



CONFERENCE PROCEEDINGS

**3rd ICSTR Bangkok – International Conference on Science &
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26-27 July 2019

CONFERENCE VENUE

Asian Institute of Technology (AIT), Conference Center, Bangkok, Thailand

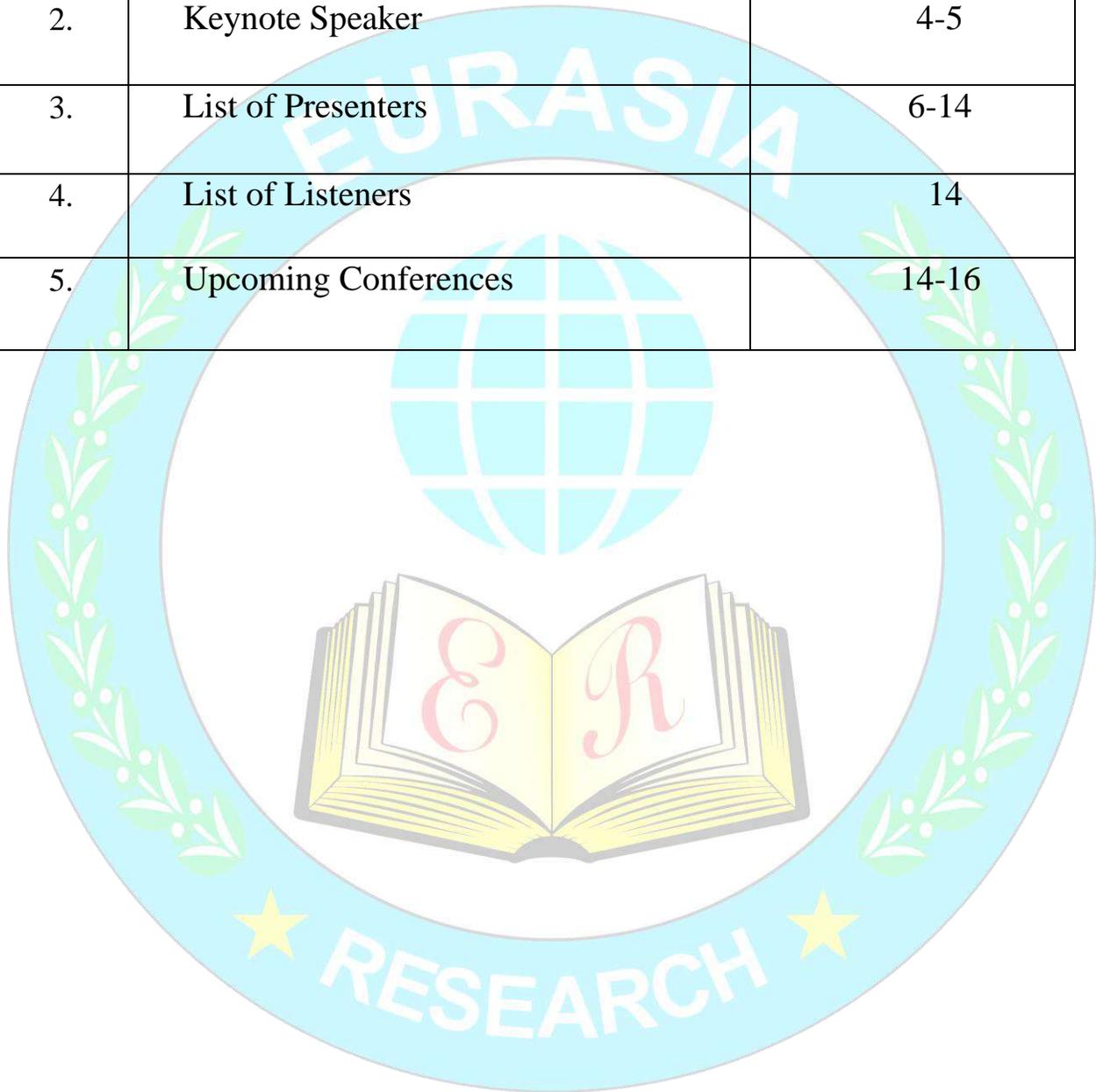
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Preface:

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KEYNOTE SPEAKER



Dr. Shirley Pelayo- De Leon

Coordinator, Researcher, Eulogio “Amang” Rodriguez Institute of Science and Technology, Philippines

Topic: Reintegration of Relevant Technology Innovation Researches in Higher Education: Challenge of the 21st century

Dr. Shirley Pelayo-De Leon is a Food Technology Professor at Eulogio “Amang” Rodriguez Institute of Science and Technology Cavite Campus. She obtained her Doctor of Education at EARIST Cavite Campus, Master’s Degree at Philippine Normal University, and BS Industrial Technology at Aklan State University and BS Industrial Education at EARIST Cavite Campus (formerly Gen. Alvarez School of Arts and Trade). She has been teaching for 24 years focusing in Food Technology, Research, and Food related subjects to Bachelor of Science in Industrial Technology (BSIT), Bachelor of Science in Hospitality Management (BSHM), and Bachelor of Science in Education (BSE) students. She conducted numerous product development researches such as medicinal plant-based, Pitaya peel products, and waterleaf by-products that won an award. At present, she co-authored a patent application on “Archi-pak,” an architect bag. Her research interests are on product development especially on the utilization of indigenous material, teaching and learning, and community services programs have a significant contribution to the institution.

KEYNOTE SPEAKER



Engr. Rhea D. Makinano, MEng'g-IE, CIE, AAE

**Faculty of Industrial Engineering Department, Quezon City
Polytechnic University, Quezon City, Philippines**

Engr. Rhea D. Makinano is an Industrial Engineering Faculty and serves as Research Coordinator at Quezon City Polytechnic University (QCPU), Philippines, which she serves in a leadership capacity to coordinate research output of the different directorates of the university. She graduated from Adamson University, Manila, Philippines, where she took up her Bachelor of Science in Industrial Engineering and Master of Engineering major in Industrial Engineering. She also finished the course R-Programming and Data Scientist's Toolbox by Johns Hopkins University on Coursera. She is currently an active member of Philippine Institute of Industrial Engineering (PIIE). She passed the Certification for Industrial Engineer (CIE) on November 26, 2017. Also, she passed the Career Service Professional Examination for Civil Service Eligibility conducted on August 6, 2017. Lastly, an Associate ASEAN Engineer (AAE) approved at 36th CAFEQ Governing Board Meeting on 14th day of November 2018 at Resort World Sentosa, Singapore.

