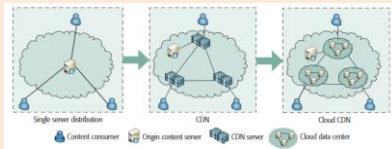


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A regular update featuring works by SUTD Faculty, Researchers, Students and Research Centres/Labs. We hope to create awareness of the Research by SUTD within the SUTD community and beyond. Share with us your SUTD works today so that we can include it in our next update.

COMPUTER SCIENCE— CLOUD COMPUTING

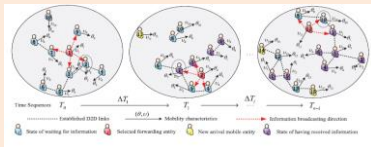


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Tang, J., & S. Quek, T. (2016). The role of cloud computing in content-centric mobile networking. *Communications Magazine, IEEE, 54(8)*, 52-59.

The use of smart handheld devices has led to more demand for multimedia services in mobile networks and content-centric mobile networking (CCMN) is replacing traditional mobile networking. Caching is an effective technique that ensures high quality multimedia services, in particular video services. The constraints inherent to caching techniques in traditional CCMN were analysed by the authors, which prompted them to design a cloud CCMN architecture that overcomes the constraints. Cloud CCMN was able to keep multimedia traffic under control and allowed the multimedia services to be of high quality.

COMPUTER SCIENCE— SOCIALLY-AWARE MOBILE NETWORKS



[Read More](#)

Wang, J., Jiang, C., Quek, T., Wang, X., & Ren, Y. (2016). The Value Strength Aided Information Diffusion in Socially-Aware Mobile Networks. *Access, IEEE, 4*, 3907-3919.

Typically employed transmission methods of big data cannot transmit information in the most optimal manner, due to shifting mobile entities. Current research largely emphasizes how information circulates, rather than on the network structure and social characteristics of the nodes which in turn spurred research on ways to enhance information dissemination ability in socially aware mobile networks. The idea of the value strength, social strength, together with a time-varying graph (TVG)-based mobility model was suggested. This model was discovered to improve both the propagation efficiency of data and the information coverage ratio of mobile networks, while at the same time it valued the importance of both network structure and the social characteristics of the nodes.

COMPUTER SCIENCE— TEXT CLASSIFICATION

```

Input: set of labeled documents L, set of unlabeled documents U
Output: labels for documents in U

On training data L
for k = 1 to |C| - 1 do
  for j = 1 to |T| do
    compute w_j^k and v_j^k (Eqs. 1, 2, 3, 4 or 5)
  end for
  compute Score^k(x) and Score^k(y) (Eqs. 7 and 8)
  learn parameters of w and v
end for

On test data U
for k = 1 to |C| - 1 do
  compute Score^k(x) and Score^k(y) (Eqs. 7 and 8)
  compute P^k(x) (Eq. 9)
end for
output k = argmax_k P^k(x) (Eq. 10)
    
```

Algorithm 1.
DIST

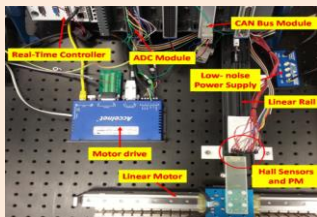
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Junejo, K., Karim, A., Hassan, M., & Jeon, M. (2016). Terms-based discriminative information space for robust text classification. *Information Sciences, 372*, 518-538.

Given the current trend of vast access to digitized text in various forms, such as emails, digital libraries and social media in the internet age, an effective and powerful text classification mechanism is essential to accurately categorize text in applications where documents have to be organized into predefined classes representing different semantic groups with scripts classified into established classes of varying semantic groups. As such, a discriminative information space for robust text classification (DIST) hinged on specific words, was introduced. DIST unified both feature space construction and linear classifier learning, bearing association with the Bayes classifier. The performance of DIST was evaluated on 6 different data sets and it was compared alongside 4 existing text classification techniques. DIST demonstrated high performance effectiveness and was found suited to a wide variety of situations where text classification is required.

