Abstract

Emerging research in the field of organometallic chemistry is centered on the development of new efficient catalysts for the production of useful organic products via group (nitrene, carbene, oxo) transfer chemistry. Nitrene, carbene and oxo transfer with 3d (base) metals allows for economically viable and sustainable alternatives to generate new C–C, C–X, and X–X (X = N, O) bonds, as compared with precious metal catalysis or lengthy organic synthesis. This review specifically focuses on the evolving group transfer chemistry using mononuclear middle and late transition metal complexes in bulky alkoxide ligand environments. Bulky alkoxides are attractive ligand candidates for this chemistry because their steric and electronic properties generally lead to high-spin electrophilic reactive metal centers. Design and synthesis of well-defined alkoxide complexes are discussed first, with the focus on “non-symmetric” alkoxides [OCR2R′] developed mostly during the last decade. Variation of the size and the electronic nature of substituents in [OCR2R′] allows for the selective formation of bis- or tris(alkoxide) ligand platforms. Next, the reactivity of these complexes in oxo, nitrene, and carbene transfer is described. The electronic structures and reactivity of discrete mononuclear oxo-alkoxide complexes M(OR)n(O) are discussed in the context of bioinorganic (photosystem II) and heterogeneous (zeolites) catalysis. In the chapters describing nitrene and carbene chemistry, the major emphasis is on the electronic structure and reactivity of novel MIII(OR)2(Y) species (Y = NR, CR2, N3R, N2CR2), which enables a multitude of coupling reactions including catalytic nitrene homocoupling, catalytic coupling of nitrenes and carbenes with isocyanides, as well as rare or unprecedented reductive coupling of azides and diazoalkanes.
Abstract

In order to realize intelligent vehicular transport networks and self driving cars, connected autonomous vehicles (CAVs) are required to be able to estimate their position to the nearest centimeter. Traditional positioning in CAVs is realized by using a global navigation satellite system (GNSS) such as global positioning system (GPS) or by fusing weighted location parameters from a GNSS with an inertial navigation systems (INSs). In urban environments where Wi-Fi coverage is ubiquitous and GNSS signals experience signal blockage, multipath or non line-of-sight (NLOS) propagation, enterprise or carrier-grade Wi-Fi networks can be opportunistically used for localization or “fused” with GNSS to improve the localization accuracy and precision. While GNSS-free localization systems are in the literature, a survey of vehicle localization from the perspective of a Wi-Fi anchor/infrastructure is limited. Consequently, this review seeks to investigate recent technological advances relating to positioning techniques between an ego vehicle and a vehicular network infrastructure. Also discussed in this paper is an analysis of the location accuracy, complexity and applicability of surveyed literature with respect to intelligent transportation system requirements for CAVs. It is envisaged that hybrid vehicular localization systems will enable pervasive localization services for CAVs as they travel through urban canyons, dense foliage or multi-story car parks.

Database

ScienceDirect
The Effects of Cold Plasma-Activated Water Treatment on the Microbial Growth and Antioxidant Properties of Fresh-Cut Pears

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Food and Bioprocess Technology

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Abstract

Herein, we examined the effects of plasma-activated water (PAW) treatment on the native microflora survival, quality maintenance, and antioxidant activity of fresh-cut pears, which were washed with PAW under three different conditions (peak voltage = 6, 8, and 10 kV) for 5 min and then stored at 4 ºC for 12 days. Distilled water and sodium hypochlorite treatment were used as control and comparison, respectively. Results showed that all PAW treatments significantly inhibited the growth of aerobic bacteria, yeast, and mold during storage, with the 8-kV PAW treatment maintaining the lowest growth rate. Additionally, no significant change was observed in the soluble solid content and titratable acidity of fresh-cut pears treated with PAW. Treatment by 6-kV PAW significantly slowed down the softening of fresh-cut pears, while the 8-kV PAW treatment significantly reduced the mass loss and the total phenolic content (P < 0.05). The ascorbic acid content and radical scavenging activity (DPPH and ABTS) of fresh-cut pears were affected by PAW treatment only at the beginning of storage. After 8 days of storage, no significant differences were found in ascorbic acid content and radical scavenging activity among the samples (P > 0.05). Furthermore, PAW outperformed sodium hypochlorite in antimicrobial effectiveness and quality maintenance. Taken together, these results suggest that PAW treatment might be a promising strategy to control microbial growth and maintain the quality of fresh-cut pears.

