1. **A mesoscale ultrasonic attenuation finite element model of composites with random-distributed voids**

   Composites Science and Technology, *Volume 89*, *13 December 2013*, *Pages 44-51*

   Yalin Yu, Jinrui Ye, Yang Wang, Boming Zhang, Guocheng Qi

Abstract

Interaction between ultrasonic wave and fiber reinforced composites with voids was investigated on the mesoscale by numerical method in this work. DIGIMAT-FE software was used to establish a mesoscale model of void-containing composites, which revealed the real microstructure with randomly distributed voids. Ultrasonic excitation was loaded into the mesoscale model via ABAQUS/Explicit before the finite element analysis (FEA) was carried out. Take T800 carbon fiber/epoxy composite material as an example, the accuracy of the simulated method was verified by comparing the numerical prediction with the analytical and experimental results. Therefore, this simulation method not only can be an effective guidance for manufacturing process but also provide a theoretical basis for reducing void level in order to increase performance of composites.

2. **Solvability and solutions for bus-type extended load flow**

   International Journal of Electrical Power & Energy Systems, *Volume 51*, *October 2013*, *Pages 89-97*

   Ye Guo, Boming Zhang, Wenchuan Wu, Qinglai Guo, Hongbin Sun

Abstract

In traditional load flow calculation, only three types of buses, *PQ*, *PV*, and *Vθ*, are generally specified. To accommodate the integration of new kinds of power equipment and flexible load flow control facilities, extra bus types are needed in load flow model. The load flow model incorporated with all possible bus types is named as bus-type extended load flow (BELF) for short in this paper. Both Newton–Raphson and decoupled BELF solutions are developed. An important problem for BELF is its solvability, which is carefully studied and topology-based criteria are proposed to ascertain BELF's solvability. Numerical tests are carried out to verify the convergence of the BELF solution and the correctness of the proposed solvability criteria.

3. **A renewal-process-based component outage model considering the effects of aging and maintenance**

   International Journal of Electrical Power & Energy Systems, *Volume 44, Issue 1*, *January 2013*, *Pages 52-59*

   Guoqiang Ji, Wenchuan Wu, Boming Zhang, Hongbin Sun

Abstract

The development of accurate component outage models for reliability assessment in power systems is a fundamental problem. Traditional outage models with constant failure rate cannot reflect the impact of changes in operating conditions and repairs after a failure. In this paper, a staircase function is used to approximate the aging failure rate curve, and a renewal-process-based model is introduced to calculate time-varying failure probabilities. The proposed time-varying outage model is able to reflect the effects of component aging and repair activities on the failure rate. Application to an actual transformer shows that given the aging failure rate curve, the new model can evaluate the life probability distribution and steady-state availability of a component as accurate as the simulation method. Compared to the traditional constant-rate model, the proposed model is more accurate and practical.

4. **Prediction of biaxial failure envelopes for composite laminates based on Generalized Method of Cells**

   Composites Part B: Engineering, *Volume 43, Issue 3*, *April 2012*, *Pages 914-925*

Zhanwen Tang, Boming Zhang

Abstract

Macro/micromulti-scale analysis based on the efficient implementation of the Generalized Method of Cells coupled with classical lamination theory was conducted to predict failure of composite laminates, applying failure criteria at the constituent level, including fiber, matrix and interface. Representative unit cells with different fiber arrays were constructed in order to study the effect of reinforcement architecture and failure criteria on strength prediction of composite laminates. In order to compare the micromechanics model's accuracy with commonly-used macroscopic failure theories, the experimental data obtained from the Worldwide Failure Exercise (WWFE) was utilized, and a quantitative assessment method for failure envelopes was developed to evaluate the model's performance. Finally, the types of representative unit cell architectures and failure theories which are applicable for different layups were identified. The results indicate that the predictive performance of the employed micromechanics-based model is closest to the three leading macroscopic failure criteria of Puck, Cuntze and Tsai–Wu, and better than all other microscopic-based failure criteria (Chamis, Mayes, Huang), employed in the WWFE study.

