# 2016 11th International Conference on Reliability, Maintainability and Safety (ICRMS 2016)

Hangzhou, China 26 – 28 October 2016



**IEEE Catalog Number: ISBN:** 

CFP1662H-POD 978-1-5090-2715-6

## Copyright © 2016 by the Institute of Electrical and Electronics Engineers, Inc. All Rights Reserved

Copyright and Reprint Permissions: Abstracting is permitted with credit to the source. Libraries are permitted to photocopy beyond the limit of U.S. copyright law for private use of patrons those articles in this volume that carry a code at the bottom of the first page, provided the per-copy fee indicated in the code is paid through Copyright Clearance Center, 222 Rosewood Drive, Danvers, MA 01923.

For other copying, reprint or republication permission, write to IEEE Copyrights Manager, IEEE Service Center, 445 Hoes Lane, Piscataway, NJ 08854. All rights reserved.

\*\*\* This is a print representation of what appears in the IEEE Digital Library. Some format issues inherent in the e-media version may also appear in this print version.

 IEEE Catalog Number:
 CFP1662H-POD

 ISBN (Print-On-Demand):
 978-1-5090-2715-6

 ISBN (Online):
 978-1-5090-2714-9

#### **Additional Copies of This Publication Are Available From:**

Curran Associates, Inc 57 Morehouse Lane Red Hook, NY 12571 USA Phone: (845) 758-0400

Fax: (845) 758-2633 E-mail: curran@proceedings.com

Web: www.proceedings.com



#### Part 1. Reliability Model

- #45. A Reliability Data Fusion Method Based on Improved D-S Evidence Theory..... I
- #59. A New NHPP Model for Modeling Failure Process with S-Shaped Mean Cumulative Function....7
- #68. Reliability and Performance Modeling for Mission-Oriented k-out-of-n System Under Common Cause Failures.....11
- #76. Area Method Used in the Evaluation of Resilience Implementation Approaches in System of Systems.....17
- #113. Step-Stress Accelerated Degradation Modeling Based on Nonlinear Wiener Process.....22
- #144. Reliability Model for Load-Sharing k-out-of-n System and its Numerical Algorithms.....27
- #170. System Testability Modeling and Analysis Method Based on Device Level FMECA.....32
- #207. Modeling Failure Data by 3-Parameter Weibull Distribution Models.....37

#### Part 2. Reliability Assessment

- #22. A Method for Reliability Assessment of Dependent Mechanical Systems.....N/A
- #32. Wear and Reliability Life of Large Modulus Gear Rack....N/A
- #42. Reliability Assessment of Car Engine Based on Dynamic Bayesian Network.....45
- #53. Study on Structural Reliability of the Loader Boom Based on Response Surface Method.....N/A
- #67. Reliability Assessment Based on Bayesian Networks for Full Authority Digital Engine Control Systems.....49
- #83. An Improved AGREE Method with Reliability Mathematical Model for Complex System Importance Degree Computation.....56
- #95. Non-Probabilistic Reliability Analysis of a Two-Link Flexible Manipulator Based on Chebyshev Method.....N/A
- #107. Degradation Process and Lifetime Evaluation of Repairable and Non-Repairable Systems Subject to Random Shocks.....63
- #114. Analysis of MTBF Evaluation Methods for Small Sample Sizes.....68
- #117. Classical and Bayes Methods for Two-Sample Prediction of a Weibull Distribution.....75
- #125. A New Technology Framework for the Reliability Assessment and Life Prediction of a Satellite Power Subsystem.....80
- #147. Bayesian Reliability Assessment for High-Value Pyrotechnics Systems Based on Inheritance Factor.....85
- #164. A Reliability Evaluation Methodology of Complex System Based on Dynamic Object Oriented Bayesian Networks.....89
- #174. Reliability Assessment Framework for Communication Products Based on Environmental Tests Data.....94
- #181. Synthetic Reliability Assessment for Shipborne Weapon Based on Dynamic Population Statistics.....98
- #184. Reliability Degradation Monitoring of CNC Machine Tools Based on SPC Method with the Metropolis-Hastings Algorithm.....102
- #191. Reliability Assessment of ZPW-2000A Track Circuit Using Bayesian Network.....108
- #204. Reliability Assessment of Electric Energy Data Collector.....112
- #216. Reliability Evaluation of Barrel Life Based on Performance Degradation Path....N/A
- #219. Reliability Analysis of Turbine-Driven Auxiliary Feedwater Pump of Nuclear Power Plant ..... 117

