1. Practical method of production decline analysis of gas field

Xu, Yuangang (1); Ruan, Min (1)
Source: *Tianranqi Gongye/Natural Gas Industry*, v 21, n 1, p 85-87, 2001; **ISSN:** 10000976
Author affiliation: (1) Xi'an Petroleum Inst, China
Abstract: After the gas field has entered into the production decline stage, its decline law can be studied by use of the typical curve fitting method or coordinate transform method through Arps hyperbolic decline equation generally. According to these methods it is necessary to determine the form of Arps equation first, then to acquire relevant decline parameters. Therefore, not only the amount of calculation work is large, but also the human error is astonishing; and the decline parameters acquired aren't optimum in general and the result predicted is often widely discrepant with the practical value. Through analyzing it is considered that the accuracy of predicting the production of gas field in accordance with the historical production data acquired and processed is decided both by the mathematic model applied and by the method used for processing data. For this reason, a new method of acquiring decline parameters by use of analog annealing algorithm is proposed. Through applying the global optimum theory and in light of the universal decline equation; by the new method the solving problem of the decline parameters can be transformed into an optimizing problem and then the type of decline may be discriminated according to the decline parameters acquired, so that this method can be commonly used in a wide range. Through calculating two examples it is indicated that the result predicted by the method is better than the one by Arps decline analysis method, being well coincident with the practical data. Therefore the method is suitful for being popularized and applied in fields. (8 refs)
Main heading: Natural gas well production
Controlled terms: Algorithms - Curve fitting - Mathematical models - Natural gas fields - Optimization
Uncontrolled terms: Production decline analysis
Classification Code: 512.2.1 Natural Gas Fields - 921.5 Optimization Techniques - 921.6 Numerical Methods
Treatment: Theoretical (THR)
Database: Compendex
Data Provider: Engineering Village

2. Robust controller design on uncertain system

Nan, Tang (1); Xiangyang, Mu (1); Lin, Li (1); Xuguang, Wu (1)
Source: *Proceedings of the IEEE International Conference on Systems, Man and Cybernetics*, v 3, p 1888-1891, 2001; **ISSN:** 08843627; **Conference:** 2001 IEEE International Conference on Systems, Man and Cybernetics, October 7, 2001 - October 10, 2001; **Publisher:** Institute of Electrical and Electronics Engineers Inc.
Author affiliation: (1) XI'an petroleum Institute, Xi'an 710065, China
Abstract: In this paper we will present the standard form of Linear Matrix Inequalities(LMIs) by mathematics in brief, and study the relationship between the control problem and LMI. Then discuss the robust controller problem based on LMI, and also research analysis and synthesize issues on H# control. We also describe how to transform the robust controller to LMI forms, then present the algorithm of H# control by solving LMIs. (7 refs)
Main heading: Uncertain systems
Controlled terms: Asymptotic stability - Matrix algebra - Nonlinear systems - Problem solving - Riccati equations - Robustness (control systems)
Uncontrolled terms: Linear matrix inequalities (LMI) - Robust controllers
Classification Code: 723.4 Artificial Intelligence - 731.1 Control Systems - 921.1 Algebra - 921.2 Calculus - 921.6 Numerical Methods
Treatment: Theoretical (THR)
Database: Compendex
Data Provider: Engineering Village

3. Analysis of kinetic energy in gas well and a bottom-hole flowing pressure calculating method considering kinetic energy term

Huang, W. ; Yang, W.
Source: *Tianranqi Gongye/Natural Gas Industry*, v 21, n 4, p 75-77, July 2001; **Language:** Chinese; **ISSN:** 10000976; **Publisher:** Natural Gas Industry Journal Agency
Author affiliation: (1) Xi'an Petroleum Institute, Xi'an, Shaanxi 710061, China
Abstract: In gas production technology, it is a general task to calculate bottom-hole pressure and determine wellbore pressure distribution by use of wellhead pressure. All the formulae applied to make such a calculation were derived from the energy equation of gas steady flow through a certain assumption and simplification, in which the kinetic energy, part of the total energy consumption, was neglected. Error analysis, however, indicates that this assumption

is only suitable for those production conditions, as a small share occupied by kinetic energy loss in the total energy consumption and low pressure gauge accuracy, etc. In light of the energy equation of gas steady flow, the kinetic energy factor (C), i. e. kinetic energy loss-to-total energy consumption ratio, is derived and defined first, which magnitude is dependent upon tubing diameter, flow rate and the average pressure on pipeline section calculated. Then, in combination with the practical data collected from East Sichuan, the values of the kinetic ene rgy factor were calculated for the tubing diameters of 50.8, 63.5 and 76.2mm at different gas well yields ranging from 10 × 104m3/d to 60 × 104m3/d and at different wellhead flowing pressures ranging from 2 MPa to 30MPa by applying the derived practical formula considering the kinetic energy factor. According to the results calculated, C less than or equal 10-3 is taken as a discriminant value from engineering viewpoint. It is thought that when bottom-hole pressure is calculated by use of wellhead flowing pressure, the kinetic energy term may be neglected as long as C less than or equal 10-3, otherwise it should be considered. Finally, a practical formula taking account of the kinetic energy term is proposed for calculating bottom-hole pressure in the paper. (6 refs)
Database: Compendex
Data Provider: Engineering Village