5. **A distribution system state estimator accommodating large number of ampere measurements**

   International Journal of Electrical Power & Energy Systems, *Volume 43, Issue 1*, *December 2012*, *Pages 839-848*

   Wenchuan Wu, Yuntao Ju, Boming Zhang, Hongbin Sun

Abstract

This paper presents a three-phase state estimation method for distribution network which can accommodate large number ampere measurements and voltage measurements. In this method, the power on sending end of branch and the square of branch current magnitude are chosen as the state variables. Therefore, measurement functions of ampere and voltage measurements are significantly simplified and no measurements transformation is needed in this method. Furthermore, a novel robust state estimation model is presented, which can suppress bad data automatically. The observability analysis indicates the proposed method can be used in distribution system with very limited measurements. Numerical tests on radial and weak-meshed network show the real-time branch current measurements can significantly improve the accuracy of estimation results.

6. **Hierarchical multiscale modeling of failure in unidirectional fiber-reinforced plastic matrix composite**

   Materials & Design, *Volume 31, Issue 5*, *May 2010*, *Pages 2312-2318*

   Boming Zhang, Zhong Yang, Yufeng Wu, Hongwei Sun

   hbor fibers is modeled, where matrix plastic hardening is considered. Local stress distribution in RVE is simulated by shear-lag model, and transferred into macro-scale for progressive damage simulation. In macro-scale, Monte Carlo simulations with the present shear-lag model were then conducted to obtain the ultimate tensile strength. Through this hierarchical multiscale simulation, composite macro-performance can be predicted by micro-scale parameters, this relationship will give a reference for composite design and optimization.

7. **Measurement and analysis of residual stresses in single fiber composite**

   Materials & Design, *Volume 31, Issue 3*, *March 2010*, *Pages 1237-1241*

   Zhang Boming, Yang Zhong, Sun Xinyang

Abstract

This paper deals with the thermal residual stress of carbon fiber-reinforced composite, which arises

from the different coefficient of thermal expansion (CTE) of constituents during cooling from the processing temperature down to room temperature. It is studied by experiment and theoretical analysis. In experiment, the real-time electrical resistance detection method is applied to measure the carbon fiber electrical resistance, where the single carbon fiber itself is used as internal sensor in composite material. The axial residual strain and also stress is obtained by the relationship between strain and electric resistance based on its electrical property. To explain the experiment data, a 3D theoretical column model with three phases was established to calculate the unit cell stress field by governing equations and boundary conditions. Result shows the experiment data is approximately close to theoretical model; meanwhile, theoretical model gives more detailed stress distribution, which is difficult to measure, in three directions of all phases.

8. **Microstructure and magnetic microstructure of La + Co doped strontium hexaferrites**
   Journal of Alloys and Compounds, *Volume 492, Issues 1–2*, *4 March 2010*, *Pages 691-694*
   Zhiyong Pang, Xijian Zhang, Boming Ding, Daxin Bao, Baoshan Han

Abstract

After being cut, carefully ground, meticulously polished and properly eroded, the microstructure and magnetic microstructure of $La_{0.3}Sr_{0.7}Fe_{11.8}Co_{0.2}O_{19}$ hexaferrites were investigated by using magnetic force microscopy. The shapes of a large amount of the $La_{0.3}Sr_{0.7}Fe_{11.8}Co_{0.2}O_{19}$ grains were determined to be mostly irregular flat columns. The shape anisotropy of the hexaferrite grains can be explained by an abnormal grain growth process occurs for La + Co-containing hexaferrite powders. The magnetizations mainly align parallel or anti-parallel to the direction of oriented magnetic field. The magnetic domain sizes are in the same order of magnitude with the grain sizes. No complex domain structures like corrugation and spike were observed. Micromagnetic simulations were also performed to help analyzing the magnetic microstructure.

