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Research papers

- ES110101 Criterion for cladding runaway oxidation during loss of flow accident 1-6
(LOFA) in nuclear reactors

E. Elias, D. Hasan, Y. Nekhamkin, P. Trinuruk

Abstract: A dimensionless criterion is derived to define runaway conditions in the upper steam section of a fuel channel during Loss of Flow Accident (LOFA) in a power reactor. The model is based on the energy balance equations in the exposed upper section of the fuel channel to account for the effect of convection heat transfer at the metal-steam interface. The ignition criterion previously developed for stationary steam is extended here to include the effect of steam flow and its time varying temperature at the exposed section of the core. The new criterion has been tested over a wide range of operating conditions using a detailed heat transfer model. Initial results show that unlike the previous ignition criterion, which depends only on the heat transfer coefficient, accounting for steam flow and heat-up yields a set of inlet flow rates and heat transfer coefficients that define the runaway behavior of the clad temperature. The approach to runaway conditions depends on a combination of thermal and design parameters, rather than solely on the predetermined limit of 2200 °F (1204°C) of the US Nuclear Regulatory Commission (US NRC).

- ES110102 Static structural analysis of a pointed tip wind turbine blade using FSI 7-12

Fadoua Zemmouri, Mahmood S. Chowdhury,
Ziaul Huque, Raghava R. Kommalapati

Abstract: Fluid Structure Interaction techniques are widely used to develop and design structures. They describe the response of a solid to a fluid flow. In this paper, a study of the structural responses of a pointed tip wind turbine blade was done. For this purpose, a static structural analysis using ANSYS was performed at a 10m/s wind speed. The National Renewable Energy Laboratory (NREL) phase VI wind turbine blade dimensions were utilized. However, the last 10% of the blade span was changed from a standard tip shape to a pointed one. Aerodynamic force distribution is used as an input for the finite element structural analysis. The pressure distribution around the blade was obtained separately through Computational Fluid Dynamics (CFD) simulations. It was successfully transferred from the fluid domain to the structural one through an interface and a mapping process. The pressure distribution was applied as surface load input for the structural analysis. The deformation and equivalent stress distributions were obtained for both NREL original shape and the pointed shape for comparison. The maximum deformation was more on the pointed tip blade, but the equivalent stress difference was not significant.

ES110103 Processing, characterization and sliding wear behavior of functionalized carbon nanotube reinforced epoxy matrix composite 13-19

Anurag Singh

Abstract: In this research article, the study of sliding wear behaviour of functionalized multi-walled carbon nanotube (MWCNT) reinforced epoxy matrix composite has been studied. The Pristine carbon nanotube is functionalized by the chemical functionalization then the grafting of carboxyl group is confirmed with the help of Fourier transformed Infrared spectroscopy (FTIR) and the structure is checked by the X-ray diffraction technique (XRD), after that Thermo Gravimetric analysis (TGA) of functionalized MWCNT is done to ensure the percentage of grafting onto the surface of MWCNT. Composite is prepared after sonicating and magnetic stirring the mixture of MWCNT and epoxy after that the mixture is cured in a mould. Sliding wear behaviour of the pristine and functionalized MWCNT composite is compared. The trend for functionalized MWCNT composite shows better resistance to wear. Finally, optical microscope images are taken and the wear surface morphology is seen and compared with epoxy, pristine MWCNT reinforced composite and Functionalized MWCNT reinforced composite.

ES110104 Is optimization possible with computationally expensive models? 20-26

Srinivas Soumitri Miriyala and Kishalay Mitra

Abstract: In spite of the ever-increasing power of computing machines, optimization and control using robust yet, complex and time expensive first principle models is confined to offline mode. Surrogate models offer practical solution to this problem; however models such as ANNs suffer with credible disadvantages. Novel ANN building algorithm, TRANSFORM aimed at simultaneous optimal estimation of architecture, training data size and transfer function is proposed in this work along with a Sobol based fast size determination algorithm. Three critical processes from Iron and steel making industries – Sintering, Induration and Continuous casting, each known for a highly nonlinear dynamics, are considered to demonstrate the performance of TRANSFORM. The ANNs constructed from proposed algorithm not only parsimoniously emulated all the first principle models with high accuracies but also lead to 7, 10 and 13 times faster optimization, respectively. TRANSFORM takes simulation model or experimental data as the only input and is generic and scalable to any dimensions.

ES110105 Virtual simulation analysis data efficient management plan of ground weapon system 27-32

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Junkyun Kim

Abstract: A defense M&S (Model & Simulation) has a hierarchical structure from an effectiveness analysis on the level of detailed engineering level analysis of a combat unit; Theater, Mission/Battle, Engagement and Engineering Models. Among those multi-level defense M&S, this paper focuses on the detailed engineering level analysis, especially, describes an integrated framework for analyzing the concept model and their alternatives of virtual ground weapon systems. In order to rapidly compare the performance of a concept design of a ground weapon system and its alternate designs, the integrated framework is required. Through the performance comparison among the models based on virtual system integration environment and systematic management of verified data, it is possible to secure the basis for L (Live) – V (Virtual) – C (Constructive) interworking, improve weapon system performance, and reduce costs.

Garg D., Bojotlhe M.

Abstract: This paper proposes a mobile based Electronic voting system for Botswana. The system will help the Independent Electoral Commission (IEC) of Botswana to conduct elections. The current manual voting process is very tiring and cumbersome whereas electronic voting system has brought innovative change in the traditional manual voting system. Electronic voting is a term used to describe the act of voting using electronic systems to cast and count votes. It can make the voting process simple, quick, convenient and fun to use. The main aim of the electronic voting system is to record the votes and count them and provide results. Considering the many benefits of electronic voting many countries like United Kingdom, United States, Switzerland, and Canada have organized trial electronic voting. The main aim of this is to provide effective, efficient system to manage the election process.