Acta Technica *61* (2016), No. 2 Institute of Thermomechanics CAS, v.v.i.

A new unified power flow controller damping control design method based on free weight matrix mode transformation

Ting Li, Bo Yang

Abstract. A novel unified power flow controller (UPFC) damping control model with delay is constructed in order to suppress the disadvantage of conventional damping control model of UPFC consisting in the fact that UPFC cannot precisely represent the influence of damping controller (DC) input signal transmission delay on damping performance since it is based on non-delay control system theory. According to the newly constructed damping control model, a new damping control design method based on free weight matrix mode transformation, which has less conservativeness and can be conveniently implemented by linear matrix inequality, is proposed in this paper. Simulation tests on four-generator interconnected power system show that the UPFC damping control model with delay and the damping control design method work very well. The results also show that properly adjusting DC gain can obtain the tradeoff between damping ratio and delay margin, and thus guarantee power system stability even if DC input signal is delayed for a certain period within delay margin.

Contents

Research on fault diagnosis in wireless sensor network based on improved wavelet neural network

Jie Li, Bin Chen

Abstract. Application of wavelet neural network in fault diagnosis of WSN is studied. As classical wavelet neural network algorithm adopts gradient algorithm, it usually has low convergence rate and easily falls into local minimum. To solve this problem, an improved wavelet neural network based on additional momentum and adaptively-adjusted learning rates is proposed. The results of training experiments show that the improved algorithm has faster convergence speed. Finally, the feasibility and good fault-tolerant performance of the improved algorithm in fault diagnosis of WSN are verified by simulation experiments.

Contents

Acta Technica 61 (2016), No. 2 Institute of Thermomechanics CAS, v.v.i.

Smooth CNC pulse sequence generation algorithm

Zhang Yongnian, Liu Lu, Xin Yuhong, Lu Wei, Wang Xiaochan

Abstract. A mathematical model of pulse sequences is established, providing a theoretical basis for analysis of the stability problem of pulse signals. An interpolation algorithm with a continuous change in frequency domain and high stability is proposed, which can improve motion stability for such pulse-driven systems. The simulation results demonstrate the feasibility of the proposed algorithm. The characteristic of no velocity discontinuity and no obvious peaks on its spectrum shows that the algorithm can significantly reduce motor impact and enhance the surface machining quality of the products.

Contents

Acta Technica *61* (2016), No. 2 Institute of Thermomechanics CAS, v.v.i.

Buckling behavior of single layer cylindrical shell roof by numerical analysis

Zhang Zhonghao, Fan Feng, Fujimoto Masumi

Abstract. Linear buckling behavior of single-layer cylindrical shell roof is investigated, based on the application of shell analogy. To evaluate the elastic buckling phenomenon, the application of shell analogy is justified by using effective rigidity. In order to easily understand the effect of various parameters, the buckling analysis is performed by orthotropic continuum analogy. The applicability of numerical analysis is conformed through the discrete treating method and continuum treating method. For the purpose of examining the bucking behavior of cylindrical shell roof, the member incremental elasticity rigidity matrix is based on the tangential rigidity matrix using stability function in the discrete treatment and the effective rigidity is used in the continuum treatment. The validity of the numerical methods is also confirmed by a comparison between the discrete results and continuum results. The mesh patterns of analysis object consist of triangular grid and two-way grids. Two-way grid cylindrical shell roof is stiffened with diagonal tension members whose purpose is to stiffen the in-plane rigidity and improve its stability behavior. The parameters of numerical calculation are the number of units, half open angle and supporting condition.

Contents

Acta Technica *61* (2016), No. 2 Institute of Thermomechanics CAS, v.v.i.

Vibration reduction analysis of special cable-damper system based on energy dissipation efficiency

Chen Yifei

Abstract. A new vibration reduction method with cable-damper or cross ties system of space layout is proposed. At first, the basic mechanical parameters is analyzed, which affects the system vibration characteristics through the simple plane model. On this basis, simulation analysis for cable-damper system of space layout is carried out using a numerical model. Put forward is the efficiency ratio of energy dissipation as the evaluation index of the system vibration performance. This index effectively reflects the vibration reduction effect of cable-damper system. Comparing the effect of vibration energy reduction with the single cable, studied is the effect of each mechanical parameters for system vibration reduction performance. Research results show that the scheme has significant effect on vibration reduction, not only for in-plane vibration but also for out-plane vibration. By adjusting the mechanical parameters of the system, its optimization is achievable. This scheme for vibration reduction has a good potential for further related research both in academic and application spheres.

Contents

Acta Technica *61* (2016), No. 2 Institute of Thermomechanics CAS, v.v.i.

Electrical and thermal parameters of induction heating systems for pipeline heating

Mikhail L. Strupinskiy, Nikolay N. Khrenkov, Alexander B. Kuvaldin, Maxim A. Fedin

Abstract. A method for electrical and thermal calculation of pipeline induction heating is developed. The electric and thermal parameters of induction heating systems for thermally insulated pipelines by means of inductors installed above the thermal insulation are defined, in relation to the transporting pipe material and transporting fluid type. Recommendations are given for transport pipeline material and thermal insulation design and material selection.

Contents

Acta Technica 61 (2016), No. 2 Institute of Thermomechanics CAS, v.v.i.

Unsteady hydromagnetic convective flow with thermal radiation through porous medium

Navin Kumar, Pooja Sharma

Abstract. Investigation of the unsteady free-convective flow of an electrically conducting viscous incompressible fluid passing through porous medium is conducted in the presence of transverse magnetic field applied normal to the direction of flow with heat source and thermal radiation. The governing equations of fluid flow have been solved using regular perturbation technique. This is observed that the small values of the Peclet number increase the thermal conductivity of the fluid and therefore, the heat is able to diffuse away from the heated surface more rapidly. Moreover, an increase in the thermal radiation leads to props up the fluid temperature within the boundary layer. Further, the non-dimensional shearing stress and the rate of heat transfer in terms of the Nusselt number at the walls of channel are also obtained.

Contents