9. **Effects of active cooling on the metal thermal protection systems**
   Aerospace Science and Technology, *Volume 15, Issue 7*, *October–November 2011*,*Pages 526-533*
   Shuang Liu, Boming Zhang

Abstract

Active cooling thermal protection systems (TPS) are investigated with potential applications in hypersonic and re-entry vehicles, which are subjected to severe aerodynamic heating environment. In order to evaluate the efficiencies of different typical active cooling methods which are potentially applied to metallic thermal protection system fast and easily, the traditional TPS is modeled using the finite difference approach. In particular, four different thicknesses of insulations' TPS are studied. Moreover, a finite difference active cooling TPS model is developed that envisions the concrete active cooling method as a constant negative heat flux applying the material interface between the insulation and structure layers. Two kinds of active cooling modes are employed in order to compare the temperature differences and protection heat efficiencies with an active cooling method. The numerical calculation results show that structure temperature decreases as the insulation thickness increases as well as temperature difference increases, however, this effect weakens as the insulation thickness increased. Active cooling TPS can efficiently cool the inner structure and decrease temperature difference. Moreover, the cooling efficiency also depends on the cooling modes.

10. **A time-varying transformer outage model for on-line operational risk assessment**
    International Journal of Electrical Power & Energy Systems, *Volume 33, Issue 3*,*March 2011*, *Pages 600-607*
    Liaoyi Ning, Wenchuan Wu, Boming Zhang, Pei Zhang

Abstract

The failure probabilities of system components may vary with changes in the operating conditions. Performing a probabilistic risk assessment in real-time is challenging, since component failure probabilities are difficult to predict. Accordingly, this paper introduces a delayed semi-Markov process that incorporates real-time data from advanced sensors, as a means of efficiently calculating time-varying or condition-based failure probabilities. To demonstrate the feasibility of the procedure, a time-varying transformer outage model with numerical examples is presented. In the proposed technique, an analytic random model is developed to accommodate the impact of real-time dissolved gas analysis data, as well as other conditions pertaining to the failure probabilities of system components.

11. **A virtual experimental approach to estimate composite mechanical properties: Modeling with an explicit finite element method**
Computational Materials Science, *Volume 49, Issue 3*, *September 2010*, *Pages 645-651*
Boming Zhang, Zhong Yang, Xinyang Sun, Zhanwen Tang

Abstract

A new virtual experimental approach to estimate the effective transverse properties of fiber-reinforced composite (FRC) is introduced. An explicit finite element method (FEM) is used to perform the composite progressive damage analysis, which successfully overcomes the numerical convergence problem that is encountered during continuous stiffness degradation. The virtual experiment includes four steps: first, generating a real microstructure; second, determining the composite constituent properties; third, progressive damage analysis; and fourth, comparing the results with those from an actual macro experiment. After completing these four steps, an accurate stress–strain curve under a transverse load is obtained. Then, we use this virtual experimental method to analyze the influence of micro parameters, such as interphase strength and residual thermal stress, on FRC macro performance. This virtual experiment method can be used for any composites and can provide more detailed material information than actual experiments as well as a direct reference for composite optimum design.

12. **Numerical simulation of the fiber fragmentation process in single-fiber composites**
Materials & Design, *Volume 31, Issue 5*, *May 2010*, *Pages 2464-2470*
Xiaohong Wang, Boming Zhang, Shanyi Du, Yufen Wu, Xinyang Sun

Abstract

This paper attempts to simulate the process of fiber break in single-fiber composite fragmentation test (SFCF). The ensued stress redistribution in fiber, matrix and interface after the fiber break is also researched. A new simulation method based on the user subroutine: “User subroutine to redefine field variables at a material point (USDFLD)” in the general finite element method (FEM) software ABAQUS is proposed. The subroutine is used for the definition of the fiber material constitutive model and is programmed in FORTRAN. It is called by ABAQUS. So the damage mode of the fiber break is simulated by the method. The forms of stress redistribution in fiber, matrix and interface are also obtained in the simulation. Then the T300/epoxy single-fiber composite is fabricated and the single-fiber composite fragmentation test is done. The simulation method and results are proved to be appropriate by the comparative analysis with the experiment.