4. The calculation of two typical evolutionary random responses

Li, J. (1); Bo, B. (1); Feng, J. (1)
Source: *Shiyou Huagong Gaodeng Xuexiao Xuebao/Journal of Petrochemical Universities*, v 14, n 1, p 52-54+81, March 25, 2001; **Language:** Chinese; **ISSN:** 1006396X; **Publisher:** Fushun Petroleum Institute
Author affiliation: (1) Xi'an Petroleum Institute, Shanxi, Xi'an 710065, China
Abstract: Earthquake excitations to ground structures and road-undulation-induced excitations to vehicles travelling with variable speed are two kinds of nonstationary random excitations commonly encountered in engineering. Actually, both kinds of the nonstationary random processes are evolved from stationary ones, though through utterly different ways. The problems of response to both kinds of excitations have much in common. The calculation formulas of nonstationary random responses under two typical evolutionary random excitations are presented by using of the theory of differential equation. By introducing Runge-Kutta integration method, the problems of evolutionary random responses for nonuniform modulated random excitations can be solved simply. By comparing the obtained results with the results of complex modal analysis, it is shown that the present method is accurate enough and efficient. The method has many advantages, such as simple in formulation, easy in programming and fast in calculating, and the method might be hopefully applied to nonlinear systems, too, if accompanied by the statistical linearization technique. (6 refs)
Main heading: Earthquakes
Controlled terms: Integration - Nonlinear systems - Random processes - Roads and streets - Structures (built objects) - Vehicles
Uncontrolled terms: Induced excitation
Classification Code: 922.1 Probability Theory - 921.2 Calculus - 731.1 Control Systems - 484 Seismology - 432 Highway Transportation - 408 Structural Design - 406.2 Roads and Streets
Treatment: Theoretical (THR)
Database: Compendex
Data Provider: Engineering Village

5. The research of the deep-hole strong honing of titanium alloy

Zhu, L. (1); Zhao, H.B. (1)
Source: *Key Engineering Materials*, v 202-203, p 403-406, 2001, *Advances in Abrasive Processes*; **ISSN:** 10139826, **E-ISSN:** 16629795; **Publisher:** Trans Tech Publications Ltd
Author affiliation: (1) Dept of Mechanical Engineering, Xi'an Petroleum Institute, Xi'an, China
Abstract: The honing is the main means for the finish machining of deep hole. Because the processing of material titanium alloy has such characteristics as high intensity lower, heat-conduction coefficient, lower modulus of elasticity and bad chemical stability, it can bring about bigger grinding force in the course of honing, higher grinding temperature and the honing abrasive strips became serious dull. The abrasive dust producing in the course of grinding is easy to adhere to the wheel, to choke dead hole, so that the grinding efficiency is lower and it is difficult for the inner hole to get high surface quality. Aiming at three kind of titanium alloy material of TC4, TC6 and TC11, the honing mechanism is investigated adopting material of different abrasion and grinding agent. The result indicates that the accuracy of coarse honing can reach 0.005mm/double stroke (hole depth is 2000~ 3000mm), the surface roughness of coarse honing hole can reach Ra0.6 μ m. It shows that the technology of strong honing for deep hole has such feature as high grinding efficiency, good surface roughness. This paper also introduces a honing tool for deep hole and its application. (1 refs)

Main heading: Honing
Controlled terms: Abrasion - Elastic moduli - Grinding (machining) - Machine tools - Surface roughness - Titanium alloys
Uncontrolled terms: Grinding force
Classification Code: 421 Strength of Building Materials; Mechanical Properties - 542.3 Titanium and Alloys - 603.1 Machine Tools, General - 604.2 Machining Operations - 931.2 Physical Properties of Gases, Liquids and Solids
Treatment: Theoretical (THR) - Experimental (EXP)
Database: Compendex
Data Provider: Engineering Village

6. Effect of cooling rate on the morphology of γ prime precipitates in a nickel-base superalloy under directional solidification (*Open Access*)

Yang, Aiming ; Xiong, Yuhua ; Liu, Lin
Source: *Science and Technology of Advanced Materials*, v 2, n 1, p 105-107, March 2001; **ISSN:** 14686996; **DOI:** 10.1016/S1468-6996(01)00034-1; **Publisher:** Elsevier Ltd
Author affiliation: (1) Department of Applied Physics, NW Polytechnical University, Xi'an 710072, China (2) Department of Mechanical Engineering, Xi'An Petroleum Institute, Xi'an 710065, China
Abstract: The morphological evolution of γ prime precipitates in a nickel-based superalloy K5 was studied by zone melting directional solidification under vacuum conditions. The results show that at the lower cooling rate of 12.42 K s-1, γ prime precipitates remand big cuboids. γ prime particles become smaller at the cooling rate ranges from 12.42 to 38.80 K s-1. For a rather fast cooling rate of 50.16 K s-1, γ prime particles retain a spherical shape. The experiments show that big cuboids will become unstable and split into several small ones at the lower cooling rate of 1.1 K s-1. The mechanism of the evolution of the γ prime morphologies is also analyzed by introducing a new parameter-shape factor which classifies the total energy into several energy levels. Based on this, the effect of the cooling rate on the γ prime morphology is discussed. © 2001 Elsevier Science Ltd. All rights reserved. (7 refs)
Open Access type(s): All Open Access, Gold
Database: Compendex
Data Provider: Engineering Village