- #231. Fatigue Life Prediction of TiAl Turbine Hub of Turbocharger for Automobile.....N/A
  #236. A Normal Approximation Approach with Higher Order for System Reliability Assessment.....123
  #261. Reliability Study on Cutting off the Shear Cap of the Squib Valve from a Passive PWR.....N/A
  #262. Response Surface Method and Reliability Calculation Based on Generating Function Method.....129
  #289. Analysis of Reliability Growth Model of Domestic Large Thermal Power Unit.....134

  Part 3. Reliability Test
  #17. Accelerated Corrosion Mechanism Research of 5A06 Aluminum Alloy in Seawater.....N/A
  #44. The Life Prediction of the Subway Bolster Based on FEM Models Validated by Modal Test.....N/A
  #47. A Comparison of Multiple Stresses Accelerated Life Test Plans on Simply-Connected Test
  Region with Convex Boundary.....N/A
- #91. Accelerative Effect Analysis of Quantitative Environmental Stress Screening.....142
- #102. A New Method for Product Field Reliability Assessment Based on Accelerated Life Test.....147
- #166. Storage Reliability Assessment for Electromechanical Components with Small Sampling Based on Prior Information Prediction.....152
- #183. A Life Evaluation Method of Film Capacitor Using Accelerated Life Testing.....160
- #195. Accelerated Life Testing of Packaging Box under Multiple Environmental Stresses.....165
- #239. A Highly Accelerated Life Test Method for Computer Keyboards.....170
- #253. New Forecasting Method of Closing Time for Aerospace Relay in Storage Accelerated Degradation Testing.....175

## Part 4. System Reliability Analysis

- #31. A Reliability Allocation Method Based on Intuitionistic Fuzzy for Mechanical Series System....N/A
- #39. The Optimization of Performance and Reliability of Brushless Direct Current Motor.....180
- #134. Regional Importance Analysis under Multiple Failure Modes.....184
- # 152. Reliability Analysis for an EHCS of Automatic Transmission Based on GO Method..... 190
- #158. A Reliability Optimization Allocation Method for MultiFunctional Systems by Using New Hybrid Particle Swarm Optimization.....199
- #194. Reliability Allocation of CNC Turret Based on Fuzzy Comprehensive Evaluation.....205
- #249. Reliability Analysis for the Reactor Protection System of HTR-PM.....211

#### Part 5. Networks and Software reliability

- #9. A High Availability Verification Framework for OpenStack based on Fault Injection.....217
- #10. A Test Case Design Method Targeting Environmental Fault Tolerance for High Availability Clusters.....224
- #26. A Cyberspace Security Situation Awareness Model Based on Complex Network.....231
- #52. Fault location Method of Complex Software Based on Community Mining.....237
- #70. A Non-Invasive Framework for XML Data Binding.....245
- #133. Enhanced-Condition-MC/DC A Method for Improving MC/DC Testing Adequacy.....250
- #182. Study on the Fuzzing Test Method for Industrial Supervisory Control Configuration Software Based on Genetic Algorithm....257
- #197. Cascading Failure of Interdependent Networks with Traffic: Using a Redundancy Design to Protect Influential Nodes.....263
- #221. A Model-driven Testing Framework Based on Requirement for Embedded Software.....269

- #224. Research on Integrated Evaluation of Military Software Supportability Based on FAHP.....275
- #225. Software Dynamic Fault Model and Injection Method.....282
- #259. Software Reliability Growth Model of Reactor Protection System Based on Ratio Analysis of Critical Faults.....289