13. **Three-dimensional Cure Simulation of Stiffened Thermosetting Composite Panels**
Journal of Materials Science & Technology, *Volume 26, Issue 5*, *May 2010*, *Pages 467-471*
Guangquan Yue, Boming Zhang, Fuhong Dai, Shanyi Du

Abstract

Stiffened thermosetting composite panels were fabricated with co-curing processing. In the co-curing processing, the temperature distribution in the composite panels was nonuniform. An

investigation into the three-dimensional cure simulation of T-shape stiffened thermosetting composite panels was presented. Flexible tools and locating tools were considered in the cure simulation. Temperature distribution in the composites was predicted as a function of the autoclave temperature history. A nonlinear transient heat transfer finite element model was developed to simulate the curing process of stiffened thermosetting composite panels. And a simulation example was presented to demonstrate the use of the present finite element procedure for analyzing composite curing process. The glass/polyester structure was investigated to provide insight into the nonuniform cure process and the effect of flexible tools and locating tools on temperature distribution. Temperature gradient in the intersection between the skin and the flange was shown to be strongly dependent on the structure of the flexible tools and the thickness of the skin.

14. **Microstructures and toughening mechanisms of organoclay/polyethersulphone/epoxy hybrid nanocomposites**

    Materials Science and Engineering: A, *Volume 528, Issue 27*, *15 October 2011*,*Pages 7999-8005*

    Yang Wang, Boming Zhang, Jinrui Ye

Abstract

Hybrid nanocomposites (HNCs) with high fracture toughness were successfully prepared by incorporating polyethersulphone (PES) and organoclay into epoxy resin. Their microstructures were studied. They were composed of homogeneous PES/epoxy matrices and micron-scale organoclay agglomerates. These agglomerates consisted of smaller tactoid-like regions which were comprised of ordered exfoliated nanolayers. The toughening mechanisms of the two tougheners were also studied and then related to their microstructures. For one thing, the PES which was dissolved in the epoxy resin homogeneously improved the ductility of the epoxy resin and made it easier to deform. For another, the organoclay agglomerates induced crack front bowing, crack bridging, crack deflection, crack bifurcation and plastic deformation of the matrices on the micron-scale, respectively. These toughening processes were achieved by the ordered exfoliated nanolayers with various orientations, which debonded from the matrices, bridged the cracks and induced the plastic deformation of the matrices on the nanoscale.

15. **Effects of Contact Resistance on Heat Transfer Behaviors of Fibrous Insulation**

    Chinese Journal of Aeronautics, *Volume 22, Issue 5*, *October 2009*, *Pages 569-574*

    Zhao Shuyuan, Zhang Boming, Du Shanyi

Abstract

In this article, a numerical model combining conduction and radiation is developed based on two flux approximation to predict the heat transfer behavior of fibrous insulation used in thermal protection systems. Monte Carlo method is utilized to determine the modified radiative properties with experimentally measured transient external temperature as high as 1 000 K. It is found that the estimated radiative properties become time-independent after about t = 3 000 s. By comparing the predicted to the measured results in transient state, the contact resistance exerts significant influences upon the temperature distribution in the specimen. Results show that the averaged absolute deviation is 3.25% when contact resistance is neglected in heat transfer model, while 1.82% with no contact resistance.

16. **A changeable aerofoil actuated by shape memory alloy springs**

    Materials Science and Engineering: A, *Volume 485, Issues 1–2*, *25 June 2008*, *Pages 243-250*

    Yu Dong, Zhang Boming, Liang Jun

Abstract

An aerofoil has great influences on the aerodynamic quality of aerial vehicles and efficiency of flight can be greatly improved by adopting the optimum aerofoil under different flying conditions. A

changeable aerofoil model is designed and manufactured. By changing the constraint condition of the skins, they can achieve large deformation without overstepping their strain allowance. Shape memory alloy springs with the help of stop structures are used to actuate accurately certain points on the skins to approach the target aerofoil. A finite element model of the skins is built and deformation of the skins under the control of the discrete points is simulated. Deformation of the skins actuated by SMA springs is measured and the results of the experiment and simulation are compared and analyzed. A method of designing a changeable aerofoil is provided.

