

# Table of Contents

|                                                                                                                                                                                           |     |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|
| <b>Committees</b>                                                                                                                                                                         | iv  |
| <b>Preface</b>                                                                                                                                                                            | v   |
| <b>Progresses on the Fatigue Reliability Research of China Railway Vehicles in Recent Decade</b><br>Z.Y. Shen, Y.X. Zhao, B. Yang and W.H. Zhang                                          | 1   |
| <b>Learning from History: The Reliability of Experts and Expert Systems</b><br>M.N. James                                                                                                 | 15  |
| <b>Some Fundamental Aspects of Redesign and Remanufacture of High Temperature Components</b><br>S.T. Tu                                                                                   | 25  |
| <b>Effect of Non-Metallic Inclusion Size and Residual Stresses on Gigacycle Fatigue Properties in High Strength Steel</b><br>K. Shiozawa and L. Lu                                        | 33  |
| <b>The Analysis on the Low Cycle Fatigue Behavior of a Directionally Solidified Superalloy with Recrystallized Surface Layers</b><br>H.J. Shi, X.F. Ma, D.W. Jia, H.F. Zhang and L.S. Niu | 43  |
| <b>A Statistically Load-Weighted Probabilistic Fatigue Life Model</b><br>L.Y. Xie and W.Q. Lin                                                                                            | 51  |
| <b>Determination of the Probabilistic Fatigue S-N Curves Including Super-Long Life Regime for a Railway Axle Steel</b><br>Y.X. Zhao, B. Yang and M.F. Feng                                | 57  |
| <b>Measurement on Scale-Induced Fatigue Behaviour for Railway Axle</b><br>Y.X. Zhao, B. Yang and M.F. Feng                                                                                | 65  |
| <b>Thermal Stability of CoTi-Substituted Manganese-Zinc Ferrites</b><br>H.N. Ji, Z.W. Lan, Z. Yu, L.Z. Li, Z.Y. Xu and S.J. Wu                                                            | 71  |
| <b>Damage Constitutive Model and Failure Mechanism of Lead-Free Solder in CBGA Package</b><br>W.N. Hao, G.Z. Chai and J. Zhou                                                             | 77  |
| <b>On Deformation of the Injection Mold Core</b><br>J.J. Jia, Z.H. Ge and Y. Li                                                                                                           | 85  |
| <b>Damaged Structural Vibration Analysis Using the Hamiltonian Matrix Perturbation Theory</b><br>L. Liu and F.Z. Xuan                                                                     | 91  |
| <b>Study on Temperature-Dependent Tensile Strength of Short-Fiber-Reinforced Elastomer Matrix Composites</b><br>D.S. Zhu, B.Q. Gu and Y. Chen                                             | 97  |
| <b>Reliability Analysis of Corrosion Fatigue Crack Growth for 2024-T3 Aluminum Alloy</b><br>S. Ge, Z. Li, J.G. Zhang, Y.C. Xiao, G.Q. Liu and B.S. Bao                                    | 105 |
| <b>Modeling of Fatigue Crack Growth Based on Two Cyclic Plasticity Models</b><br>W.F. Tu, X.G. Wang and Z.L. Gao                                                                          | 111 |
| <b>Fatigue Fracture Behavior of Bearing Steel GCr15 in Very High Cycle Regime</b><br>J.W. Zhang, K. Shiozawa, L.T. Lu, W. Li and W.H. Zhang                                               | 119 |
| <b>Dynamic Characteristics of the Coupled System of the High Pressure Rotor and the Radial Driveshaft of a Turbofan Engine</b><br>Y.S. Fan, S.M. Wang and Z. Yang                         | 127 |
| <b>Application of Lubrication Theory to Near-Dry Green Grinding – Feasibility Analysis</b><br>C.H. Li, Y.L. Hou, S.C. Xiu and G.Q. Cai                                                    | 135 |
| <b>Reduction of Friction and Calibration Pressure by Section Preform during Hydroforming of Tubular Automotive Structural Components</b><br>C. Han, S.J. Yuan and L.N. Sun                | 143 |