### Part 6. Fault Diagnosis, Prognosis, Condition Monitoring and

#### **PHM**

- #20. Fault Diagnosis for Railway Track Circuit Based on Wavelet Packet Power Spectrum and ELM.....295
- #43. Bivariate empirical mode decomposition of Grinding Chatter Signals.....302
- #100. On-Line Estimation of State-of-Health for Lithium Ion Batteries Based on the Charge Curves.....309
- #116. Degradation of Fatigue Crack Propagation Behavior of 7N01 Aluminum Alloy Due to a Long Term Service Life.....N/A
- #124. The Health Assessment of Superstructure of Bridge Based on Markov Chain Deterioration Modeling.....N/A
- #155. The Study of Turbo-Engine Early Fault Detection Technology Based PHM Sensor.....316
- #180. A Combined Method of Kullback-Leibler Divergence and Self-Organizing Map for Bearing Degradation Feature Extraction.....N/A
- # 209. Research on Fault Diagnosis Training Simulation Technology Based on MCGS.....320
- #223. Discriminate Intermittent from Permanent Faults Based on Fault Event Evaluation and Diagnoser.....324
- #232. The Fatigue Life Prediction of Train Wheel Rim Containing Spherical Inclusions.....N/A
- #244. Case Study: A Prognostic Method for Predicting Failure of DC/DC Converter.....N/A
- #251. A Fatigue Crack Size Evaluation Method Based on Lamb Wave Simulation and Bayesian Method.....N/A
- #266. Case Study of Constrained Independent Component Analysis Application to Gearbox Fault Diagnosis.....N/A
- #279. Rolling Bearing Fault Classification using a Multi-kernal Hypersphere Support Vector Machine.....N/A

## Part 7. Safety, Maintenance and Risk Assessment

- #13. Threshold N-Policy for Machine Interference Problem with Additional Repairman and Spares under Bernoulli Vacation Schedule.....329
- #14. Maintenance Policies for Improving the Availability of a Software-Hardware System.....334
- #19. A Reliability Risk Analysis Method Based on the Fuzzy Fault Tree and Fuzzy Event Tree.....339
- #23. Study on Safety Risk Assessment Methods for Plastic Toys in Use.....N/A
- #50. Joint Economic Design for VSS X-Bar Control Chart and Age Replacement Policies.....N/A
- #64. Armored Equipment Effectiveness Evaluation Based on Hierarchy-Grey Theory.....345
- #74. Important Degree Evaluation of Test Equipment Based on Fuzzy DEMATEL and Fuzzy Hierarchical TOPSIS.....350
- #92. Research on Subway Passengers' Unsafe Behaviors Based on Extended the Theory of Planned Behavior....N/A
- #120. Risk Analysis of Atmospheric and Vacuum Distillation Unit Using Bayesian Networks.....357
- #136. A Safety Evaluation Method for Heavy-Duty CNC Machine Tools for the Total Life Cycle Based on an Entropy Weight Method.....363

- #178. Research on Imperfect Preventive Maintenance Strategy for Turret System of the CNC Lathe.....370
- #193. Model-Based Safety Analyses of Embedded System Using Stateflow.....374
- #199. Transformation Rules from AADL to Improved Colored GSPN for Integrated Modular Avionics....380
- #215. Research on the Comprehensive Evaluation of Equipment Maintainability Qualitative Index Based on Virtual Prototypes.....386
- #235. Uncertainty Analysis Based on Probability Bounds in Probabilistic Risk Assessment of High Microgravity Science Experiment System....391
- #277. Research Method for Determining Preventive Maintenance Period Based on Time Stress Factors.....397 #286. Research on Comprehensive Evaluations of Equipment Maintainability Based on Incomplete Judgment Matrix.....402