Database

SpringerLink
Title: Enhancing speed of SIMON: A light-weight-cryptographic algorithm for IoT applications
Author: Norah Alassaf | Adnan Gutub | Shabir A. Parah | Manal Al Ghamdi
Journal: Multimedia Tools and Applications
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Abstract

Multimedia communication is revolutionizing all major spheres of human life. The advent of IoT and its applications in many fields like sensing, healthcare and industry, result exponential increase in multimedia data, that needs to be shared over insecure networks. IoT driven setups are however constrained in terms of resources as a result of their small size. From data security point of view a conventional algorithms cannot be used for data encryption on an IoT platform given the resource constraints. The work presented in this paper studies the performance of SIMON cryptographic algorithm and proposes a light-weight-cryptography algorithm based on SIMON for its possible use in an IoT driven setup. The focus is on speed enhancement benefitting from software prospective, making it different than common studies mostly reflecting hardware implementations. To achieve performance in practical prospective, the contribution looks into SIMON cipher’s characteristics considering utilizing it for internet of things (IoT) healthcare applications. The paper suggests further improvement to implement the original SIMON cryptography in order to reduce the encryption time and maintain the practical trade-off between security and performance. The proposed work has been compared to Advanced Encryption Standard (AES) and the original SIMON block cipher algorithms in terms of execution time, memory consumption. The results show that the proposed work is suitable for securing data in an IoT driven setup.

Database
SpringerLink
Title: Implementing two-qubit phase gates by exchanging non-Abelian quasiparticles

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Journal: Quantum Information Processing

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Abstract

We study how to implement two-qubit phase gates by exchanging non-Abelian quasiparticles. We firstly investigate quantum dynamics of a single trapped ion with two stable electronic ground states and with a larger energy gap from the rest of the spectrum, which is held in the Lamb–Dicke regime of a driven optical lattice. A set of degenerate Schrödinger’s cat states with the same expected energy is found, and wavepackets of the probability densities occupying different spin states are identical to the quasiparticles obeying the proposed non-Abelian interchange. The controlled transitions between different instantaneous degenerate ground states are illustrated for an array of \[ \text{[Math Processing Error]} \]-shaped laser pulses. Making use of the mathematical equivalence between the single-ion system and the center-of-mass system of two trapped ions, the two-qubit phase gates are implemented by exchanging the non-Abelian quasiparticles of the center-of-mass motion via the periodic state-dependent forces. Such phase gates depend on geometric and topological properties of the system, which makes them resistant to certain errors. The results can be justified with the current experimental capability and may be extended to an array of weakly coupled trapped-ion pairs for demonstrating the non-Abelian statistics of the quasiparticles and for encoding the topological qubits.
Abstract

Species delimitations by morphological and by genetic markers are not always congruent. Magnolia kobus consists of two morphologically different varieties, kobus and borealis. The latter variety is characterized by larger leaves than the former. For the conservation of M. kobus genetic resources in natural forests, the relationships between morphological and genetic variation should be clarified. We investigated variations in nuclear microsatellites, chloroplast DNA (cpDNA) sequences and leaf morphological traits in 23 populations of M. kobus over the range of species. Two genetically divergent lineages, northern and southern were detected and their geographical boundary was estimated to be at 39°N. The northern lineage consisted of two genetic clusters and a single cpDNA haplotype, while the southern one had multiple genetic clusters and cpDNA haplotypes. The northern lineage showed significantly lower genetic diversity than the southern. Approximate Bayesian computation indicated that the northern and southern lineages had experienced, respectively, population expansion and long-term stable population size. The divergence time between the two lineages was estimated to be 565,000 years ago and no signature of migration between the two lineages after divergence was detected. Ecological niche modeling showed that the potential distribution area in northern Japan at the last glacial maximum was very small. It is thus considered that the two lineages have experienced different population histories over several glacial-inter-glacial cycles. Individuals of populations in the central to northern part of Honshu on the Sea of Japan side and in Hokkaido had large leaf width and area. These leaf characteristics corresponded with those of variety borealis. However, the delimitation of the northern and southern lineages detected by genetic markers (39°N) was not congruent with that detected by leaf morphologies (36°N). It is therefore suggested that variety borealis is not supported genetically and the northern and southern lineages should be considered separately when identifying conservation units based not on morphology but on genetic markers.
Title: Electrostatically Driven Guanidinium Interaction Domains that Control Hydrogel-Mediated Protein Delivery In Vivo