| <b>Study on the Mechanical Fatigue Life Estimated of Pistons</b><br>Y.X. Wang, H.Y. Shi and Y.Q. Liu                                                                                      | 151 |
| <b>Dynamic Response Analysis for Structures with Interval Parameters Based on Affine Arithmetic</b><br>Z.Q. Zhu and J.J. Chen                                                             | 157 |

|                                                                                                                                                                 |     |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|
| <b>Investigation into Leakage Behavior of Bolted Flanged Connection with Octagonal Gasket</b><br>H.Q. Zhou and B.Q. Gu                                          | 165 |
| <b>Research on System of Quality Assessing and Defects' Information Managing of Strip Steel Surface</b><br>X.J. Zhao and S.Y. Luo                               | 173 |
| <b>Modulus Prediction for 2D PWF Composites</b><br>X. Cheng and J.J. Xiong                                                                                      | 181 |
| <b>Journal Bearing Wear Monitoring via On-Line Visual Ferrography</b><br>T.H. Wu, J.H. Mao, G.N. Dong, H. Xu and Y.B. Xie                                       | 189 |
| <b>Finite Element Analysis on Fatigue Stress History of a Railway Bogie Bolster</b><br>J.C. Peng, Y.X. Zhao, L.Y. Yu and A.G. Yang                              | 195 |
| <b>Coding and Decoding of Topological Entities in Constraint-Based Variational Design</b><br>T. Wu, Y.S. Xi, Z. Li and Y.L. Wan                                 | 201 |
| <b>A Framework to Integration Development Process</b><br>J. Mi                                                                                                  | 209 |
| <b>Process Planning Dynamic Model Based on HOOPN for Top-Down Collaborative Assembly Design</b><br>Y.D. Yang, Z.H. Li and S.T. Zhang                            | 215 |
| <b>A Novel Methodology to Manage Uncertainty for Multidisciplinary Design and Optimization in Conceptual Design</b><br>X.Y. Shao, X.Z. Chu, L. Gao and H.B. Qiu | 225 |
| <b>Radial Clearance is Key Factor Affecting Roller Bearing Life Prediction in Tri-Cone Bit</b><br>C.G. Bu                                                       | 233 |
| <b>An Aircraft Tooling Cooperative Design Model Based on Neuron-Endocrine-Immunity Working Principle</b><br>Y.G. Li, Z.Y. Pan, R.J. Yan and J.B. Jian           | 239 |
| <b>Research on Workflow Modeling Methods for Collaborative Product Development</b><br>H.B. Qiu, Y. Wang, P. Jiang and L. Gao                                    | 247 |
| <b>Research on Tolerance Analysis System Based on 3D Collaborative Design Platform</b><br>X.Y. Shao, K. Lin, L. Gao and H.B. Qiu                                | 253 |
| <b>The Parameter Selection System of Vehicle Overall Design Based on Cooperation and Specialty</b><br>L. Zhang, X.Y. Shao, L. Gao and W. Tao                    | 261 |
| <b>Integrated Fuzzy Analysis and Group Decision Making Method for Collaborative Product Development</b><br>H.B. Qiu, C.Y. Zhang, P. Jiang and X.Y. Shao         | 267 |
| <b>Dynamic Reliability Sensitivity Analysis of Torsion Bar</b><br>X.G. Wang, Y.M. Zhang, Y.F. Yan and B.Y. Wang                                                 | 275 |
| <b>All Set Theory in the Fuzzy-Random Heat Conduction Structure</b><br>C.H. Liu and F.Z. Xuan                                                                   | 283 |
| <b>Research on the Rollover Safety of Fuel Cell Bus</b><br>Y.K. Gao and F. Sun                                                                                  | 289 |
| <b>Destroy Probability of Ship Defensive Structure Subjected to Underwater Contact Explosions</b><br>J. Zhang, X.H. Shi, D.H. Xu and S. Wang                    | 297 |
| <b>Robustness Analysis of Responses of Structures with Uncertain Parameters</b><br>Y.D. Chen and S.H. Chen                                                      | 303 |
| <b>Test Method of the <math>\epsilon_{rms}</math>-N Curves of Laminated Composite Beams</b><br>C. Shao, S. Ge, H. Tao and C. Bathias                            | 311 |
| <b>Research on Simulation of Fatigue Reliability Based on Rainflow Counting Range</b><br>G.W. Yang and S.N. Xiao                                                | 317 |