#### Part 8. Aerospace

- #6. Preventive Strike vs. Counter Intelligence and Protection for a Target under Attack.....406
- #24. Review on Civil Aviation Safety Investment Research....410
- #61. Research of Reliability Assessment Technology for Spacial Complex Mechanical Products....N/A
- #62. Research on Fault Injection Technology for Embedded Software Based on JTAG Interface.....415
- #103. Research on IETM Access Control Technology.....421
- #104. Research of Aircraft Equipment Cabin Layout Optimization Method Based on Virtual Maintenance.....425
- #109. Diagnostic Ability Validation Methods for Prognostics and Health Management Systems in Complex Systems.....433
- #137. Reliability-Centered Optimal Design Method for Flight Vehicle Control System.....439
- #140. Maintenance Request Prediction for Airplanes Based on Multivariate Damage Model.....445
- #161. Study on Optimal Inventory Strategy for Worn Spare Parts of Chinese Space Station.....451
- #162. Partitioning Strategy Based on Safety In Integrated Modular Avionics.....456
- #226. Aircraft Runway Excursion Prediction Model Based on Exponential Weight.....462
- #258.Reliability Modeling and Fuzzy Evaluation for Locking Device of Satellite Communication Terminal Rotating Platform.....N/A
- #268. Reliability Simulation Analysis of Satellite Products.....467
- #274. Satellite Lifetime Prediction with Random Failure.....471

### Part 9. Failure Analysis

- #33. Monte Carlo Simulation of Dendrite Growth Due to Contaminant Deposition on Printed Circuit Board.....475
- #63. Failure Analysis of Multilayer Ceramic Capacitor Board Level Interconnect Caused by Monotonic Bending Stress.....479
- #79. Failure Analysis for Micro-Short Circuit between Two Pins in Printed Circuit Board Assembly.....484
- #82. An Analytical Method to Find the Effect of Storage Time on Solderability of Sn Plating.....488
- #86. Research on Failure Mechanisms of Domestic Intelligent Electric Energy Meters.....492
- #118. Failure Analysis for Poor Vertical Fill of ENIG Holes.....501
- #121. Fuzzy Fault Tree Theory-Based Fault Search Strategy Research for FAST Hydraulic Actuators.....505
- #138. Discussion of Failure Cases for Contamination in Electronics Assembly Process.....510
- #200.The Mechanism of Cyclic Stress Enhanced Oxidation in Monocrystalline Silicon Microstructures.....514

#238. Typical Failure Forms of High Speed Railway Wheels and Causes Analysis.....N/A #276. Failure Analysis on the Hydraulic Burst Test of JN02 Pressure Vessel.....N/A

#### Part 10. Quality Engineering, Process Control, Security

#### Technology

#73.	Study on	<b>Optimization</b>	of Backward	Compatible	Reflow	Soldering Process5	519

- #108. Prediction of Nonlinear Deformation Behavior of GLARE Laminates.....N/A
- # 127. The Design for General Quality Characteristics Engineering Solution of Shipbuilding.....N/A
- #135. AHP Based Evaluation Method for Technology Readiness Level of DC-DC Converter.....525
- #163. Optimal Price, Warranty and Reliability for the New Products Considering Customer's Utility.....N/A
- #168. Parameter Design Of Magnetic Latching Relays.....529
- #172. Research on Aerospace Quality Improvement Solutions.....538
- #179. The Quality Control of Single Crystal Blade Based on the Process Stability.....N/A
- #201. Analog Integrated Circuits Parameters Online Test System for Accelerated Test.....543
- #220. Longitudinal Compressive Behavior of CFRP and GFRP with Random Fiber Packing.....N/A
- #222. Quality Entropy Model of the Numerical Control Manufacturing Process.....548
- #245. TDR Measurement of a Solder under Temperature Cycle Test.....556
- #260. Research of the Influence of Heat Treatment Process on the EMU Wheel's Fatigue Performance.....N/A
- #263. Analysis of Wheel/Rail Thermo-Structural Coupling Effects in Sliding and Idling Cases.....N/A
- #265. Development Status of the Micro Thrust Measurement Technology Based on Cantilever Beam Structure.....560
- #280. A Five-Dimensional Chaotic System with a Large Parameter Range and the Circuit Implementation of a Time-Switched System.....566
- #282. Challenges and Opportunities of Complex Equipment Operational Reliability Technology in Industrial Big Data Age....572
- #283. The Topical Issues on the Advancement and Reliability of Novel Microelectronic Devices.....580
- #290. The Influence of Machining Parameters on the Dynamic Behavior of Spiral Bevel Gear....N/A
- #291. Strain Monitoring in Fiber-metal Laminates Using Digital Image Correlation.....N/A