PRESENTERS

<p>Allemar Jhone P. Delima ERCICSTR1914051</p>	<p>A Modified Genetic Algorithm with a New Crossover Mating Scheme</p> <p>Allemar Jhone P. Delima Graduate Program, Technological Institute of the Philippines, Quezon City, Philippines</p> <p>Ariel M. Sison Emilio Aguinaldo College, Philippines</p> <p>Ruji P. Medina Graduate Program, Technological Institute of the Philippines, Quezon City, Philippines</p> <p>Abstract</p> <p>This paper introduced the inversed bi-segmented average crossover (IBAX), a novel crossover operator, which enhances the offspring generation of the genetic algorithm for variable minimization and numerical optimization problems. An attempt to come up with a new mating scheme in generating new offspring under the crossover function through the novel IBAX operator has paved way to a more efficient and optimized solution for variable minimization particularly on premature convergence problem using GA. The simulation results showed that the IBAX operator outperformed the Average Crossover (AX) operator of GA having removed 20 variables or 66.66% of the variables while 13 variables or 43.33% were removed from the 30 variables that represents the faculty instructional performance from the four State Universities and Colleges (SUC) in Caraga Region, Philippines. Keywords: Modified Genetic Algorithm, Novel Crossover, Modified Average Crossover, IBAX, Variable Minimization Using GA</p>
<p>S.A. Shrief ERCICSTR1914052</p>	<p>Genetic Analysis and Combining Ability Effects of Yield Contribution Traits in Bread Wheat (T. Aestivum L) Hybrids</p> <p>S.A. Shrief Agronomy Dept., Faculty of Agriculture Cairo University Giza, Egypt</p> <p>M. A. Abd El-Shafi Agronomy Dept., Faculty of Agriculture Cairo University Giza, Egypt</p> <p>Abstract</p> <p>Combining ability analysis was under taken in 4x4 in half diallel fashion during 2014/2015 season to obtain six cross combinations. The resulted six cross combinations in F1 and F2 beside the four parental lines were evaluated during 2010/2018 to estimate the mode of inheritance, gene action and general combining ability (GCA) and specific combining ability(SCA) for plant height, spike length, total dry matter/plant, spike dry matter/plant, grain yield/plant, 1000 grain weight and number of kernels/spike. Highly significant differences was detected between the sixteen genotypes (6F1 crosses, 6 F2 crosses and 4 parental lines), also highly significant differences was observed within parents, within F1 crosses, within F2 crosses, parents vs. crosses and F1 vs. F2 for all studied traits. Except TDM /plant in F2 the results exhibited significant effect for GCA and SCA for all studied traits which reflect the importance roll of additive and dominance genetic variance in the inheritance of studied traits. The GCA: SCA ratio revealed predominance of additive gene effects for plant height. On the other hand, the GCA:SCA ratio revealed predominance of dominance gene effects for the reminder traits (spike length, total dry matter/plant, spike dry matter/plant, grain yield/plant, 1000 grain weight and number of kernels/spike). Except plant height, the results showed highly significant and larger in magnitude values of dominance component (H1) than additive component (D) for all traits resulting in more values of (H1/D)0.5 which were more than unity in both generations. The estimates of GCA effects in both generations showed that the best combiner for grain yield were P1 and P2. For plant height the best combiner for tallest plant was P4 in both generations. On the other hand the best combiners for dwarf plant in both generations were P1 and P2. Respect to SCA, the best cross combination in F1 for grain yield was P1xP2 meanwhile, in F2 the cross combinations P1xP2 and P2xP3 exhibited the highest SCA effects for grain yield. A high degree of narrow sense heritability was detected for most traits in both generations.</p>

 <p>Ahmad Amirabadizadeh ERCICSTR1914053</p>	<p>Keywords: Wheat, GCA, SCA, Gene Action and Heritability</p> <p>Study Structural and Magnetic Properties of Superparamagnetic Fe₃O₄ Nanoparticles and PVA/Fe₃O₄ Nanocomposite for Biomedical Applications</p> <p>Ahmad Amirabadizadeh Department of Physics, University of Birjand, Birjand, Iran</p> <p>Aol-Fajer Nakhee Department of Physics, University of Birjand, Birjand, Iran</p> <p>Abstract</p> <p>By developing medical application of nanomaterials the interest for synthesizing nanocomposites for drug delivery applications are also increased. Magnetite (Fe₃O₄) nanoparticles are one of the best candidates for biomedical applications. This paper describes a simple way for synthesizing PVA/Fe₃O₄ nanocomposites. Magnetite nanoparticles were prepared by Co-precipitation method. Then, the Fe₃O₄ nanoparticles with different weight percentages (1%, 3%, 5%, 7% and 9%) were added to PVA polymer and PVA/Fe₃O₄ nanocomposite films were formed successfully via direct mixing approach. Morphological study show uniform superparamagnetic Fe₃O₄ nanoparticles with cubic phase were synthesized successfully. XRD results indicate the average crystallite size estimated using Scherrer's formula is about 19 nm. Room temperature hysteresis measurements (vibrating sample magnetometer) show Fe₃O₄ nanoparticles (Ms= 82.25 emu/g) and PVA/Fe₃O₄ nanocomposite films (Ms=6.47 emu/cm³) both are soft magnetic materials that with increasing magnetite concentration in polymer matrixes, the amount of Saturation Magnetization (Ms) and Remanent Magnetization (Mr.) have also increased.</p> <p>Keywords: Biomedical Applications, Drug Delivery, Magnetite, Nano composites, PVA</p>
<p>Md Jalal Uddin ERCICSTR1914056</p>	<p>Structural Appraisal of Old Structures Using NDT</p> <p>Md Jalal Uddin Asst Professor in Civil Engineer, JNTU, Hyderabad, India</p> <p>Abstract</p> <p>Structural audit is an overall health and performance check-up of buildings .It is important to the building to check their safety and they have no risk. It is process of analyses of building And this process suggest a appropriate repairs and retrofitting measures required for the buildings to perform better in its service life structural audit is an important tool for knowing the real health status of the old buildings. Buildings and structures are normally designed for a specified target life based on the functional and economical aspects. Now-a-days it is very common to see the structures, getting degraded and distressed much before attaining their design life. It is due to the fact that the assumptions are made regarding durability of material without knowing the behaviour of material completely in real environment. Before taking up the repair & rehabilitation of structures, the causes of distress must be identified as clearly as possible by means of initial visual appraisal, detailed investigations and strength assessment of structures. The various tests are to be carried out to assess the causes & extent of distress, the quality/strength of concrete and adequacy of structure. The paper briefly discusses various NDT techniques such as Rebound Hammer, Ultrasonic Pulse Velocity, Carbonation Test, Rebar Locator Test & Impact Echo Test, from a practical standpoint of an experienced Structural Engineer along with some partial-destructive testing methods of in-situ concrete.</p> <p>Keywords: Structural Audit, Non-Destructive Test, Repairs and Controls, Audit Standards</p>
<p>Tz-Chuen Ju ERCICSTR1914057</p>	<p>Investigation on the Protective Mechanisms of Citral Against Chronic Metabolic Disease</p> <p>Tz-Chuen Ju Department of Animal Science and Biotechnology, Tunghai University, Taiwan</p> <p>Kuo-Feng Hua Department of Biotechnology and Animal Science, National Ilan University, Ilan, Taiwan</p> <p>Abstract</p> <p>Many civilized diseases have a very close relationship with chronic inflammation, which plays an</p>