17. **A load reconstruction model for advanced grid-stiffened composite plates**
    Composite Structures, *Volume 82, Issue 4*, *February 2008*, *Pages 600-608*
    Boming Zhang, Jifeng Zhang, Zhanjun Wu, Shanyi Du

Abstract

This paper presents a practical method for load reconstruction on an advanced grid-stiffened (AGS) composite plate. With this method, separate AGS ribs are smeared onto a continuous unsymmetrical plate. A forward response approximate model is then built to describe the dynamic response of the plate. Numerical verification indicates that the proposed model can simulate the structure with reasonable accuracy and high computing speed. We also adopted an optimization technology to recover the load history and location. The load history is recovered with a smoothing/filter algorithm and the load location is estimated with a linear search for the lowest value of a defined figure of merit *J*, which measures the difference between the calculated response and the measured response. The feasibility of the reconstruction technology has been verified by numerical experiments in which good agreements were obtained. Since it calculates rapidly, it is possible to use the proposed method to develop an automatic system to monitor *environmental conditions causing emergency* in real time.

18. **A new method for the determination of damping in cocured composite laminates with embedded viscoelastic layer**
    Journal of Sound and Vibration, *Volume 319, Issues 3–5*, *23 January 2009*, *Pages 822-831*
    Lijian Pan, Boming Zhang

Abstract

A new method for the determination of damping in cocured composite laminates with embedded viscoelastic layer is developed based on mode superposition and modal strain energy method. The calculated damping value is not modal loss factor but a combination of damping from the contributing modes. The dynamic mechanical properties of the viscoelastic material cocured with composites were investigated and were substituted in the present method for calculating the damping in cocured composites. The analytical results were compared with the experimental results by dynamic mechanical thermal analysis (DMTA). The results demonstrate a good agreement between analytical and experimental results. This work provides a means for the study of damping in this structure with different environment temperature and excited frequency.

19. **Cost estimates to guide manufacturing of composite waved beam**
    Materials & Design, *Volume 30, Issue 3*, *March 2009*, *Pages 452-458*
    Jinrui Ye, Boming Zhang, Haiming Qi

Abstract

A cost estimation model on the basis of manufacturing process has been presented. In the model, the effects of the material, labor, tool and equipment were discussed, and the corresponding formulas were provided. A method of selecting estimation variables has been provided based on a case study of composite waved beam using autoclave cure. The model parameters related to the process time estimation of the lay-up procedure were analyzed and modified for different part

configurations. The result shows that there is little error while comparing the estimated process time with the practical one. The model is verified to be applicable to guide the design and manufacturing of the composite material.

20. **Vaporization effect studying on high-power nanosecond pulsed laser deposition**
Physica B: Condensed Matter, *Volume 358, Issues 1–4*, *15 April 2005*, *Pages 86-92*
Xinyu-Tan, Duanming-Zhang, Boming-Yu, Zhi-hua Li, Guan Li, Li Li

Abstract

The vaporization effect generated by high-power nanosecond pulsed laser ablation was studied in detail based on the heat flux equation which accounting for the energy loss of vaporization. The vaporization velocity and temperature evolvement with different laser fluence, and the effect of vaporization on ablation depth during and after the laser irradiation were emphatically analyzed. The results show that the vaporization strongly affects the surface temperature and whole ablation depth in the pulsed laser ablation. Under the same experimental conditions, the numerical results calculated with our modified ablation depth calculation formula are more in agreement with the experimental datum.