| <b>The Influence of HAZ on Fatigue Life of 16Mn Steel</b><br>G. Chen, X.M. Luo, X. Chen and W.H. Zhang                                                          | 323 |
| <b>Integrity Stable Reliability Analysis of Stochastic Structure System under Multiple Stochastic Loads</b><br>W.G. An, G.P. Tian, L. Zhou and L. Wang          | 329 |
| <b>Reliability Analysis for Rubbing in Cracked Rotor System</b><br>C.Q. Su and Y.M. Zhang                                                                       | 337 |

|                                                                                                                                                                                 |     |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|
| <b>ExProMod, a Product Development Support Tool</b><br>L. Ding, J. Matthews, C. McMahon and G. Mullineux                                                                        | 345 |
| <b>Rapid Prototyping of Constraint-Based Production Flows in Outsourcing</b><br>S. Saniuk and A. Saniuk                                                                         | 355 |
| <b>Manufacture of Fine <math>AL_2O_3</math> Granules as Catalyst Carrier by an Extrusion/Spheronization Method</b><br>R.S. Zhang, J.Z. Pan and L.W. Wang                        | 361 |
| <b>Determination of the Maintenance Tasks for Aircraft Structural Significant Items Based on CBR Method</b><br>D.Y. Geng                                                        | 367 |
| <b>Research on PLM System Interoperability with a Feature-Object-Based Approach</b><br>Y.S. Ma                                                                                  | 373 |
| <b>Methodology to Support a Collaborative DFX Process with Integration of PDM and Expert System Tools</b><br>E.D. Ramón-Raygoza, D.A. Guerra-Zubiaga and M. Tomovic             | 381 |
| <b>A New Up-and-Down Estimate Method for Sensitivity Test</b><br>W. Huang, S. Zhang, G.H. Liu and Z.S. Lu                                                                       | 389 |
| <b>Study and Application of Driving Cycle for City Bus</b><br>H.T. Sun, X.G. Song and T.L. Wang                                                                                 | 395 |
| <b>Optimization Analysis for Fuel Cell Bus Body Structure in Multi-Load Cases</b><br>Y.K. Gao and P. Liu                                                                        | 401 |
| <b>Valve Parameters Design and Performance Test of Hydro-Pneumatic Spring with Trapezium Throttle Slice</b><br>C.C. Zhou and W. Xu                                              | 409 |
| <b>Power Train-Vehicle Modeling to Simulate Shifting Transients of Off-Highway Vehicles</b><br>L.C. Mou and G.F. Yin                                                            | 415 |
| <b>Integration of Axiomatic Design and Design Structure Matrix for Product Design</b><br>D.B. Tang, G.J. Zhang and S. Dai                                                       | 421 |
| <b>Functional Evolution Process Modeling and Management for Conceptual Product Design</b><br>D.B. Tang, M.J. Xu and M. Wan                                                      | 429 |
| <b>Development of Assistive Medical Device Based on Reverse Engineering and Biomechanics</b><br>G.Q. Shang, C.H. Sun and X.F. Chen                                              | 437 |
| <b>Design of Personal Positioning for Coal Mine Based on Mesh</b><br>W.H. Gao, J. Ma and L. Kang                                                                                | 443 |
| <b>Product Design of a Precision Recycle-Process Tool for Displays' Color Filters of TFT-LCDs</b><br>P.S. Pa                                                                    | 449 |
| <b>Rolling-Leveling Assistance in Ultrasonic Electrochemical Finishing of External Cylindrical Surface</b><br>P.S. Pa                                                           | 455 |
| <b>Robust Optimization Design of Compensative Pulley Block of Luffing Mechanism Using the Compromise Decision Support Problem</b><br>X.F. Cheng                                 | 463 |
| <b>A Port-Based Approach to Configuration Design of Mechanical Products</b><br>D.X. Cao, X.J. Zhang, Q.L. Jia and L.X. Nan                                                      | 471 |