	<p>important role, especially in metabolic diseases. The risk factors caused by the metabolic abnormalities of the body, such as hyperglycemia, hyperlipidemia, high cholesterol and uric acid level, etc., are important causes of inflammatory reactions. The inflammasome is a protein complex composed of many protein molecules, including caspase-1, caspase-5, NLRP3, and PYCARD, which is involved in the activation process of many inflammatory reactions in cells. The inflammasome has recently been found to be the core of acute gout attacks. Among different types of inflammasomes, the NLRP3 inflammasome has been the most thoroughly studied. The NLRP3 inflammasome consists of NLRP3, ASC, and caspase-1, and is involved in the activation of IL-1β and IL-18. Compared with normal subjects, patients with gout have a significantly higher level of IL-1β. The levels of IL-1β and IL-18 in the blood of patients with type-2 diabetes are also higher than those in the blood of people with normal blood sugar levels. Intravascular cholesterol crystals would enter the intracellular activation of NLRP3, which consequently causes the cells to release IL-1β to induce an inflammatory reaction leading to atherosclerosis. Citral is extracted from the fruit of mountain pepper. In the past, citral was found to have anti-bacterial, anti-oxidation, and anti-inflammatory effects; protects against DNA damage; and improves lupus nephritis. Citral decreases adenosine triphosphate-induced IL-1β secretion and caspase-1 activation in low-dose lipopolysaccharide (LPS)-primed macrophages. In addition to the NLRP3 inflammasome pathway, citral also participates in the traditional anti-inflammatory pathway by reducing LPS-induced NO via NF-κB inhibition. This study is expected to link the three risk factors (i.e., uric acid crystals, palmitic acid, and cholesterol crystals) produced by metabolic disorders in vivo to study how citral regulates the inflammatory response induced by metabolic abnormalities in vivo and discuss whether citral has the potential to be developed as a health care product for gout, type-2 diabetes, atherosclerosis, and other metabolic diseases. Keywords: Citral, Metabolic Disease, NLRP3 Inflammasome</p>
<p>K.Elavarasi ERCICSTR1914058</p>	<p style="text-align: center;">EEG and Artifacts- A Guideline and Review</p> <p style="text-align: center;">K.Elavarasi Assistant Professor, Sethu Institute of Technology, Anna University, Madurai, India</p> <p style="text-align: center;">K.Gnanambal Professor/EEE, Sethu Institute of Technology, Anna University, Madurai, India</p> <p style="text-align: center;">A.Umarani Professor/EIE, Sethu Institute of Technology, Anna University, Madurai, India</p> <p style="text-align: center;">Abstract</p> <p>Electroencephalography (EEG) is the most predominant brain activity recording technique used in wide range of applications. These are neurological signals which help in the study of various diseases. These are often contaminated with various artifacts. This paper presents an extensive review on the artifact removal algorithms used to eliminate the main sources of interference encountered in the electroencephalogram (EEG), specifically ocular, muscular and cardiac artifacts. We first introduce background knowledge on the characteristics of EEG activity, of the artifacts. This paper focuses on the artifact removal techniques with their features. Important parameters were taken into consideration while the study of various published papers. Strength and weakness of each paper are mentioned. This review of various papers is best of my knowledge. we believe that the optimal method for removing artifacts from the EEG consists in combining more than one algorithm to correct the signal using multiple processing stages, even though this is an option largely unexplored by researchers in the area. Keywords: EEG, Artifact, Ocular, Muscular, Contaminants</p>
<p>Krista Mae F. Ramos ERCICSTR1914059</p>	<p style="text-align: center;">Public Servants Serving the Environment through Urban Agriculture</p> <p style="text-align: center;">Krista Mae F. Ramos Basic Education Schools, Lorma Colleges, La Union, Philippines</p> <p style="text-align: center;">Zairylle Trixie Nicole P. Garcinez Basic Education Schools, Lorma Colleges, La Union, Philippines</p> <p style="text-align: center;">Raessa Gayle M. Valmonte Basic Education Schools, Lorma Colleges, La Union, Philippines</p>

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Abstract

The research looked over the possibility of Urban Agriculture and encountered a lot of certain topics such as Production of Foods, Lack of Space, Early Childhood Education, now Urban Agriculture offers such an alternative ways to continue with the flow of modernization without any complications. This research covered implications of Agriculture in cities once it's already implemented. The goal of this study is to find ways of implementing Agriculture in urban areas that can benefit the people and also the country. Policemen of Baguio City who participated in the Gulayan sa Kapulisan program were the chosen participants for the study. The researchers made use of semi-structured interview as the instrument in data gathering for the research. The policemen of Baguio City applied organic farming, vertical gardening and crop rotation which is a way to maximize the limited space available. Urban Agriculture interplays with food production, early childhood education, and space wherein it provides secure access to food and the policemen were raised in a childhood of knowing basics of gardening, and maximizing space but certainly some were affected by road widening. As a conclusion, Agriculture is open for any profession wherein the policemen became role models for students and bystanders because they motivated people and sparked their interests.

Keywords: Urban Agriculture, Policemen, Sustainability, Urbanization, Farming



Richa Sharma
ERCICSTR1914062

Multi-Server M/M/C Queue and Multiple Working Vacation under Phase Repair

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Abstract

In this investigation, our aim is to analysis multi server queueing system with server breakdown wherein the repair is provided in two phase of essential repair. Moreover, the servers may opt exponential working vacation (WV) in case there is no customers available in the system. After back from their first vacation, if the servers find that the customer is waiting in the system, they immediately start providing services to the waiting customers. Otherwise, they can continue their vacation. The customer joins the system according to the Poisson distribution. The life-time, service time and vacations time follow an exponential distribution. Further, Runge-Kutta method has been applied for solving the time-dependent probability. In addition, numerical results are also provided. Finally, the conclusion is given.

Keywords: Multi-Server Queue, Working Vacation, Server Breakdown, Repair, Queue Size.