21. **State estimation for power systems embedded with FACTS devices and MTDC systems by a sequential solution approach**
Electric Power Systems Research, *Volume 55, Issue 3*, *1 September 2000*, *Pages 147-156*
Ding Qifeng, Zhang Boming, T.S. Chung

Abstract

This paper reports the development of a novel and effective approach in state estimation for power systems with flexible AC transmission system (FACTS) and multi-terminal DC (MTDC) systems, called improved sequential method. The proposed approach is sequential in nature in which the FACTS and MTDC systems without neglecting the coupling submatrices in the gain matrix, it exhibits good convergence characteristics compared to conventional techniques. The variables and measurement equations of the FACTS and MTDC systems related to the problem formulation are discussed. The effectiveness of the proposed algorithm is demonstrated in this paper with extensive testing in several test systems and the results are compared with the other state estimators.

22. **Temperature field of thick thermoset composite laminates during cure process**
Composites Science and Technology, *Volume 65, Issues 3–4*, *March 2005*, *Pages 517-523*
Zhan-Sheng Guo, Shanyi Du, Boming Zhang

Abstract

The development of temperature field of thick thermoset matrix laminates manufactured by autoclave vacuum bag process were measured and compared with the numerically calculated results. The finite element formulation of the transient heat transfer problem was carried out for polymeric matrix composite materials from the heat transfer differential equations including internal heat generation produced by exothermic chemical reactions. The finite element analysis software, which was based on the general finite element software package, was developed for numerical simulation of the entire composite process. From the experimental and numerical results, it was found that the measured temperatures profiles were in good agreement with the numerical ones, and conventional cure cycles recommended by prepreg manufacturers for thin laminates should be modified to reduce out-of-plane temperature gradient.

23. **Fractal characterization of the dipole moments of dielectric particle chains**
Journal of Electrostatics, *Volume 44, Issues 1–2*, *July 1998*, *Pages 47-51*
Zehui Jiang, Xiaodong He, Jiecai Han, Boming Zhang, Shanyi Du

Abstract

A simple self-similar fractal model is presented for obtaining the dipole moments of dielectric particle chains subjected to uniform electric field. The chains are replaced by equivalent spheres, and the effective radii of these spheres are determined from a fractal generating process. The dipole moments are determined in terms of the effective radii and are expressed as simple functions of the fractal dimension and the number of the particles in chain. The computed results for the longitudinal dipole moments are consistent with the previous calculations of the linear multipole expansion. The many-sphere nature of the moments of chains is well understood.

24. **A new model of pulsed laser ablation and plasma shielding**

Physica B: Condensed Matter, *Volume 362, Issues 1–4*, *15 May 2005*, *Pages 82-87*

Duanming-Zhang, Dan Liu, Zhihua-Li, Sipu-Hou, Boming-Yu, Li Guan, Xinyu-Tan, Li Li

Abstract

A new theoretical model of pulsed laser ablation has been developed, which studies the characteristics of laser–plasma interaction and the effect of plasma shielding in the ablation process. Two different absorption processes are considered, namely inverse bremsstrahlung and photoionization of excited species, also plasma radiation is included. The model is used to simulate 25 ns square pulsed laser irradiation on $YBa_2Cu_3O_7$ targets. The evolution of the plasma length and the transmitted intensity are performed, and the variation of ablation depth per pulse with energy density at three most common excimer wavelengths (193, 248 and 308 nm) are simulated too. Moreover, we obtain the dependence of ablation depth on the number of laser pulses at 248 nm. Under the same experimental conditions, our numerical results are more in agreement with the experimental results, which confirms that plasma shielding plays a relevant role in the ablation process.

25. **Unified piecewise solution of power-system networks combining both branch cutting and node tearing**

International Journal of Electrical Power & Energy Systems, *Volume 11, Issue 4*,*October 1989*, *Pages 283-288*

Zhang Boming, Xiang Niande, Wang Shiying

Abstract

In this paper a unified network diskoptics which includes both node tearing and branch cutting is proposed. An application of this method to power system load flow calculation is proposed. Using this unified diakoptics, a fast decoupled load flow program has been written. The results of digital calculations on the IEEE 14-bus system are reported.

