but desferrioxamine caused a 44% reduction. Hydroxyl radical scavenger failed to inhibit the peroxidation of BSA by peroxynitrite at neutral pH. The yield of protein hydroperoxide may be low compared to the concentration of peroxynitrite used. However, the results presented here suggested that peroxynitriti could be a potential biological agent for protein hydroperoxide formation and that protein peroxidation could be another pathway by which peroxynitrite can cause biological damage.

Keywords: protein, hydroperoxides, peroxynitrite, hydroperoxides, oxidants, protein peroxidation, protein damage

HYPOGLYCEMIC ACTIVITY OF SOME FOLKLORE ANTIDIABETIC PLANTS

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Plants have long been used to cure and/or prevent many diseases. The observed efficacy of these plants has made them very popular and in fact, some are considered as "cure-all" medicines. As a first step towards establishing, in part, scientific basis for the folklore use of some of these plants as antidiabetics, 8 folklore antidiabetic plants and 2 edible seaweeds were tested for their hypoglycemic or blood glucose lowering activity.

High blood glucose level was induced in fasted mice by intraperitoneal injection of glucose solution of a dosage of 7.5 g per kg body weight. The blood glucose level returned to the initial level or remained constant using Haemoglucotest strips. The hypoglycemic activity of the plant extracts was determined by comparing the blood glucose levels of the extract-treated mice with those of the control group. Results indicate that *Mimosa pudica* Linn. (makahiya, leaves, and roots), *Solanum nigrum* Linn. (lubi-lubi, leaves), *Luffa acutangula* Roxb. (patola, fruit), *Chrysophyllum cainito* L. (kaymito, leaves), *Basella rubra* L. (alugbati, leaves and stems), and *Blumea balsamifera* (sambong, leaves) have hypoglycemic activity. From these results, these plants can now be considered to contain potential antidiabetic compounds and warrant further studies to isolate and identify the antidiabetic principles.

Keywords: hypoglycemic, antidiabetic, folklore medicine

DESIGN CONSTRUCTION AND EVALUATION OF AN ACID TREATMENT BATH

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An electrically-operated acid treatment bath was designed constructed, and evaluated at DMMMSU-SRDI, Bacnotan, La Union from January 1994 to December 1996 to speed up acid treatment activity in silkworm egg production areas in order to cater the needs of sericulture farmers nationwide.

After a series of tests and improvements, an acid treatment device equipped with electrical and electronic parts was developed. The main assembly is made of stainless angle bar and steel sheets. It has a replaceable acid holder to fit with the desired number of layings of silkworm eggs to be treated.

The maximum input capacity of the designed device is 40 boxes/hr (800,000 eggs/hr) with a power consumption of 1.5 kw-hr. The performance evaluation result showed that the hatching efficiency (laboratory rate) was found to be 93.56% for silkworm hybrids. Economic analysis showed that the cost of treating silkworm eggs is only P4.13 per box with a return of investment of 24.84%. With its promising performance and economic feasibility, the designed machine is best suited for the country's growing sericulture industry.

Keywords: sericulture acid bath machine

PROSPHORUS-31 NMR STUDIES ON *Escherichia coli* AND *Bacillus subtilis*

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The phosphate metabolism in *Escherichia coli* and *Bacillus subtilis* was studied using Phosporus-31 NMR at various temperatures under both aerobic and anaerobic conditions. The pH was determined using the observed chemical shift of orthophosphate and the concentrations of the various phosphates were estimated by integration vs. methylene disphosphonic (MDPA) standard.

Increasing the temperature of the bacterial culture resulted in a decrease in intracellular pH. Addition of glucose also resulted in a decrease in intracellular and pH and was accompanied by the formation of sugar monophosphates. The total soluble intracellular phosphates concentration was estimated to be 2×10^{-17} mole/cell. Intracellular and extracellular orthophosphate was observed, although these appeared to move rapidly between the intracellular and extracellular volumes on the NMR time scale. The rate of utilization of dissolved oxygen in the BOD experiment increased as the concentration of orthophosphate in the test solution increased. This result reinforces the importance of orthophosphate in bacterial metabolism.

Keywords: phosphate metabolism, *Escherichia coli, Bacilus subtilis,* NMR, BOD