Gireesh Kumar
ERCICSTR1914063

Software Reliability Growth Model with Warranty for Prediction of Optimum Release Time

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Abstract

High level of reliability can be achieved at optimum cost based on the optimum time of the software release. In order to increase the software reliability, warranty is provided by the manufacturer at the time of software release. The present investigation deals with the analysis of software reliability growth model (SRGMs) with testing based on non-homogenous poisson process (NHPP) to study the optimal release time (ORT) and warranty cost. Software testing (ST) is considered into two phases (i) testing phase, and (ii) operational/warranty phase for the prediction of software reliability. The mean value function of model has been discussed which are further used to obtain the various performance indices of the software reliability growth model (SRGMs). To validate the analytical results, numerical results are performed using MATLAB software. Further, genetic algorithm (GA) tool has also been used for

	<p>facilitating the ORT and to facilitate comparison with results obtained analytically. Keywords: SRGM, NHPP, ORT, Reliability, Warranty Cost, GA, Cost Estimation.</p>
<p>Li-Fu Hsu ERCICSTR1914064</p>	<p>The Study on Mobile Advertising in Consumer Preference Survey</p> <p>Li-Fu Hsu Department of Information Management, Hwh Hsia University of Technology, Taipei, Taiwan</p> <p>Abstract</p> <p>As time progressed, smart phones gradually become mainstreamed in the blooming market of cell phones. In order to enhance product differentiation, many famous brands of cell phones have devised wireless function, the high operation rate of which results in more abundant as well as diverse layouts of cellphone commercial media, particularly pop-up advertising as a frequently used display of advertisements.</p> <p>Consumers using wireless function experience the effect of advertisements through wireless cell phones. Brand and agencies have to redefine and comprehend consumer preferences for different accesses to information. Thy key to reading cellphone advertisements relies on consumers' access and its right content, bridging the gap between brands and consumers.</p> <p>The target of this study is a cluster of cellphone users. This research not only examines the users' reception, acceptance, and reliability of cellphone advertisements but also analyzes amusing, informative, and disturbing functions of cellphone advertisements. The research makes a final integration of hypotheses and analyses, and indicates that cellphone users accept and purchase advertised products.</p> <p>Keywords: Effect of Advertisements, Advertising Attitude, Consumer Preference</p>
 <p>Aniket Raj YRICSTR1914051</p>	<p>Fuel Cells: Contamination and Recent Advancements for its Stabilization</p> <p>Aniket Raj Electrical Engineering, Madan Mohan Malaviya University of Technology, India</p> <p>Dr. Manish Kumar Indian Institute of Technology (BHU) Varanasi, India</p> <p>Abstract</p> <p>A Fuel cell will soon be a very robust weapon to replace current highly carbonized fossil fuel generation of electricity by a more cleaner and efficient source of generation. The kind of electricity generation that is being used nowadays impacts environment badly and contributes to Global Warming. In this context, Fuel Cell can prove to be significant in generation of cleaner energy. In addition to this, fuel cell is more efficient as it doesn't operate as any heat engine; so not bound upto Carnot efficiency. Certain impurities either from the fuel that is being supplied or from the environment might result into undesirable reactions that cause fuel cell contamination. This becomes the reason for the dramatic drop in the performance of a fuel cell that has been observed from our working "Solar Hydrogen Plant" model. For testing and extending the life of a fuel cell by detecting and mitigating the cause of degradation, the researchers has passed the sample of distilled water and Ultra-pure water (Type I) after electrolysis through Total Organic Carbon Analyzer, Ion Chromatographer, Total Dissolved Solid test, Electrical Conductivity Test, pH test and titration of the sample against H2SO4. The cell has been allowed to run in the lush green campus of Banaras Hindu University whose environmental conditions are considered to be less polluted in the Varanasi. Henceforth, the researchers also tested atmospheric situations and its effect on fuel cell. The results of this paper will be useful in designing a device which can mitigate contamination and will ensure successful domestication of Fuel cell. In this paper, various methods of obtaining pure hydrogen gas like Pressure Swing Adsorption (PSA), High & Low Temperature Diffusion, Solvent absorption of CO and CO2 are also discussed. A new model is also discussed with an additional stage of hydrogen fuel filtration using PSA, TSA to supply hydrogen fuel with purity up to 99.8%.</p>
<p>Jane Omboto ERCICSTR1914066</p>	<p>Data Correlation and Economic Analysis of Wind Regimes of Manga Hill in Nyamira County, Kenya</p> <p>Jane Omboto Physics, Jomo Kenyatta University of Agriculture and Technology, Nairobi, Kenya</p> <p>Abstract</p> <p>Wind power is one of the fastest growing energy sources in the world. The Kenyan government has a</p>

new energy policy that directs its state-owned energy system, KenGen, as well as the country's independent power producers, to eliminate fossil fuel-powered generation. The country's energy plan outlines how the majority of the country's electricity will come from renewable sources at utility, commercial, industrial scale and Off-grid connections. An understanding of the characteristics of the wind is critical to all aspects of wind energy generation, from the identification of suitable sites to predictions of the economic viability of wind farm projects to the design of wind turbines themselves, all is dependent on the characteristic of wind. An economic evaluation of wind regimes of Manga Hill done by making an analysis of three different wind turbines chosen to simulate the performance using their specific power curves are presented in this paper. In addition, data from the Kisii meteorological station was used to make a comparison and correlation with the data obtained from the Manga Hill site, to determine how the data collected from the two sites tend to vary. In this correlation, the Pearson's Correlation Coefficient was found as 0.85. In order to utilize wind energy, installation of a 10 kW rated power horizontal axis wind turbine, with rotor diameter between 1 m and 7 m, at 30 m height would be economically viable for Manga Hill site for domestic power generation: for lighting and small house electrical applications as a supplement power to the grid connected electricity in the region.

Keywords: Energy Potential, Economic Analysis, Energy Output, Power Curve



Prateek Srivastava
ERCICSTR1914068

3D Design and Simulation of Magnetic Field Tapering on Whistler Pumped FEL

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Abstract

FEL designed with innovative scheme of linear tapering of magnetic field using cutting edge technology and with application of enhancement in the field of plasma. 3D design and simulation of Whistler Pumped FEL having a linear tapered magnetic field configuration in the interaction region with the length L_s has been analysed. This analysis is done on ANSYS platform with desired material for tapering, current excitation, thermal impact and plasma confinement for determining its economic viability, efficiency and real life production. Using high-temperature superconductors stranded structure available in the ANSYS software is simulated for magnetic field generation up to 5T also the variation of magnetic field along radial direction is analysed so as to reduce the fringing effect losses to increase efficiency. The simulation predicts the confinement, behaviour of magnetic field due to tapering, whistler pumped wiggler-beam particle interaction and the shielding of electron with speed near to light. Other parameters have been observed like magnetic flux, flux leakage, average magnetic field, inductance, divergence of field etc. Formula of design parameter is developed too including all perspective of designing. Analytical result of this design and simulation on ANSYS will provide opportunity for designing of the FEL device which will be very cost effective with its application in Laser particle acceleration, Bio-medical, surgery, military grade weapon system and to find the traces of dark energy in the outer space.

Keywords : Whistler, Wiggler, Tapering

Nguyen Viet Ha
ERCICSTR1914054

Structural Health Monitoring for Bridge Structures with the Consideration of Temperature Effects

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Abstract

Health condition of a civil engineering structure as bridges can be tracked by either repeatedly static load or vibration testing during the whole life-cycle of the structure. Abnormality perceived from the comparison of properties with the healthy state are used as damage indicators. However different environmental situations during measurement can lead to changes of monitored quantities. This environmental influence may be even larger than changes due to a real damage. Hence temperature effects need to be removed prior to any condition analysis. This is the objective of the present paper that is carried out by several techniques. Two real bridges with continuous monitoring show the variation along complete seasonal temperatures in the intact state. The results are coherent and efficient. The proposed techniques allow removing noise from the raw data like a filter. The corrected data can serve for further comparison or be combined with other methods to match numerical simulations. Such a fitting procedure, often based on a finite element model, allows to exactly detect, localize and assess damage the structure.

