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## Research papers

ES110301 Energy network optimization using a Markov Chain-Monte Carlo algorithm 82-94

Guangran Zhang and E. H. Chimowitz

**Abstract:** We describe a mathematical model and two-tier computational algorithm for finding network structures that best satisfy energy supply/demand constraints in the system. The method uses a Markov matrix for routing flows in the algorithm's 'inner' loop while elements of this matrix are periodically updated in an 'outer' loop using Monte Carlo sampling. We illustrate the efficacy of the method on two numerical examples.

ES110302 Modeling impulse generator using curve fitting technique 95-102

Isa S. Qamber, Hussain Al-Oraibi, Mohamed Y. AL-Hamad

**Abstract:** The impulse generator is a well-known topic as a test system designed to test any high voltage equipment of power systems with lightning and switching impulses. The impulse generator produces a very short high current or high voltage surges. In this case, the high voltages used to test the strength of the tested high voltage equipment against lightning and switching. The impulse currents needed to test fuses and many other technical applications such as lightning arresters. The impulse generator consists of multiple number of capacitors. The present study helps to model and simulate the impulse voltage generator, which helps in testing the equipment to determine the critical flashover maximum voltage of a sphere gap,  $\alpha$  and  $\beta$  which are the main objectives of the present study. The results of voltage impulse generator obtained. Finally, in the present study the impulse generator is used to evaluate the performance of up to sixteen-stage impulse generator. The developed models produce the waveforms of required shape results obtained and plotted.

ES110303 Performance optimization of a masonry solar still using Taguchi's fraction factorial experimental technique 103-108

Satej Sudhakar Kelkar and Pradeep Patil

**Abstract:** Solar stills are used to achieve pure palatable water from saline or impure water. Output or yield of solar still (i.e. the pure palatable water) received, depends upon number of factors, namely material of lid, color of tank/sink base, etc. The output cannot be directly mathematically related with some of factors upon which it depends. Therefore a mathematical model cannot be completely formulated and hence to optimize (maximize) the output, analytical methods cannot be employed. Therefore for such kind of examples, for which a complete mathematical model cannot be formulated, experimental optimization techniques are necessary. One of the predominant experimental optimization techniques is the 'Taguchi Technique' which has received wide acceptance and has proved its merit over the period. In this paper use of the 'Taguchi Technique' for setting the level of different parameters/factors with an aim of optimizing/maximizing the output/yield is illustrated.

ES110304      Modeling and simulation of ultrasound interactions with fibrous tissue      109-112

Hasith E. Perera, W. A. M. Madhavi, Janaka Wansapura

**Abstract:** In this study, we computationally modeled and simulated the interaction of ultrasound waves with biological tissues using a simple solid sphere model of scatterers. An algorithm was developed to generate virtual tissue samples with different scatterer parameters. Propagation of ultrasound through the virtual samples was modelled using a simple theoretical model and the frequency dependent ultrasound backscatter coefficient (BSC) was calculated in the clinical frequency range of 2–15 MHz while varying the scatterer radius, number of scatterers and scatterer packing fraction. A detectable difference of BSC was observed for different packing fractions in the low frequency range of 2–3.5 MHz. Other parameters were not sensitive enough to distinguish between the different tissue samples in the clinical frequency range. This work provides ground for the development of novel ultrasound imaging techniques incorporated with computational techniques allowing ultrasound imaging to be used for early diagnosis of tissue fibrosis.

ES110305      Behaviour of natural frequency by using impact of weight on human femur bone      113-120

Balaji D. Kshirsagar and Subim N. Khan

**Abstract:** In the present experimental research, left side of human femur bone is used. Natural frequency of human femur bone is evaluated by using FFT Analyzer. Evaluation of natural frequency is obtained by varying impact weights i.e. 50 gram, 100 gram, and 150 gram on human femur bone from height of 5 cm, 10 cm and 15 cm at a distance of 8 cm, 16 cm and 24 cm respectively. Design of experiments are carried out by using Taguchi method i.e.  $L_9(3^3)$  Orthogonal Array. The natural frequency pattern variation is studied by using different combinations of height, length and weight. The present research indicates that for constant values of height (5 cm & 10 cm), length (8cm & 16 cm), and weight (50 grams & 100 grams), natural frequency increases linearly, while for constant values of height (15 cm), length (24 cm), and weight (150 grams), natural frequency decreases linearly.