7. Fractal characteristics of dendrite and cellular structure in nickel-based superalloy at intermediate cooling rate (*Open Access*)

Yang, Aimin ; Xiong, Yuhua ; Liu, Lin
Source: *Science and Technology of Advanced Materials*, v 2, n 1, p 101-103, March 2001; **ISSN:** 14686996; **DOI:** 10.1016/S1468-6996(01)00033-X; **Publisher:** Elsevier Ltd
Author affiliation: (1) Department of Applied Physics, NW Polytechnical University, Xi'an 710072, China (2) Department of Mechanical Engineering, Xi'An Petroleum Institute, Xi'an 710065, China
Abstract: The fractal characteristics of dendrite and cellular structure of nickel-based superalloy K5 are investigated under directional solidification. Results show that the fractal dimension of the dendrite increases from 1.228 to 1.418 as the withdraw speeds change from 40 to 264 μm/s, whereas the fractal dimension of the cellular changes little as the withdraw speeds from 600 to 952 μm/s. The physical significance of the fractal dimension is analyzed by fractal theory. Based on this, a new idea is proposed that both the fractal dimension and the dendrite arm spacing or cellular spacing be considered to describe the evaluation of the solidification structure completely and integrally. © 2001 Elsevier Science Ltd. All rights reserved. (14 refs)
Open Access type(s): All Open Access, Gold
Database: Compendex
Data Provider: Engineering Village

8. Goal programs with -ni, -pi and -(ni + pi) objective functions

Yong Zhang, Zhi (1); Shang, Jen S. (2)
Source: *European Journal of Operational Research*, v 134, n 1, p 157-164, October 1, 2001; **ISSN:** 03772217; **DOI:** 10.1016/S0377-2217(00)00245-9; **Publisher:** Elsevier
Author affiliation: (1) Economics and Management Department, Xi'An Petroleum Institute, Xi'an, Shaanxi Province 710065, China (2) Joseph M. Katz Graduate School of Business, University of Pittsburgh, Pittsburgh, PA 15260, United States

Abstract: The (minimizing) achievement function of the traditional goal programming (GP) model has five basic forms: ni, pi, (ni + pi), (ni - pi), and (pi - ni), where ni and pi are nonnegative under and over achievement variables in the ith goal-constraint. This paper proposes and justifies three new objective-function forms: -ni, -pi, and (ni + pi) and presents an algorithm for solving the ensuing nonconvex program. We also introduce the intuitive concepts of the supposed indifference satisfactory interval (SISI), and the supposed indifference dissatisfactory interval (SIDI). We believe that these concepts will help the decision maker understand the different objective-function forms. © 2001 Elsevier Science B.V. (17 refs)
Main heading: Operations research
Controlled terms: Algorithms - Computational complexity - Functions - Mathematical programming
Uncontrolled terms: Goal programming - Multiobjective algorithms
Classification Code: 721.1 Computer Theory, Includes Formal Logic, Automata Theory, Switching Theory, Programming Theory - 723 Computer Software, Data Handling and Applications - 912.3 Operations Research - 921 Mathematics - 921.5 Optimization Techniques
Treatment: Applications (APP) - Theoretical (THR)
Database: Compendex
Data Provider: Engineering Village

9. Microstructure transformation and brittlement of a ultra-low carbon QT steel during double welding thermal cycle

Gao, Huilin ; Dong, Yuhua ; Hendricks, R.W.
Source: *Jinshu Xuebao/Acta Metallurgica Sinica*, v 37, n 1, p 34-38, January 2001; **Language:** Chinese; **ISSN:** 04121961; **Publisher:** Chinese Academy of Sciences
Author affiliation: (1) Department of Mechanical Engineering, Xi'an Petroleum Institute, Xi'an 710065, China (2) Sch. of Mat. Science and Engineering, Xi'an Jiaotong University, Xi'an 710049, China (3) Virginia Polytech. Inst. Stt. Univ., Blackburg, VA, United States
Abstract: The relationship between microstructure and toughness of the welding heat-affected zone (HAZ) in a ultra-low carbon QT steel (HSLA-100) was investigated using welding thermal simulation experiment and TEM. The experimental results show that the toughness of coarse grained HAZ decreases due to the formation of coarse austenite grain and the appearence of the untempered martensite in the first welding thermal cycle. During the second welding thermal cycle of multi-pass welding, the experimental steel shows no local brittlement in the intercritically reheated coarse-grained HAZ, but a local brittlement appears in subcritically reheated coarse-grained HAZ. This phenomenon is caused by the precipitation of carbide and thermal decomposition of retained austenite. (6 refs)
Database: Compendex
Data Provider: Engineering Village