Keywords: Damage Detection, Temperature Compensation, Principal Component Analysis, Frequency

Tony Nacional
ERCICSTR1914060

RDF Databases – Concepts and Performance Evaluation

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Abstract

The Resource Description Framework (RDF) data presentation model and the SPARQL query language have been the core of the semantic web technologies since the early 2000's. In this article, we evaluate three RDF storage technologies. Our motivation is to find a storage solution that can be used to process "big data" RDF sets. Our method is based on measuring query response times with large samples (hundreds of thousands of RDF documents, millions of RDF statements). We find that all the proposed technologies provide much better performance than querying RDF data stored in files. However, with 300 000 documents, even with the fastest technology, an aggregation query still lasts more than 100 seconds in our environment. As a further performance improvement, we test the same data and queries with MongoDB, demonstrate its performance (10 seconds instead of 100) and scalability (up to 1000 000 documents). However, despite its benefits we must note that because of its data presentation and query limitations, MongoDB probably cannot serve as a generic storage for all kinds of RDF documents.

Keywords: RDF, Database, Nosql, Benchmarking

1. Introduction

The Resource Description Framework (RDF) was originally developed for describing resources on the Web. This is done by making statements about Web resources (pages) and things that can be identified on the Web, like products in on-line shops (W3C, 2014). Using RDF, one identifies things using Uniform Resource Identifiers, or URIs, and describes resources by issuing statements in terms of simple properties and property values.

An RDF statement is a triple of subject, predicate, and object. The statement asserts that some relationship, indicated by the predicate, holds between the things denoted by the subject and the object of the triple. As an example of a resource on the Web, we can have the following statement. The web page whose URI is "http://www.example.org/xyz.html" (subject) has a creator (predicate) that is N.N. (object). As an example of a thing outside of the Web, but referred to it by an URI, we can consider the following: A person, Magnus Carlsen, referred to by the URI "<http://www.wikidata.org/entity/Q106807>" (subject) has a date of birth (predicate) 30 November 1990 (object). Both subject and object can be blank nodes that represent unknown or undetermined values. Figure 1 (from (W3C, 2004)) shows an illustration of a set of RDF statements about a person as a directed graph. If the email address was unknown, it would be represented as a blank node illustrating that there is an email address but we do not know it.

The SPARQL language (W3C, 2008) was designed for querying RDF documents. Intuitively, we can see an SPARQL query as a template containing blank nodes. The query evaluation process matches the blank nodes with actual data (if possible). For instance in the query "SELECT ?MCdb WHERE {

`<http://www.wikidata.org/entity/Q106807> <http://www.wikidata.org/prop/direct /P569> ?MCdb . }`
the blank node “?MCdb” will be matched with the actual date. P569 in the query is the property “date of birth”.

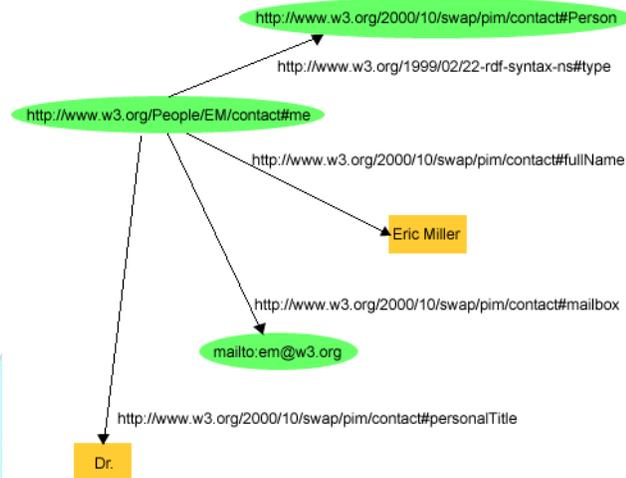


Figure 1: An RDF Graph

Since RDF graphs express information as subject-predicate-object, there is a terse text format called N-triples (W3C, 2014). However, graphs are normally stored in an XML format, often in files. It is possible to use command line tools to issue SPARQL queries using such files as sources, but with large amounts of data this will become impractical. Some of the early attempts to deal with large data included an RDF query API that could be used persistent RDF graph data stored in a BerkeleyDB database (Miller, Seaborne, & Reggior, 2002). Later, “native” RDF databases, among them many commercial solutions have appeared (Faye & Curé, 2012). One of the early databases was Sesame (Broekstra, Kampman, & Van Harmelen, 2002) that later developed into a framework called RDF4J. In general, databases that store RDF data in the subject-predicate-object format are called triple-stores (Levandoski & Mokbel, 2009). Levandoski and Mokbel (Levandoski & Mokbel, 2009) discuss popular approaches for implementing a storage for a triple-store. They mention a triple-store schema, where each triple is stored in a three-column table in of a relational database, and a property table model where RDF properties are stored as n-ary table columns.

In this paper, we evaluate the performance and scalability of three different RDF storage solutions. One of the is based on BerkeleyDB and two others are “native RDF” commercial products. The other one of the products is intended for enterprise data integration and the other one is seen as more generic. The generic one is based on Sesame/RDF4J. In our measurement section, we call these products “Integration” and “Sesame based”, respectively.

In related research, Arenas et al (Arenas, Gutierrez, & Pérez, 2009) present the semantics of RDF and the complexity of evaluating SPARQL expressions. Morsey at al (Morsey, Lehmann, Auer, & Ngomo, 2009) present DBpedia datasets and queries that can be used for query performance analysis. Unfortunately, the tool is no longer available, but an earlier benchmark by Becker (Becker, 2008) used similar data and five queries such as (i) query all information about a specific subject (ii) “two degrees of separation” (iii) unconstrained query about specific types (iv-v) combining web and GPS information in two cities. Other RDF query benchmark tools are discussed by Schmidt et al. (Schmidt, Schallhorn, Lausen, & Pinkel, 2009), and they additionally develop their own benchmark. Vicknair et al. (Vicknair, et al., 2010) compare features of a relational database management system with a graph database that is not based on RDF. Our own dataset has earlier been used earlier in our XML database performance evaluation (Niinimaki, Heikkurinen, & Schmidt, 2019). The main contribution of our paper is to test RDF databases with data from medical articles and compare the retrieval times with retrieval times of similar data in other types of databases. This research is a part of our long-term project where we build tools for accessing data from large data sets (Niinimaki & Thanisch, 2019), (Niinimaki & Niemi, 2009).

