
Editorial

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Biographical notes: Santanu Bandyopadhyay is a Professor in the Department of Energy Science and Engineering, IIT – Bombay, India. Before joining IIT – Bombay, he served the Heat and Mass Transfer Division of M/s Engineers India Ltd., New Delhi. His research interests include industrial energy conservation, energy integration, process optimisation, mathematical modelling and simulation of various energy systems.

C.A. Babu received his BSc (Engineering) and MTech degrees in Electrical Engineering from Cochin University of Science and Technology (CUSAT), Cochin, India, and his PhD in Electrical Engineering from the National Institute of Technology Calicut, Calicut, India. After acquiring a few years of industrial experience, he joined the Division of Electrical Engineering, School of Engineering, CUSAT, as a faculty member, where he is currently a Professor and the head of the division. His research interests include energy conservation and management, industrial load management, safety in electrical systems, renewable energy and distributed generation.

James Varghese is an Assistant Professor in the Division of Mechanical Engineering, Cochin University of Science and Technology, Kochi, India. He worked as a Post Doctoral Fellow for one year with the I2E2 program, University of Limerick, Ireland. He has ten years of teaching experience and four years of industrial experience in thermal design and R&D of heat exchangers. His research interests include energy efficiency, energy system integration, energy system modelling and analysis, low grade energy utilisation, and solar heat for refrigeration.

The papers, presented in this special issue entitled, 'Energy efficient and environment friendly technologies for the future' are based on the selected papers presented at the International Conference on Energy, Environment, Materials and Safety (ICEEMS'14) held at the Cochin University of Science and Technology, Kochi, India from 10th to 12th December 2014. The conference focused on advances in energy technologies, related environmental issues, advances in materials, and related safety issues. The conference had more than 100 participants from across India and also delegates from three different countries. There were three parallel sessions with 87 paper presentations and keynote lectures by eminent international academicians. The conference received major funding from the Technical Education Quality Improvement Programme (TEQIP), MHRD Government of India. In this special issue, 12 papers are peer reviewed and published.

In the advances on energy technologies, Shrivastava et al. present a mathematical model of the passive direct methanol fuel cell (DMFC) the model considers the methanol and oxygen mass transport phenomena along with the electrochemical reactions. It is claimed that the outcome of this research will be useful for improving understanding of the transport phenomena in the passive DMFC and to optimise the cell design.

Palaskar and Deshmukh analyse performance of spiral flow heat exchanger of hybrid system with reflectors fixed to shorter sides of module. The results such as performance efficiencies of photovoltaic, thermal, and combined photovoltaic/thermal are compared for forced and natural circulation of water through heat exchanger system. Authors report that the results of the study showed that for this system, thermo-siphon method if used can be an ideal solution for generation of electrical power and hot water.

Abraham et al. present a dual source variable output switched capacitor that can be operated in step down mode. The feature of the converter is that it can be selectively switched between two input sources one being a solar source. The application of this converter can be in portable electronic devices or a processor for future which need three buck voltage levels typically in active, standby and sleep mode. The authors claim the SC converter has the capability to integrate with solar PV applications.

On the advances in efficient electrical energy generation and distribution systems, Vineetha and Babu propose development of model and algorithm of hybrid power system (HPS) connected to single directional grid to determine optimal HPS. Comparison of optimal energy cost with conventional energy cost is done to evaluate the economic impact of the systems. The results show that the optimal systems are financially viable for both combined and individual RES and most feasible system is HPS.

Bindu and Babu propose a simple and inexpensive solution with a simple control for the reduction of DC bus voltage stress. This topology is the integration of discontinuous conduction mode (DCM) boost rectifier for the input current shaping and flyback converter for fast output voltage regulation. A design solution and a simple controller are proposed to reduce DC bus voltage stress. Authors claim that this converter is best suited for universal line application (90–265 V AC).

Bindumol and Babu propose an analytical approach for sizing and placement of DG in radial distribution system. This paper applies a new algorithm, bus voltage sensitivity index on balanced distribution networks for the proper placement of DG. The bus having least BVSI gives the highest priority for active power. The results show that the proposed method converges to better solutions much faster than the genetic algorithm (GA)-based BFSA.

In the advances on materials for energy technology applications, Lekshmi et al. present a study about the potential of mud as sustainable building material, identified some of the positive aspects for choosing mud as a construction material. Anything built of mud can be reused without affecting the environment. Due to the unique property of breathability, mud buildings ensure better health and impart positive energy to its inhabitants. The response from the inhabitants assures that mud is an excellent thermal regulator. Authors suggest mud buildings can be a solution to reduce global warming.

Lal et al. present the torsional springback problems of L-sectioned bars of linear work-hardening materials. Using the deformation theory of plasticity, a numerical scheme based on the finite difference approximation has been proposed. The results are verified experimentally with mild steel bars having a L cross-section and the experimental result have been found to agree well with the theoretical results obtained numerically.

In the environment friendly technological aspects, Sandhya and Tide present computational analysis of subsonic jets from round and bevelled nozzles. Authors propose new designs in the nozzle geometry intended to reduce the noise level from the jet. Numerical simulations of a turbulent compressible subsonic jet from round and bevelled nozzles were carried out using commercial CFD software. Authors report that the bevelling of nozzle can significantly change both flow pattern and turbulence structure and thus act as a passive method for jet noise reduction.

Kumar et al. report a study assessing the impact of coal mining on soil nutrients and their efficient restoration through different combination of soil amendments. The physico-chemical and biological properties of mine spoil before and after treatment were analysed. Results indicated that the applications significantly improved the physico-chemical and microbiological properties (which were practically absent) of the coal mine spoil dump. The findings of this study can be utilised by the mine management programs in the large-scale re-vegetation of several adjacent coal mining overburden dumps for eco-friendly mining.

Bhagawati and Shivayogimath report a study conducted to find the feasibility of electrocoagulation (EC) process for the treatment of paper mill wastewater. The studies were conducted in an EC reactor of 1.50 L capacity with aluminium electrodes connected in a monopolar parallel system. The effects of operating parameters such as pH, current density, electrolysis duration and applied voltage on turbidity, total organic carbon and COD removal efficiency has been investigated.

Gupta et al. present the study of treatment of waste water from sugar industry in perspex glass reactor using EC process. Experiments were conducted by varying pH, current density and electrode gap. Authors report that COD was reduced from 1,880 mg/dm³ to 606 mg/dm³ and colour reduction of 95.67% was achieved by this process.

We hope the papers presented reflect the current research activities taking place in the energy efficiency and environment friendly technologies.