| <b>Theoretical Research on Inheriting Degree in Appearance Design of Brand Products</b><br>Z. Gao, X.M. Ji and C.Q. Zhang                                                       | 479 |
| <b>Jig Grinding, an Effective Method in Ball Lock Punches Production</b><br>R.A. Mahdavinjad                                                                                    | 489 |
| <b>Function-Oriented Designing and Generating Technology for the Point-Contact Tooth Surfaces of Spiral Bevel and Hypoid Gears</b><br>X.C. Wu, C. Li, R.P. Zhang and H.B. Zhang | 495 |
| <b>Study of Electro-Hydraulic Converter with Strong Restoring-Motion</b><br>X.Y. Zhang, C.L. Dang, L. Chai and C.P. Jiang                                                       | 503 |
| <b>Numerical Simulation of Fuel Processor for Fuel Cell Vehicles</b><br>C. Li, X.C. Wu and L. Jiang                                                                             | 509 |
| <b>Reliability Analysis of Uncertain Nonlinear System Subject to Correlated Failure</b><br>X.F. Zhang, Y.M. Zhang and X.Z. Huang                                                | 515 |

|                                                                                                                                                                               |     |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|
| <b>Fatigue Life Prediction of a Railway Bogie Frame</b><br>R. Deng, W.M. Zhai and S.N. Xiao                                                                                   | 523 |
| <b>Experimental Investigation and Elastic-Plastic Analysis on Connection Strength of Zirconium Tube-Tubesheet Joints</b><br>B. Yuan, Y.Z. Wang, X. Ma, Y.Y. Zheng and S.T. Tu | 529 |
| <b>The Quantitative Assessment of Domino Effects Based on Stochastic Petri Nets</b><br>S.Y. Bao, J.X. Zhu, L.J. Wang, N. Jiang and Z.L. Gao                                   | 537 |
| <b>Fuzzy Reliability-Based Optimal Design for the Primary Cylinder of Giant Hydraulic Forging Press</b><br>Y.J. Deng and Z.W. Liu                                             | 545 |
| <b>Chi-Square Optimization Parameter Estimation for Incomplete Data Distribution</b><br>H. Mao and Q. Li                                                                      | 553 |
| <b>Probabilistic Cyclic Stress-Strain Relations of a Cast Steel for Railway Bogie Frame</b><br>B. Yang, Y.X. Zhao, J.C. Peng, L.Y. Yu and W.D. Shao                           | 557 |
| <b>Hardware Design of Diesel Generator Sets Digital Control System Based on DSP</b><br>C.L. Dang, L. Chai and X.Y. Zhang                                                      | 563 |
| <b>Reliability Analysis of Damaged Piezoelectric Structure</b><br>D. Zhang, W.G. An and X.S. Lu                                                                               | 569 |
| <b>Reliability Assessment Methods of Complicated Mechanical Product Based on Statistical Learning Theory</b><br>X.Y. Shao, J. Wu, Y.Q. Lv and C. Deng                         | 575 |
| <b>A New Approach for Multi-Criteria ABC Analysis</b><br>R. Jiang and X.N. Yuan                                                                                               | 581 |
| <b>Research on Multi-Attribute Decision Making Using Grey Relation Analysis, Information Axiom and Fuzzy Preferences</b><br>X.F. Cheng                                        | 587 |
| <b>Research on DSM for Simulation of Concurrent Product Development Process</b><br>X.M. Qian and D.B. Tang                                                                    | 595 |
| <b>Research on Product Model Based on Object-Oriented Method</b><br>X.M. Qian and D.B. Tang                                                                                   | 601 |
| <b>Identification of the Optimal Design and its Production Process for One-of-a-Kind Production</b><br>G. Hong, P. Dean, W. Yang, Y.L. Tu and D. Xue                          | 607 |
| <b>The User Research in New Product Development</b><br>Z.H. Huang and W. Su                                                                                                   | 619 |
| <b>A Primary Research and Exploration on Choosing Green Material in Product Design</b><br>L.J. Li, Z.H. Huang and Q.L. Xiong                                                  | 627 |
| <b>Optimization of Groove-Hole Distribution with Equidistant and Unequal Diameter on Air-Cushion Belt Conveyor</b><br>J.F. Li and S.L. Zhang                                  | 635 |