Our sample RDF documents, hardware and software environments and methods of measurement are introduced in Section 2. The performance results are presented in Section 3. Additionally, we discuss the performance of RDF access with two other technologies, XML databases and MongoDB in Section 4. Finally, Section 5 contains a summary, notes about non-RDF graph databases, and items for future

research.

2. The Environment and Data

We have built and executed our query performance benchmarking in a relatively typical higher end Linux environment. The hardware is a 24-core Xeon server (E5-2620 v2 @ 2.10 GHz) with 32 GB memory running the Debian 8 distribution of the Linux operating system. Our native RDF databases are Java-based, and the Java version in the computer is 1.8.0_66.

Our data set consists of hundreds of thousands of XML documents downloaded from the U.S. National Institute of Health's PubMed collection of medical articles (Steinbrook, 2005). The articles (without images) are available in compressed files at <ftp://ftp.ncbi.nlm.nih.gov/pub/pmc>. The size of the compressed files is currently about 50 GB, and the uncompressed size about 140 GB. At the time of the writing, the files contained 2.1 million articles and thus the average size of an XML file was 67 kilobytes. The earliest article in the collection is from 1610, but almost 90% of the articles are from 2000 or later. Most of the articles contain both the metadata and the textual contents in the JATS (Journal Article Tag Suite) XML format. For details about JATS, see (Donohoe, Sherman, & Mistry, 2015). The XML documents were converted into an RDF format using a JATS-to-RDF stylesheet.

We have used four document sample sets for our measurements: a set of 100 000, 200 000, 300 000, and one million documents. The number of RDF statements in these sets is 7.6 million, 17.5 million, 27.6 million and 124 million, respectively.

The queries that we tested with the sets are as follows:

- Q1: Print the publication date (actually only the publication year is recorded as a date) of each article. The corresponding SPARQL expression is `select ?a ?y { ?a <http://purl.org/dc/elements/1.1/date> ?y }`
- Q2: Print article information if the article contains the word “genitalia” anywhere. `select ?s ?p ?o WHERE { ?s ?p ?o. FILTER (regex(?o,'genitalia')) }`
- Q3: Print top 100 articles that have been cited by other articles, and how many times they have been cited. `select ?c (count(?c) AS ?total) { ?a <http://purl.org/dc/terms/references> ?c } group by ?c order by ?total limit 100`

For curious readers, the most frequent year of publication was 2016, the word “genitalia” appeared in 3634 articles (of 1 million), and the most cited article was “Gapped BLAST and PSI-BLAST: a new generation of protein database search programs”.

3. Measurements and Results

We timed the execution time of each query with the standard Linux “time” command. Each measurement was repeated several (usually 10) times. Other than the usual operating system tools, there were no programs executing in the computer during the measurements.

RDF frameworks and tools can evaluate queries even when the RDF source is plain files. With large amounts of data this, however, becomes impractical. For example, evaluating query 1 (list the publication year of each article) when each article is stored in an RDF file takes about 2.8 seconds per file, making this method unusable in general. This is mainly because the RDF tool needs to parse each file before evaluating the query. When using a database, the data has been already parsed and organized. All the databases that we have measured (below) perform much better than a file-based approach.

We have tested the performance with datasets containing RDF documents and loading them to the database products that we tested. With Python RDFlib, we first wrote a Python program that reads the RDF contents from files and stores it in a BerkeleyDB using its API. The queries are then executed using Python programs that build a graph from the database contents and then evaluate the query. Practically this means that each query evaluation is with a “cold start” since the data is always read before the query is evaluated. We can test the database opening time by “query 0” that just opens the database and exist.

The data integration oriented commercial RDF runs only as a client/server application. To imitate a “cold start”, we stop and start the database server after each query. The database startup time is shown as “query 0” result. For completeness, for this product, we have included numbers of “warm start”. These were measured by starting the database, running the queries 10 times in sequence and calculation the averages of query times. As an interesting detail (acknowledged by the software developers, too), the complex “most cited articles” query was faster after a cold start.

The Sesame based commercial RDF database has no limitations in terms of number of statements, and it has a command line tool that opens the database and then executes the query. A “query 0” is used to test the database opening time similarly to Python RDFlib.

The number of RDF statements in each of our datasets is as follows:

100k 7 581 887
200k 17 551 293
300k 27 652 173
1M 124,319,278

Results (query times in seconds) for each of the database products are shown in Table 1, and an illustration of the results in Fig 2.

Table 1: Query times in seconds

Python RDFlib with BerkeleyDB:	Q0	Q1	Q2	Q3
100k	23.8	55.1	2349.1	60.4
200k	53.5	102.4	5357.3	284.0
300k	95.2	175.4	8182.7	539.2

Integration, cold start				
100k	6.1	5.6	19.4	3.9
200k	7.1	7.1	40.0	11.5
300k	8.0	8.5	59.6	24.6
1M	9.6	25.2	221.0	58.4

Integration, warm start				
100k		3.8	18.1	3.9
200k		5.6	36.6	11.5
300k		6.8	57.6	24.6
1M		22.2	220.4	58.

Sesame-based				
100k	6.1	6.7	32.8	10.6
200k	6.5	7.5	66.7	43.4
300k	6.8	8.4	103.9	70.7
1M	7.3	14.8	507.6	-



Figure 2: Query times in seconds, logarithmic scale

We can see that the text matching query (Q2) took most time with all the databases. This is probably because RDF databases are very seldom optimized for textual search. The native RDF databases were (not surprisingly) generally faster than Python with a BerkeleyDB back-end. Both commercial RDF databases were able to process queries even with data of 1 million documents. However, with that amount of data, query Q3 was too hard for the Sesame-based database: the database query engine failed after 1 hour 14 minutes due to heap memory problem (we had allocated 8 GB maximum heap). In the era of “big data”, a collection of one million RDF documents (or 124 million triples) is not exceptionally large – Oracle has tested an RDF storage with 475.6 billion triples (Oracle, 2016). In order to manage larger amounts of data in our environment, we shall compare the triple-store technology with other approaches in the next section.

4. Comparison with Other Solutions

In our earlier paper (Niinimäki, Heikkurinen, & Schmidt, Performance of XML databases, 2019), we studied the query performance of XML databases with the same source documents (medical articles) and same queries (using the XPath query language) as in this study. We measured the performance of an XML enabled relational database and a native XML database (query 3 refused to run on the native XML database). A summary of the results combined with the results of this study are shown in Table 2 and illustrated in Figure 3.

Table 2: Query times (in seconds) with XML and RDF based databases.