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ELECTROCHEMISTRY— MAGNETIC SENSORS

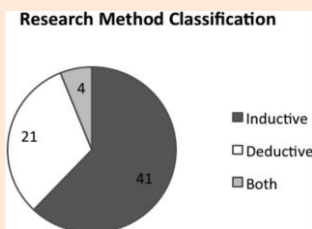


[Read More](#)

Foong, S. & Sun, Z. (2016). High Accuracy Passive Magnetic Field-Based Localization for Feedback Control Using Principal Component Analysis. *Sensors*, 16(8), 1280-1-18.

A new, innovative sensing system based on magnetic fields and which used statistically optimized parallel multiple sensor outputs to accurately determine field-position association and localization was designed by the authors. Concurrent spatial field measurements at multiple locations were unaffected by each other and this finding was used to produce correlations between field and position, by the system. The sensing accuracy and closed-loop tracking performance of the authors' sensing system was tested on a linear actuator relative to a more expensive optical encoder. Field position determination was found to have accuracy comparable to that of the optical encoder.

ENGINEERING, MECHANICAL— DESIGN THEORY AND METHODOLOGY



[Read More](#)

Fu, K., Yang, M., & Wood, K. (2016). Design Principles: Literature Review, Analysis, and Future Directions. *Journal Of Mechanical Design*, 138(10), 101103-1-13.

Design principles are established to organize and define design knowledge so that both new and well-known practices may be communicated and employed to improve the design process and address subsequent issues it may face. Prevailing research methods and practices with design principles were identified and classified. Research methodologies, techniques for validation, semantic principle composition, together with a suggested formal method to communicate design principles were analysed by the authors. This analysis prompted them to provide recommendations for enhancing research methodology in design principles to make them more accurate and repeatable.

ENGINEERING, MECHANICAL— SUSTAINABLE DESIGN

Did not change	Good, knows and does it	Missed Opportunities <i>Increased Knowledge+ Create Attention Control: User + Product</i>
	Knows but does not do	Misconceptions or guesses <i>Spur and Steer Control: Product + User Behavioural Strategies Control: User</i>
Changed	Correct	Wrong

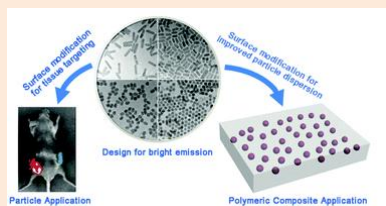
User behavior categorization matrix

[Read More](#)

Withanage, C., Hölttä-Otto, K., Otto, K., & Wood, K. (2016). Design for Sustainable Use of Appliances: A Framework Based on User Behavior Observations. *Journal Of Mechanical Design*, 138(10), 101102-1-12.

Wasteful appliance use, known as energy overuse failure modes (EOFMs), enable design engineers to help users use appliances in a sustainable manner via design strategies. So, a unique revealed behaviour-based scheme was presented by the authors to investigate the causes of EOFMs and to suggest methods to mitigate them. The main causes of EOFMS were found to be a penchant for excessive energy consumption and poor awareness of energy and power interactions among various appliances and household settings. Likely design solution strategies were taken into account to mitigate the EOFMs and each one of them differed in terms of how much knowledgeable decision-making was expected of the user. The authors' framework was determined to be a step towards sustainable households.

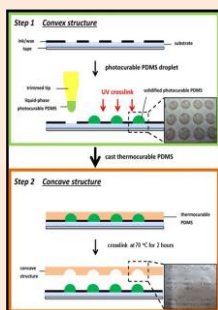
WE SHARE TO INSPIRE AND IGNITE IDEAS!