26. **Evolution of microstructures and thermal properties with heat treatment for absorbing, emitting and scattering fibrous medium**

Composites Science and Technology, Volume 71, Issue 3, 7 February 2011, Pages 415-423

S.Y. Zhao, X.D. He, B.M. Zhang, S.Y. Du

Abstract

The microstructure changes of a fibrous insulation for thermal protection system were examined before and after thermal exposures at different temperatures between 1000 °C and 1400 °C. The consequent thermal properties, i.e., thermal conductivity, extinction coefficient, albedo of scattering, and linear coefficient of phase function at different stages were measured by using a developed experimental device and data processing method. The effects of microstructure changes on the thermal properties degradation were discussed. It was found that the devitrification of mullite and

the microstructure changes induced by heat treatment had a significant influence upon the thermal properties, and higher temperature treatment yielded a strong increase in thermal conductivity of fibrous insulation. The results also indicated that the relative contribution of conductive and radiative heat transfer would be re-regulated after high temperature thermal annealing.

27. **Experimental and theoretical studies on high-temperature thermal properties of fibrous insulation**

    Journal of Quantitative Spectroscopy and Radiative Transfer, Volume 109, Issue 7, May 2008, Pages 1309-1324

    Bo-Ming Zhang, Shu-Yuan Zhao, Xiao-Dong He

Abstract

The dispatch of capacitors in distribution systems for daily operation is investigated in this paper. The objective is to determine the next day operating schedule of the capacitors so as to minimize the total daily energy loss. A loop-analysis based analytic algorithm is developed in this paper to efficiently calculate the optimal settings of capacitor with time-varying load. Firstly, capacitors switching times are determined by a heuristic method. Then, the optimal settings of capacitors for all operating times are calculated by an iterative algorithm. Numerical simulations were done and the results show that the proposed algorithm has an approximately linear convergence and is efficient.

28. **A new method for the determination of damping in cocured composite laminates with embedded viscoelastic layer**

    Journal of Sound and Vibration, *Volume 319, Issues 3–5*, *23 January 2009*, *Pages 822-831*

    Lijian Pan, Boming Zhang

Abstract

A new method for the determination of damping in cocured composite laminates with embedded viscoelastic layer is developed based on mode superposition and modal strain energy method. The calculated damping value is not modal loss factor but a combination of damping from the contributing modes. The dynamic mechanical properties of the viscoelastic material cocured with composites were investigated and were substituted in the present method for calculating the damping in cocured composites. The analytical results were compared with the experimental results by dynamic mechanical thermal analysis (DMTA). The results demonstrate a good agreement between analytical and experimental results. This work provides a means for the study of damping in this structure with different environment temperature and excited frequency.

29. **Experimental and theoretical studies on high-temperature thermal properties of fibrous insulation**

    Journal of Quantitative Spectroscopy and Radiative Transfer, *Volume 109, Issue 7*, *May 2008*, *Pages 1309-1324*

    Bo-Ming Zhang, Shu-Yuan Zhao, Xiao-Dong He

    Abstract

    In the present paper, an experimental apparatus has been developed to measure heat transfer through high-alumina fibrous insulation for thermal protection system. Effective thermal conductivities of the fibrous insulation were measured over a wide range of temperature (300–973 K) and pressure (10−2–105 Pa) using the developed apparatus. The specific heat and the transmittance spectra in the wavelength range of 2.5–25 μm were also measured. The spectral

extinction coefficients and Rosseland mean extinction coefficients were obtained from transmittance data at various temperatures to investigate the radiative heat transfer in fibrous insulation. A one-dimensional finite volume numerical model combined radiation and conduction heat transfer was developed to predict the behavior of the effective thermal conductivity of the fibrous insulation at various temperatures and pressures. The two-flux approximation was used to model the radiation heat transfer through the insulation. The experimentally measured specific heat and Rosseland mean extinction coefficients were used in the numerical heat transfer model to calculate the effective thermal conductivity. The average deviation between the numerical results for different values of albedo of scattering and the experimental results was investigated. The numerical results for ω=1 and experimental data were compared. It was found that the calculated values corresponded with the experimental values within an average of 13.5 percent. Numerical results were consistent with experimental results through the environmental conditions under examination.