| <b>Green Pump Development Based on the Analysis of Unsteady Flow</b><br>C.L. Shao, B.Q. Gu and Y. Chen                                                                        | 643 |
| <b>Development of a New Kind of Sealing Composite Material Reinforced with Carbon and Glass Hybrid Fibers</b><br>Y. Chen and B.Q. Gu                                          | 651 |
| <b>Modelling to Reduce the Configuration Phase Time of Machine Design</b><br>J. Matthews, L. Ding, B. Singh, G. Mullineux and T. Medland                                      | 659 |
| <b>Integrated Modeling Towards Collaborative Product Development</b><br>D.X. Cao, Y.H. Han, J. Yang, G. Yang and C.X. Cui                                                     | 669 |
| <b>Development of a New Flux for Aluminium Gas Welding</b><br>J.I. Achebo and A.O.A. Ibhadode                                                                                 | 677 |
| <b>Structure Design and FE Analysis of a Newly Basketball Wheelchair</b><br>L. Lei, T.M. Guan and L.J. Shan                                                                   | 685 |
| <b>Research on Fuzzy Information Modeling Process of Quality Function Deployment</b><br>Z.H. Ren, X.P. Li, J.S. Dai and B.C. Wen                                              | 691 |
| <b>Harmonious Design Method for Product Development</b><br>X.P. Li, Z.H. Ren, W. Sun, C.F. Li and B.C. Wen                                                                    | 697 |

|                                                                                                                                                                           |     |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|
| <b>Classification Syllogism in the Farm Vehicle Design Based on the Kansei Engineering</b><br>Z. Li, Y. Jin and J. Hou                                                    | 703 |
| <b>Analysis of Nonlinear Characteristics of Double-Crank Ring-Plate-Typed Pin-Cycloid Gear Planetary Drive</b><br>L.J. Shan, W.D. He and T.M. Guan                        | 711 |
| <b>A Service-Oriented Collaborative Design Platform for Concurrent Engineering</b><br>W.S. Xu, J.Z. Cha and M. Sobolewski                                                 | 717 |
| <b>Reliability-Based Optimization Robust Design of Electronic System</b><br>T.X. Zhang                                                                                    | 725 |
| <b>Hybrid Fatigue Analysis Method for Railway Carbody Structure</b><br>B.R. Miao, W.H. Zhang, S.N. Xiao, D.C. Jin and Y.X. Zhao                                           | 733 |
| <b>Fatigue Scatter Factor of Whole Life and Reliability of Aircraft Structure Service Life</b><br>C.L. Yan and K.G. Liu                                                   | 739 |
| <b>Theory of Active Reliability-Based Design for Predetermined Life of Structures</b><br>C.L. Yan and K.G. Liu                                                            | 745 |
| <b>Probabilistic Critical Fatigue Safety State of the RD2 Type Axle of China Railway Freight Car</b><br>Y.X. Zhao, B. Yang, M.F. Feng, Y. Li, M.J. Liu and G.X. Song      | 751 |
| <b>Probabilistic Critical Safety Wheel Wear Sizes of Chinese Railway Freight Cars</b><br>Y.X. Zhao, B. Yang, M.F. Feng, Y. Li, M.J. Liu and G.X. Song                     | 759 |
| <b>Damage Analysis of Glass-to-Metal Diffusion Welded Joints</b><br>X.H. Shen and X. Ling                                                                                 | 765 |
| <b>Reliability Design Method for Interference Joint in Mechanical Engineering</b><br>S.C. Xiu, Q. Feng and S.Q. Gao                                                       | 773 |
| <b>Failure Analysis of a Die for Cold Precision Forging of Bevel Gears</b><br>J.S. Jin, J.C. Xia, X.Y. Wang and H. Liu                                                    | 779 |
| <b>A Study on Optimal Inspection Strategies of Reliability Systems with Parallel-Chain Precedence Constraints under Failure States</b><br>Z.W. Bao, H.Y. Li and L.R. Cui  | 787 |
| <b>Product Reliability Assessment Method Combining Degradation Data and Lifetime Data</b><br>B.H. Peng, J.L. Zhou and J. Feng                                             | 795 |