MATERIALS SCIENCE—
CORE-SHELL NANOPARTICLES

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Zhao, X., He, S., & Tan, M. (2016). Design of infrared-emitting rare earth doped nanoparticles and nanostructured composites. *Journal Of Materials Chemistry C*, 4(36), 8349-8372.

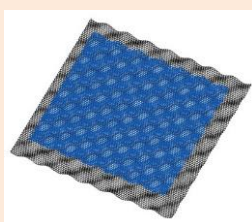
Rare earth (RE) doped materials possess exclusive optical properties that are independent of particle size. RE doped nanoparticles (RENPs) are among the commonly prepared of the RE doped materials. RENPs are widely used in various applications that include flexible optoelectronics, photovoltaics and photodetectors. Adapting features such as luminescence, size and surface properties of RENPs is vital in such applications to enable devices to function at their best. With this in mind, the authors reviewed techniques through which features of RENPs can be adjusted. This prompted the offering of standards regarding RNP design to enhance their optical efficiency, which in turn may produce favorable outcomes from the devices that include enhanced detection sensitivity and energy efficiency.

MATERIALS SCIENCE—
CURVED, POLYMERIC STRUCTURES

Read More

Chang, T., Sung, C., Hashimoto, M., & Cheng, C. (2016). Fabricating small-scale, curved, polymeric structures for biological applications using a combination of photocurable/thermocurable polydimethylsiloxane and phase interactions. *Applied Physics A*, 122(9), 813-1-7.

An uncomplicated technique to assemble small curved and polymeric structures in specific manners for biological use was developed. Droplet polymerization of polydimethylsiloxane (PDMS) that could be hardened in the presence of light was initially employed by the authors to make a master mould. This was followed by UV cross-linking, which then transformed the PDMS into solid state. The elastic PDMS that could be made denser in the presence of heat could subsequently be casted into curved PDMS structures that could have a wide variety of possible forms. As the PDMS master mould designs could be altered in an uncomplicated manner, this may enable multi-purpose biomedical tools to be fabricated to be less fragile. Additionally, manufacturing costs of biomedical devices could be reduced.

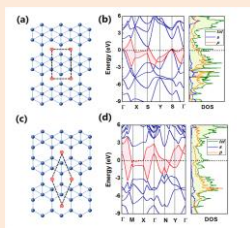
MECHANICS, ADHESION—
GRAPHENE

Read More

Boddeti, N., Long, R., & Dunn, M. (2016). Adhesion mechanics of graphene on textured substrates. *International Journal Of Solids And Structures*, 97-98, 56-74.

The logistics of graphene's adhesion onto textured substrates were analysed in 2 studies. In the first study, the way in which graphene sticks upon one and two dimensional periodic corrugations were evaluated and found to perform molecular statics simulations. The simulations closely correlated to what the authors had expected on the theoretical adhesion mechanism. The first study concluded that substrates with large curvatures allow graphene to stick on them in a manner conforming to the curvatures. However, the second study analysed the peeling of graphene ribbons from one dimensional sinusoidally textured substrates. From the molecular statics simulations, the ribbons were found to oscillate. The frequency of the oscillations was employed to determine the wavelength of the underlying substrate.

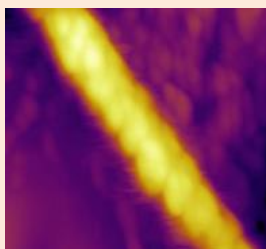
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NANOSCIENCE & NANOTECHNOLOGY—
BOROPHENE

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Zhang, X., Hu, J., Cheng, Y., Yang, H.Y., Yao, Y., & Yang, S. (2016). Borophene as an extremely high capacity electrode material for Li-ion and Na-ion batteries. *Nanoscale*, 8(33), 15340-15347.