100k	RDBMS-XML	Native XML	Python-RDF	Integration	Sesame-based
Q1	10.5	5.1	55.1	5.6	6.7
Q2	145.8	17.2	2349.1	19.4	32.8
Q3	45.5		60.4	3.9	10.6

200k	RDBMS-XML	Native XML	Python-RDF	Integration	Sesame-based
Q1	53	18.3	102.4	7.1	7.5
Q2	889	74.6	5357.3	40.0	66.7
Q3	262		284	11.5	43.4

300k	RDBMS-XML	Native XML	Python-RDF	Integration	Sesame-based
Q1	91.9	33.1	175.4	8.5	8.4
Q2	1731.6	133.7	8182.7	59.6	103.9
Q3	523.1		539.2	24.6	70.7

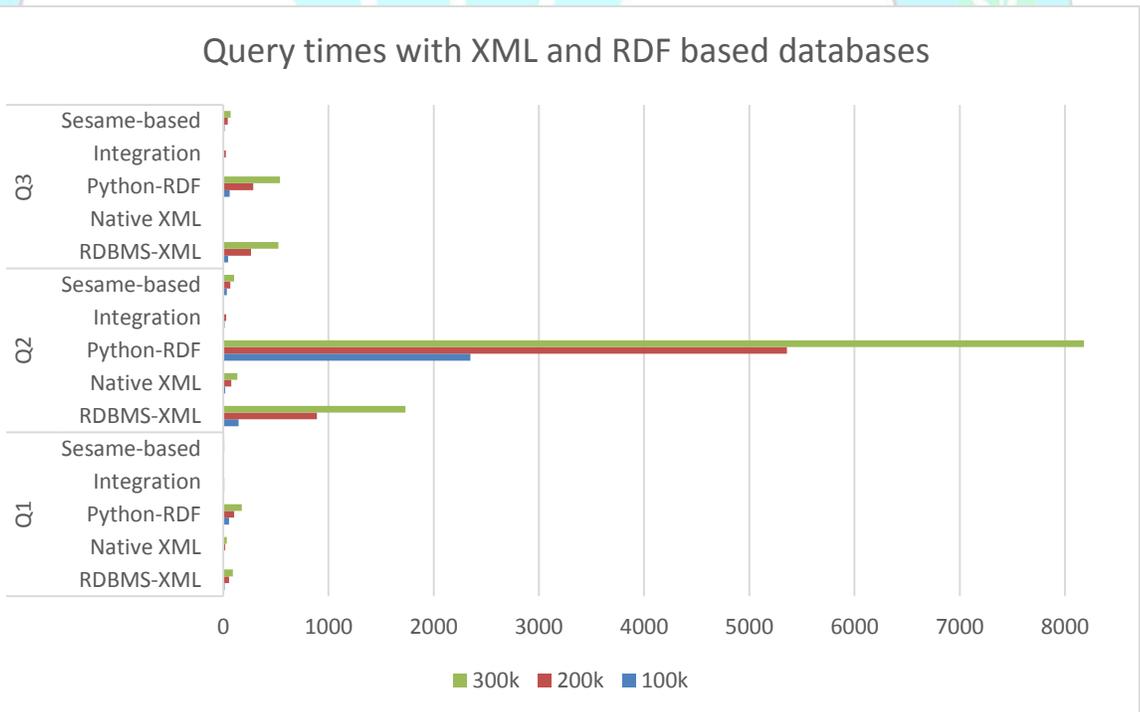


Figure 3: Query times with XML and RDF storage solutions

We can see that the native RDF databases most often provided better performance than their alternatives. However, in our article (Niinimäki, Heikkurinen, & Schmidt, 2019; Oracle, 2016), in addition to XML databases we tested MongoDB, a popular “noSQL” database. For the tests, we converted our documents into the JSON format used by MongoDB (for details, see (Banker, 2011)) and rewrote the queries using MongoDB’s query language. We found the performance generally very good,

especially with aggregation queries. In Table 3 we summarize the results, adding a further test with 1 million documents. Figure 4 illustrates the results. It must be noted that MongoDB's query language is quite different from SPARQL and therefore this approach cannot be used for all RDF storage/query needs. For details about the expressiveness of MongoDB's query language, see (Botoeva, Calvanese, Cogrel, & Xiao, 2018).

Table 3: Query times with MongoDB.

	100k	200k	300k	1M
Q1	24.5	55.1	84.9	1062
Q2	1.2	4.2	4.3	14.5
Q3	5.2	5.2	10.5	823.9

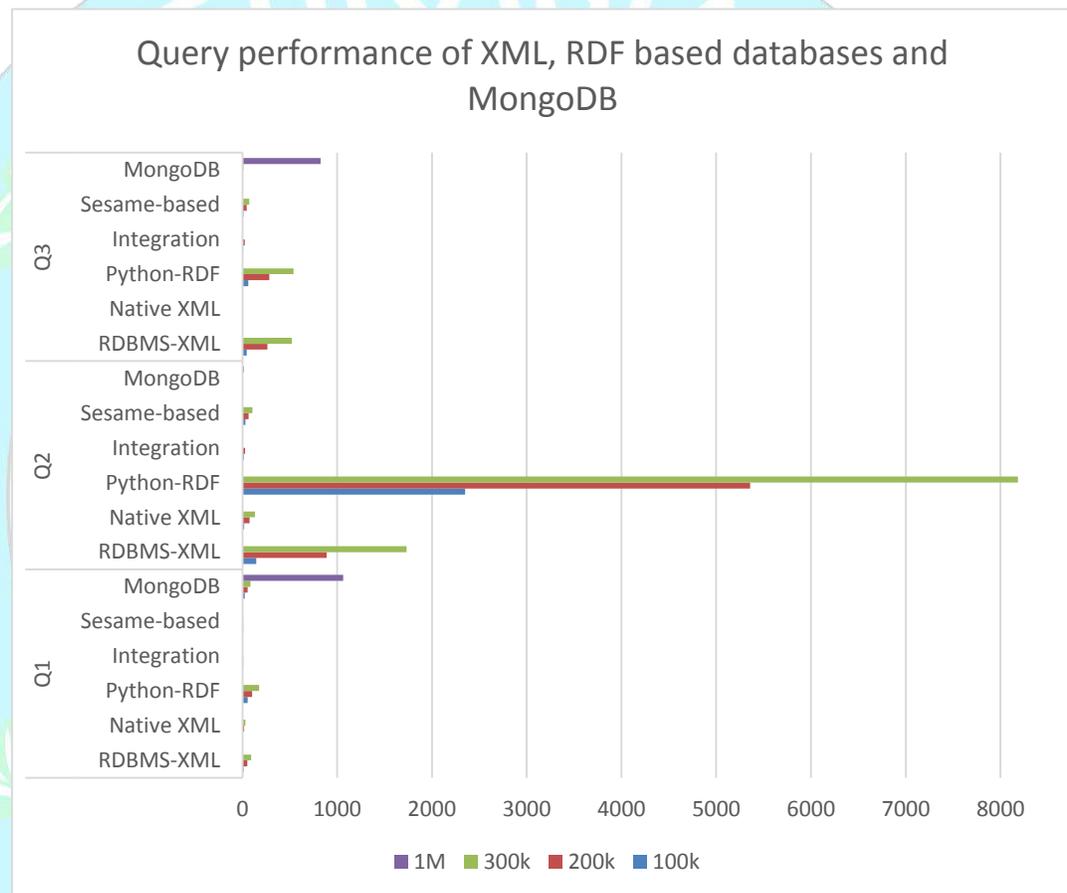


Figure 4: Query times with XML, RDF based databases and MongoDB

5. Summary and Discussion

In this paper, we have compared the query performance of RDF database packages. The test data is based on XML files of medical articles, converted into an RDF XML form. The documents originate from the U.S. National Institute of Health's PubMed collection. The queries represent "typical" tasks in an information system containing a database, namely:

Q1 List the publication year of all the documents in the database.