30. **A three-phase power flow algorithm for distribution system power flow based on loop-analysis method**
International Journal of Electrical Power & Energy Systems, *Volume 30, Issue 1*, *January 2008*, *Pages 8-15*
W.C. Wu, B.M. Zhang
Abstract
Based on loop-analysis method, a theoretical formulation of the forward/backward sweep with compensation power flow method is presented. The reason, why the convergence of this widely used method deteriorates when the network becomes more meshed, is also well analyzed. Subsequently, a novel solution of unbalanced three-phase power systems based on loop-analysis method is developed in this paper. The convergence speed of this algorithm remains very well even when network become more meshed. Furthermore, the implementation of this algorithm is similar with that of the forward/backward sweep with compensation method with the characteristic of understandability. This proposed method has clear theory foundation and takes full advantage of the radial (or weakly meshed) structure of distribution systems. The numerical test proves this new method is very robust and has excellent convergence characteristics.

31. **An inverse analysis to determine conductive and radiative properties of a fibrous medium**
Journal of Quantitative Spectroscopy and Radiative Transfer, *Volume 110, Issue 13*, *September 2009*, *Pages 1111-1123*
Shu-Yuan Zhao, Bo-Ming Zhang, Shan-Yi Du
Abstract
In present paper, a modified factor of extinction coefficient and an equivalent albedo of scattering were defined taking into account anisotropic scattering in fibrous insulation. An inverse conduction–radiation analysis in an absorbing, emitting and scattering medium was conducted for the simultaneous estimation of the conductive and radiative properties using the experimentally measured temperature responses for external temperatures up to 980 K. The estimated properties were validated by comparing the predicted and measured results under transient and steady-state condition. It was found that the calculated results corresponded well with the experimental data within an average of 3.1% under transient condition and 9.8% under steady-state condition. This confirms the good behavior of the model and the validity of results.

32. **A systematic analytical method for quasi-steady-state sensitivity**
Electric Power Systems Research, *Volume 63, Issue 2*, *28 September 2002*, *Pages 141-147*
H.B. Sun, B.M. Zhang
Abstract
Conventional sensitivity analysis can not simulate physical response of an actual power system

realistically. In order to overcome this shortcoming, a novel systematic method named as quasi-steady-state sensitivity analysis is proposed, and its calculation formulas are given in detail. As a result, a practicable software package for quasi-steady-state sensitivity analysis was developed and has been applied to several energy management systems (EMSs) in power system control centers successfully. The study shows that this new analytical method can meet the demand of real-time decision-making.

33. **Global state estimation for whole transmission and distribution networks**

Electric Power Systems Research, *Volume 74, Issue 2*, *May 2005*, *Pages 187-195*

H.B. Sun, B.M. Zhang

Abstract

Traditionally, transmission and distribution state estimators are studied and developed separately. But lots of large cities have their hybrid transmission and distribution networks. In order to face keen competition in market, the requirement of coordinated operation between transmission and distribution systems is now here. Therefore, in order to balance the boundary mismatch between the transmission and distribution network models existing in the results of traditional state estimation methods, the transmission and distribution networks are studied as a whole in this paper. The weighted least squares (WLS) model for global state estimation (GSE) is presented for estimating the global consistent state in the whole network. A novel master–slave-splitting (MSS) iterative method is developed for solving the hybrid GSE problem. In the proposed method, the GSE problem of large scale is split into a transmission state estimation and lots of distribution state estimation sub-problems, which supports on-line geographically distributed computation. In order to fit the different features between transmission and distribution networks, each sub-problem can be solved with different algorithm. Several case studies are carried out, and the accuracy, convergence, efficiency and reliability of the proposed method are validated.