Current trend widely assumed that two-dimensional (2D) borophene may function as an ideal electrode material with high electrochemical performance for both lithium (Li)-ion and sodium (Na)-ion batteries. Two borophene allotropes were analysed and the results proved that both allotropes had high energy storage capacity of several times higher than the traditional graphite electrode. Both allotropes also exhibited good stability over many charging-discharging cycles. This study indicates that borophenes will eventually be suitable anode materials for both Li-ion and Na-ion batteries of high power density.

NANOSCIENCE & NANOTECHNOLOGY—
POTASSIUM NIOBATE NANOFIBERS

Read More

Ganeshkumar, R., Sopiha, K., Wu, P., Cheah, C., & Zhao, R. (2016). Ferroelectric KNbO₃ nanofibers: synthesis, characterization and their application as a humidity nanosensor. *Nanotechnology*, 27(39), 395607-1-7.

Potassium niobate (KNbO₃) is a ferroelectric nanomaterial viewed as an environmentally-friendly alternative to ferroelectric materials containing lead, for piezoelectric transducers and energy harvesting applications. Currently, KNbO₃ nanofiber wires developed hydrothermally have limited length and are randomly aligned and this is a barrier to analysis of KNbO₃ and enabling it to be used in a wide variety of applications. Attempting to overcome this hurdle, the authors employed a specialized electrospinning process to manufacture lengthy KNbO₃ nanofibers. The nanofibers produced by their processing technique were shown to have adjustable diameter and high aspect ratio. A new resistive-type humidity nanosensor made out of the KNbO₃ nanofibers as synthesized by the authors was designed. This nanosensor had exceptionally strong sensing ability. The authors' work has potential for the increased deployment of KNbO₃ materials in photocatalysis, flexible optoelectronics and nanogenerators.

PHYSICS—HIGH-POWER
MICROWAVE GENERATION

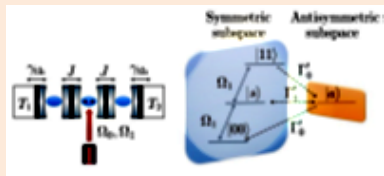
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Seviour, R., Shiffler, D., Jelonnek, J., Grabowski, C., Hemmady, S., & Ang, R. (2016). Guest Editorial The Sixteenth Special Issue on High-Power Microwave Generation. *Plasma Science, IEEE Transactions on*, 44(8), 1257.

This is a review of the Sixteenth Special Issue on High-Power Microwave (HPM) Generation. It first provides an overview of HPM generation by providing research areas that have been in progress, such as free-electron lasers, Cerenkov radiation generators along with virtual cathode and reflex oscillators. It also features two up and coming areas in HPM research, namely metamaterials and additive manufacturing, which have been added into Sixteenth Special Issue on High-Power Microwave (HPM) Generation. The addition of additive manufacturing in this issue gives a multidisciplinary aspect to it. Each article in this issue reflects the success and impact of contemporary computational, theoretical and manufacturing techniques in the realm of HPM research.

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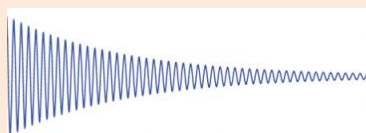
PHYSICS—OPTICS AND PHOTONICS



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Manzano, D. & Kyoseva, E. (2016). An atomic symmetry-controlled thermal switch. *Scientific Reports*, 6, 31161-1-6.

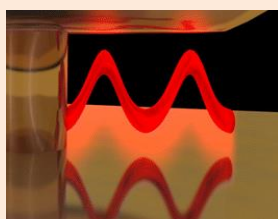
An atomic thermal switch system dependent on quantum symmetry comprising two atoms, which restrained the energy flow between two thermal baths, was introduced. The system reached a non-equilibrium steady state due to the presence of the baths. Theory on Large Deviation was employed to illustrate that the number of photons moving from one bath to the other varied according to symmetry of the atomic states. This system design will aid in the fabrication of switches controlled by symmetry for quantum applications such as quantum dots, optical lattices and trapped ions.