Q2 List the document ID's of all documents containing word "genitalia" anywhere in the document.

Q3 Find the article that is most cited by other articles in the collection.

Our test environment was a relatively high-end Linux server (a 24-core Xeon server with 32 GB memory). We tested three methods of storing RDF data persistently: a Python library with a BerkeleyDB back-end and two native, commercial RDF database products. All the methods were significantly faster than querying RDF files, but the native databases were faster than the Python library. Additionally, we demonstrated that MongoDB can work efficiently as a storage of some RDF-style data if the RDF structures are converted to JSON, and the SPARQL queries are converted to

MongoDB's query language.

It's worth noticing that though an RDF graph is a graph, there are "graph databases" that are not meant for storing only RDF data. Notably, Neo4j presents their graph database simply as a database that exposes a graph data model (Robinson, Webber, & Eifrem, 2015). The graph data model in this case is "labeled property graph". Labeled property graphs contain nodes and relationships (arcs between nodes); nodes contain properties (key-value pairs); nodes can be labeled with one or more labels; relationships are named and directed and have a start and end node; and relationships can contain properties. Moreover, GraphQL, promoted by Facebook (Hartig & Pérez, 2017) is a design of a query language and a query processor API that follows some graph-style principles.

There are several interesting directions for future research. Scalability, especially when processing queries in parallel is essential in modern database systems (Agrawal, El Abbadi, Das, & Elmore, 2011). We are currently researching clustered database solutions for RDF. On the other hand, large clusters use a lot of energy. Energy efficient query processing in clusters is another area of our research.

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<p>Saman Muthukumarana ERCICSTR1914061</p>	<p>Bayesian Methods for User Behaviour Analysis of Customers</p> <p>Saman Muthukumarana Department of Statistics, University of Manitoba, Winnipeg, Canada</p> <p>Abstract In this talk, I will introduce statistical models used in the literature within the Bayesian framework to analyze customer survey data arising from various sources. These models allow us to capture the heterogeneity of data in different capacities with different features. For this reason, model assessment methods need to be developed for better inferential purposes. I will introduce an assessment criteria based on predictive simulations and illustrate the approaches using actual data arising from Banking and user assessment surveys.</p>
<p>Juthasiri Chaisamphao ERCICSTR1914072</p>	<p>Enhancement of Nickel Loaded on Surface Modified Clay Support In Dry Reforming of Methane</p> <p>Juthasiri Chaisamphao Interdisciplinary Graduate Program in Sustainable Energy and Resources Engineering, Kasetsart University, Bangkok, Thailand</p> <p>Waleeporn Donphai Department of Chemical Engineering, Faculty of Engineering, Kasetsart University, Bangkok, Thailand Research Network of NANOTEC – KU on NanoCatalysts and NanoAaterials for Sustainable Energy and Environment</p> <p>Kajornsak Faungnawakij National Nanotechnology Center (NANOTEC), National Science and Technology Development Agency (NSTDA), Pathum Thani, Thailand</p> <p>Abstract Dry reforming of methane has been taken an interest in research and development for converting greenhouse gases (CH₄ and CO₂) into hydrogen (H₂) and carbon monoxide (CO). Clay has been considered as promising materials because of their structure, low cost and wide availability. Different surface modifications of clay directly affect the performance of catalyst in term of CH₄ and CO₂ conversion. This research studied nickel loaded on montmorillonite (MMT) clay support with different surface modifications on the activity in dry reforming of methane in fixed-bed reactor with reactant gases flow rate of 60 ml/min (CH₄:CO₂ of 1) at reaction temperature ranges of 500 – 800°C. Montmorillonite clay support with different surface modifications including trimethyl stearyl ammonium (MMT-TSA), dimethyl dialkyl amine (MMT-DDA), methyl dihydroxy-ethyl hydrogenated tallow ammonium (MMT-MEA) and aminopropyltriethoxysilan and octadecylamine (MMT-AO) were investigated. As the results, the performances of all catalysts increased with increasing reaction temperature because this reaction is endothermic reaction. Among them, Ni/MMT-TSA catalyst exhibited the highest CH₄ and CO₂ conversions at all reaction temperatures due to its high surface area, and high metallic surface area. Keywords: Dry Reforming Of Methane, Synthesis Gas Production, Methane Conversion, Nickel, Montmorillonite</p>
<p>Jianpeng Wang ERCICSTR1914070</p>	<p>A Biomechanics-based Locomotion Controller Optimized by PSO</p> <p>Jianpeng Wang A College of Instrument Science and Engineering, Southeast University, NanJing, China</p> <p>Wenhu Qin College of Instrument Science and Engineering, Southeast University, NanJing, China</p>

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Abstract

Hill-type muscle models are commonly used in biomechanical simulations to predict passive and active muscle forces. In this work, we implement a hierarchical controller based on Hill-type muscle force to simulate the real human walking motion. The lower control layer is based on neuro-physiologically muscle-reflex pathways to realize limb functions essential to legged systems in stance and swing. The higher control layer that adjusts the desired foot placements and selects the leg that is to transition into swing control during double support. All parameters of the controller are optimized by PSO. Using physics-based simulation, the optimized controller is exemplarily applied to biped movements. The result suggest that this controller achieve good locomotion across behaviours.

Keywords: Biomechanical, Motion Control, PSO

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Comparative Study on Defect Repairing Cost and Bond in Apartment Building Complex

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Abstract

In Korea, various institutional strategies are being prepared or there is a need for the maintenance of existing systems in the middle of economic development and changes in the social structure. In the housing industry, there are lawsuits regarding defect repairs, and collective actions in apartment building complexes has risen as one of the social issues since it became a universal housing style in Korea. However, there is no proper legal instrument related to defect repairs, which is interfering with the smooth resolution of those conflicts. The defect repairing bond is an important safety net to protect the rights of divided owners. However, the standards are not specific enough to resolve the conflicts since it only regulates that the bond should be within 3% of the construction costs. As such, the present research intends to conduct a fundamental study to establish the proper amount of the defect repairing bond, by examining the previous cases of defect lawsuits, in order to analyze the defect repairing costs and compare them with the defect repairing bond.

Keywords: Defect Lawsuit, Defect Repairing Cost, Defect Repairing Bond, Apartment Building Complex

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