Author: Stephen E. Miller | Yuji Yamada | Nimit Patel | Ernesto Suárez | Caroline Andrews | Steven Tau | Brian T. Luke | Raul E. Cachau | Joel P. Schneider

Journal: ACS Central Science

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Abstract

Protein biologics are an important class of drugs, but the necessity for frequent parenteral administration is a major limitation. Drug-delivery materials offer a potential solution, but protein-material adsorption can cause denaturation, which reduces their effectiveness. Here, we describe a new protein delivery platform that limits direct contact between globular protein domains and material matrix, yet from a single subcutaneous administration can be tuned for long-term drug release. The strategy utilizes complementary electrostatic interactions made between a suite of designed interaction domains (IDs), installed onto the terminus of a protein of interest, and a negatively charged self-assembled fibrillar hydrogel. These intermolecular interactions can be easily modulated by choice of ID to control material interaction and desorption energies, which allows regulation of protein release kinetics to fit desired release profiles. Molecular dynamics studies provided a molecular-level understanding of the mechanisms that govern release and identified optimal binding zones on the gel fibrils that facilitate strong ID-material interactions, which are crucial for sustained release of protein. This delivery platform can be easily loaded with cargo, is shear-thin syringe implantable, provides improved protein stability, is capable of a diverse range of in vitro release rates, and most importantly, can accomplish long-term control over in vivo protein delivery.
Abstract

We present a first-principles approach to electronic many-body systems strongly coupled to cavity modes in terms of matter–photon one-body reduced density matrices. The theory is fundamentally nonperturbative and thus captures not only the effects of correlated electronic systems but accounts also for strong interactions between matter and photon degrees of freedom. We do so by introducing a higher-dimensional auxiliary system that maps the coupled fermion-boson system to a dressed fermionic problem. This reformulation allows us to overcome many fundamental challenges of density-matrix theory in the context of coupled fermion-boson systems and we can employ conventional reduced density-matrix functional theory developed for purely fermionic systems. We provide results for one-dimensional model systems in real space and show that simple density-matrix approximations are accurate from the weak to the deep-strong coupling regime. This justifies the application of our method to systems that are too complex for exact calculations and we present first results, which show that the influence of the photon field depends sensitively on the details of the electronic structure.
Abstract

Big data analytics and data mining are techniques used to analyze data and to extract hidden information. Traditional approaches to analysis and extraction do not work well for big data because this data is complex and of very high volume. A major data mining technique known as data clustering groups the data into clusters and makes it easy to extract information from these clusters. However, existing clustering algorithms, such as k-means and hierarchical, are not efficient as the quality of the clusters they produce is compromised. Therefore, there is a need to design an efficient and highly scalable clustering algorithm. In this paper, we put forward a new clustering algorithm called hybrid clustering in order to overcome the disadvantages of existing clustering algorithms. We compare the new hybrid algorithm with existing algorithms on the bases of precision, recall, F-measure, execution time, and accuracy of results. From the experimental results, it is clear that the proposed hybrid clustering algorithm is more accurate, and has better precision, recall, and F-measure values.
Abstract

Advances in flexible and stretchable electronics, functional nanomaterials, and micro/nano manufacturing have been made in recent years. These advances have accelerated the development of wearable sensors. Wearable sensors, with excellent flexibility, stretchability, durability, and sensitivity, have attractive application prospects in the next generation of personal devices for chronic disease care. Flexible and stretchable wearable sensors play an important role in endowing chronic disease care systems with the capability of long-term and real-time tracking of biomedical signals. These signals are closely associated with human body chronic conditions, such as heart rate, wrist/neck pulse, blood pressure, body temperature, and biofluids information. Monitoring these signals with wearable sensors provides a convenient and non-invasive way for chronic disease diagnoses and health monitoring.

In this review, the applications of wearable sensors in chronic disease care are introduced. In addition, this review exploits a comprehensive investigation of requirements for flexibility and stretchability, and methods of nano-based enhancement. Furthermore, recent progress in wearable sensors-including pressure, strain, electrophysiological, electrochemical, temperature, and multifunctional sensors-is presented. Finally, opening research challenges and future directions of flexible and stretchable sensors are discussed.