PHYSICS, APPLIED—
DIELECTRIC MATERIALS

Read More

Sinha, D. & Huang, S. (2016). Selective polarization of dielectric materials under electromagnetic scattering at radio frequency. *Journal Of Applied Physics*, 120(7), 074101-1-7.

Scattering between electromagnetic waves at the frequency of radio waves and the electromagnetic modes in dielectric solids due to short-term polarization of the bound charges in the presence of heat were analysed. The symmetry of frequency spectrum of electromagnetic modes was discovered to disintegrate as finite electrodynamic boundaries meant that particular modes were more pronounced than others. Furthermore, under the influence of external environmental factors, radio frequencies became more pronounced to result in radio emissions. Evidence of scattering of electromagnetic waves at radio frequencies that was similar to Raman scattering, occurred in the presence of two distinct electromagnetic force fields.

PHYSICS, APPLIED—
PLASMONIC NANOCAVITIES

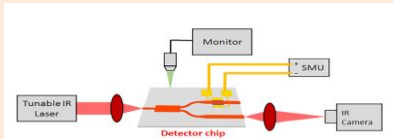
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Mertens, J., Demetriadou, A., Bowman, R., Benz, F., Kleemann, M. & Yang, H.Y. et al. (2016). Tracking Optical Welding through Groove Modes in Plasmonic Nanocavities. *Nano Letters*, 16(9), 5605-5611.

The growth of conductive links over very small insulating gaps occurred in the presence of light. This phenomenon was attributed to the introduction of spacers of molecules or single two-dimensional (2D) layers within an arrangement called gold plasmonic nanoparticle-on-mirror (NPM). When NPMs were irradiated by lasers, the plasmonic system was altered such that conductive bridges between particle and the gold substrate grew and this reduced the size of the insulating gaps. Dark-field spectroscopy and an analytic cavity model were employed to determine plasmonic modes and results indicated that optics could aid in knowing more about electrical transport characteristics across metallic nano-gaps. This knowledge could improve some existing technologies such as resistive memory devices or memristors.

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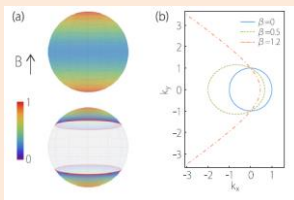
PHYSICS, APPLIED—SENSORS



Read More

Han, Z., Singh, V., Kita, D., Monmeyran, C., Becla, P., & Tan, D. T. H. et al. (2016). On-chip chalcogenide glass waveguide-integrated mid-infrared PbTe detectors. *Applied Physics Letters*, 109(7), 071111-1-3.

Applications such as medical diagnostics and chemical sensing are dependent upon detecting infrared (IR) radiation. Mid-infrared (MIR) system-on-a-chip platforms that include spectroscopic sensors rely upon waveguide-integrated mid-infrared (MIR) detectors. However, waveguide-integrated MIR detectors are not commonly used because of the lack of options for appropriate materials to make them. Thus, the authors suggested the use of lead chalcogenides to substitute for waveguide-integrated MIR detectors. A lead telluride (PbTe) photoconductive detector and a chalcogenide glass waveguide were used to fabricate a device that operated at room temperature. This device was inexpensive and had good responsivity.

PHYSICS, MULTIDISCIPLINARY—
WEYL SEMIMETALS

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Yu, Z., Yao, Y., & Yang, S. (2016). Predicted Unusual Magnetoresponse in Type-II Weyl Semimetals. *Physical Review Letters*, 117(7), 077202-1-6.

The response of Weyl semimetals (WSMs) to an external magnetic field was evaluated by the authors. It was found that the Landau levels (LLs), which are energy levels of sets of wave functions, of WSMs were compressed. For type-II WSMs, there was a critical angle between the B field and the tilt, at which the LL spectrum degraded and this phenomenon was observed to not depend upon magnetic field strength of the surroundings.