| <b>Study on Service Life of Last Stage Blade with Damped Structure in Large Power Steam Turbine</b><br>D. Zhang and Y.H. Xie                                              | 803 |
| <b>Online Forecast of Fatigue Life in Welded Grider of Bridge Crane</b><br>C.H. Liu, X.T. Liu, H. Huang and L.H. Zhao                                                     | 809 |
| <b>A Method for the Calculation of the Mean Time To Failure (MTTF) of Repairable System</b><br>J.X. Zhu, L.J. Wang, S.Y. Bao, W.P. Wang and Z.L. Gao                      | 813 |
| <b>Analysis and Study of Ergonomics on Virtual Maintenance of Civil Airplane Based on DELMIA</b><br>W. Wang, Y.C. Sun and F.F. Kong                                       | 821 |
| <b>Fatigue Failures of the 353130B Type Roller Bearings on China Railway Freight Cars</b><br>L. Chen                                                                      | 829 |
| <b>Delivery Quality Product in Value Chain: A Case Study to Rebuild Broken Quality System in Piecewise Organization</b><br>T.P. Tsai, J.F. Yu, J. Stracener and F.C. Wang | 835 |
| <b>Study on Reliability of Chaotic System of Nonlinear Grid Coupling Based on Adaptive Control</b><br>Y.F. Yin, S.L. Wang and G. Hang                                     | 845 |
| <b>Damage Equivalent Method of Fatigue Reliability Analysis of Load-Sharing Parallel System</b><br>G.B. Hao and L.Y. Xie                                                  | 853 |
| <b>Composite GM (1, 1) Model for Treating Data of Constant Stress Amplitude Accelerated Life Tests</b><br>Y. Qian, Y.H. Zhou and J.C. Pei                                 | 859 |
| <b>Reliability Analysis of Condition Monitoring Systems under Fuzzy Environment</b><br>P.X. Yi, S.Y. Liu, Y.M. Hu and W. Liu                                              | 863 |

|                                                                                                             |     |
|-------------------------------------------------------------------------------------------------------------|-----|
| <b>A Reliability-Based Approach to Assess Fatigue Behaviour Based on Small Incomplete Data Sets</b>         |     |
| C.Y. Luo, J.J. Xiong and R.A. Shenoi                                                                        | 871 |
| <b>A Method of Fuzzy Probability under Small Sample</b>                                                     |     |
| H. An, W.G. An, Y.L. Zhao and Z.J. Song                                                                     | 879 |
| <b>Reliability-Based Sensitivity Design of Mechanical Components with Arbitrary Distribution Parameters</b> |     |
| Z. Yang, Y.M. Zhang and L.S. Zhu                                                                            | 885 |
| <b>The Reliability Virtual Experiment Based on Deep Groove Ball Bearing</b>                                 |     |
| C. Li and Z.L. Sun                                                                                          | 893 |
| <b>Disk Brake Element Chatter Analysis and Strength Evaluation for Railway Vehicle System</b>               |     |
| H. Gao and H.Y. Dai                                                                                         | 901 |
| <b>Failure Mechanism of Electromigration in Solder Joint</b>                                                |     |
| Y.D. Lu, X.Q. He, Y.F. En and X. Wang                                                                       | 905 |
| <b>Influence of Partial Slip Conditions on Rolling Contact Fatigue of 1070 Steel</b>                        |     |
| L.J. Lu, X.G. Wang, L.J. Zhuang, Z.L. Gao and Y.Y. Jiang                                                    | 911 |
| <b>Two Models for Predicting Fatigue Crack Growth</b>                                                       |     |
| B.X. Qiu, Z.L. Gao, L.J. Lu, X.G. Wang and Y.Y. Jiang                                                       | 917 |
| <b>Management System on Fatigue Reliability Database of Chinese Engineering Materials</b>                   |     |
| J.H. He, Y.X. Zhao and B. Yang                                                                              | 925 |
| <b>Finite Element Analysis on the Fatigue Stresses of a Railway Vehicle Roller Bearing</b>                  |     |
| F. Lin and Y.X. Zhao                                                                                        | 935 |