Non-fragile delayed state feedback control for uncertain time-varying delay systems subject to sensor faults

Lingyan Hu, Xingcheng Wang, Gwynfor Richards

Abstract. The fault tolerant control for uncertain systems, with a time-varying delay in different sensor fault modes, has been investigated. Considering the controller gain perturbation and delay possibly existing in a practical engineering system, a non-fragile delayed state feedback controller is presented. Using Lyapunov stability theory and an LMI approach, a sufficient condition to guarantee such a system globally asymptotic stability is obtained for any admissible sensor fault. A numerical example for a beam-reheating furnace verifies the effectiveness and feasibility of the proposed approach; the system performance being simulated and compared by varying the controller perturbation coefficient and system maximum delay. The present work can give insight into industrial production process.

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Rheology analysis of multiphase flow and its non-viscosity dependent modeling. I: Theory and modeling

Han Zhihong, Liu Shuyang

Abstract. A two-phase wedge-sliding non-viscosity dependent model is developed in this paper. Two variables of drift-inhibition angle and expansion-inhibition angle were defined and their expressions were deduced from the model, which can well index the phase-drift trend of mixed fluid. The study also found that there is an optimal ratio in the ingredients design of mixed fluid and mixed fluid can only be stable when the volume ratio of heavier phase is smaller than this optimal value.

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Research of vulnerability for sea port coal supply chain based on batch Poisson process

Liu Jia

Abstract. The formation of coal supply chains vulnerability hinders the supply chains smoothly working and even triggers the interruption risk. The paper solves the problem of coal supply chains vulnerability in port caused by supply and demand imbalance. The paper puts forward the structure of coal supply chains in port and identifies its vulnerability, on this basis, analyzes the vulnerability under the hypothesis of batch Poisson process in coal transporting. By constructing the calculation model of coal supply chains vulnerability, we get the probability distribution of the vulnerability occurrence on the basis of the expectation and variance of discrete sample data, and then identify the weak links in the coal supply chain through empirical research. The research results provide a theoretical basis for the enterprises operational decision for the coal supply chain, and have important significance to the healthy development of the coal supply chain in the port.

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Experimental study of mechanical parameters of coal and rock mass

Zhang Jingzhao, Qi Junde

Abstract. MTS815.02 electro-hydraulic triaxial rock mechanics experimental system was used to test different types of uniaxial and triaxial stress and strain characteristics of coal and rock (coal, gangue, mudstone, argillaceous sandstone) and carry out split tests and analysis of the reasons for its compressive strength and rupture change. The tests were performed in the knot scanning electron microscopy (SEM) testing laboratory. The results show that the tensile strengths of gangue, mudstone and argillaceous sandstone are significantly higher than those of the coal. The tensile strength of coal and rock mass increases gradually with confining pressure and cohesion. The mechanical parameters of coal and rock mass mainly depend on the minerals contained within the clay mineral composition, and its internal mixed-layer illite, microcracks, transgranular cleavage and intergranular brittle fractures and mixed fractures affect the type and shape of their destruction.

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Study on pre-stressed concrete grain silo based on non-cohesive properties

Huang Hai-rong

Abstract. Design and construction of a partially pre-stressed structure case is presented. For the design of grain silos, the amount of steel bars in their structures is very high. With the increasing height and diameter of bulkhead, a serious problem can occur that the safety of its crack will not meet the prescribed demands even when much more steel bars are used. But using totally or partially pre-stressed structures, this problem can completely be solved.

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Position tracking control for a permanent magnet spherical motor via adaptive fuzzy backstepping

Xiwen Guo, Qunjing Wang, Yan Wen,
Yuansheng Li, Shen Li, Lijuan Zhao

Abstract. The problem of stability and position tracking control for a direct-drive permanent-magnet spherical motor (PMSM) dynamic system is presented. The proposed approach effectively combines the design techniques of backstepping and adaptive fuzzy control. Firstly, the basic structure of PMSM is briefly described. Then, by using the Lagrange equations of the second kind and the Cardan angle coordinate transformation, the PMSM dynamic model that transformable to a pure-feedback form is achieved. Secondly, an adaptive fuzzy inherited backstepping control scheme is proposed to relax the requirement of detailed system model information and to deal with the uncertainties caused by the fuzzy approximation function and external disturbance. Moreover, the adaptive law is derived in the sense of Lyapunov stability theorem to ensure the boundedness and convergence of the PMSM dynamic system. Finally, numerical simulation studies further prove that the control scheme is of high accuracy and rapid response. Also, the results can serve as a basis for future research and experiment.

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Low voltage low power wide-tuning-range LC voltage controlled oscillator

Jie Jin, Lv Zhao

Abstract. A low voltage low power wide-tuning-range LC voltage controlled oscillator (VCO) is presented. The NMOS and PMOS transistors are in series with the LC tank in the DC path, and they generate the required negative resistance to compensate the energy loss of the LC tank and maintain the steady oscillation of the LC oscillator. The proposed LC VCO is designed and simulated with GlobalFoundries' 0.18 μm CMOS RF process. The Cadence IC Design Tools post-layout simulation results show that the oscillation frequency of the VCO can be tuned from 2.0 GHz to 5.75 GHz by adjusting the bias voltage, and the phase noise of the VCO is −120.6 dBc/Hz at 1 MHz offset. Moreover, the proposed LC VCO consumes only 729 μW from a 1 V supply voltage and occupies a compact area of 0.36 mm^2 including the test pads.

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Calculation of traction force of electromagnetic actuator

Mykhaylo V. Zagirnyak,
Irina A. Shvedchikova,
Anna A. Velchenko

Abstract. An expression for determination of the traction force of an electromagnetic actuator with a prismatic plunger is found on the basis of the energy method and solution of Poisson equation by the variable separation method. It takes into account the distribution of leakage flux in the space window. Correctness of the offered expression is confirmed by the comparison of the calculation results with experimental data obtained for an industrial actuator.

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