

2010 2nd International Conference on Reliability, Safety and Hazard – Risk-Based Technologies and Physics-of-Failure Methods

(ICRESH 2010)

**Mumbai, India
14-16 December 2010**



**IEEE Catalog Number: CFP1082K-PRT
ISBN: 978-1-4244-8344-0**

Contents

Scientific Scale of Reliability	1
<i>Jezdimir Knezevic</i>	
Use of PSA Level 2 and Level 3 Risk Insights in the siting of Nuclear Power Plants	8
<i>Vinod Mubayi</i>	
PSA Applications for Research Reactors Towards a Very Low Risk	14
<i>Jorge Barón</i>	
A Novel Reliability Evaluation Method for Large Dynamic Engineering Systems	21
<i>Achintya Haldar and Reda Farag</i>	
Technological (Domino Effect) and Natural Hazards: A Probabilistic Framework for Structural Vulnerability	32
<i>Ahmed Mébarki, Julien Baroth and Frédéric Mercier</i>	
Ageing Management & Residual Life Assessment of Heavy Water Plants	38
<i>R. V. Gupta and R. D. Patel</i>	
Critical Issues Pertaining to the Evaluation of Passive System Reliability	47
<i>A. K. Nayak, Vikas Jain and D. Saha</i>	
Review of R & D Activities in Level-1 Probabilistic Safety Assessment and Aging Studies	52
<i>V.V.S. Sanyasi Rao, V. Gopika, P. K. Ramteke, M. Hari Prasad, Santhosh, K. K. Vaze and A.K. Ghosh</i>	
Methodology to Estimate Remaining Service Life of Piping Components Against Erosion Corrosion	59
<i>H. N.Suresh and A. Srividya</i>	
Reliability and Life Prediction for Electronic Connectors for Control Applications	63
<i>P. V. Varde, M. Agarwal, P. P. Marathe, U. Mohapatra, R. C. Sharma and V. N. A. Naikan</i>	
Anomaly Detection of Non Punch Through Insulated Gate Bipolar Transistors (IGBT) by Robust Covariance Estimation Techniques	68
<i>Nishad Patil, Sandeep Menon, Diganta Das and Michael Pecht</i>	
Bird's Nest Network-A Logical Approach in Product Development	73
<i>A. K. Chakrabarti</i>	
Structural Reliability Analysis of AHWR and PHWR Inner Containment using High Dimensional Model Representation ...	78
<i>B. N. Rao, Rajib Chowdhury, R. K. Singh and H. S. Kushwaha</i>	
Probabilistic Assessment of Fatigue Life for Components under Varying Cyclic Load	87
<i>Pravin Kadekodi</i>	
Fuzzy Measure Theory Based Risk Assessment of Radioactive and Special Nuclear Material During Transport.....	91
<i>D. Datta, D. S. Joshi and P. K. Sarkar</i>	
Recent Advances in Digital System Reliability Prediction	96
<i>Gopika Vinod, Santosh, V. V. S. Sanyasi Rao, K. K. Vaze and A. K. Ghosh</i>	
A Study on the Effect of Trees on Gas Explosions.....	100
<i>Kees van Wingerden, Prankul Middha and Pol Hoorelbeke</i>	
Improving Overall Equipment Effectiveness (OEE) of Process Plant Equipments Through E-Diagnosites.	107
<i>Trinath Sahoo</i>	

Prospect Theory on Energy Options?-Towards Decision Making under Risk	112
<i>Vidyottama Jain and Ashok Deshpande</i>	
Design and Optimization of an Integrated Reliability Redundancy System with Multiple Constraints	118
<i>G. Sankaraiah, Y. Raghunatha Reddy, C. Umasankar and B. Dattatraya Sarma</i>	
A Commercial-Off-the-Shelf (COTS) Dedication of a QNX Real Time Operating System (RTOS)	123
<i>Jang Yeol Kim, Young Jun Lee, Se Woo Cheon, Jang Soo Lee and Kee Choon Kwon</i>	
Hardware Reliability Prediction of Computer Based Safety Systems of Indian Nuclear Plants	127
<i>S. V. Shrikhande, V. K. Patil, G. Ganesh, B. B. Biswas and R. K. Patil</i>	
Probabilistic Safety Assessment-Risk Informed Approach	133
<i>Rajee K. Guptan, S.P. Dharne and S.G. Ghadge</i>	
Test Effort Optimization by Prediction and Ranking of Fault-prone Software Modules	136
<i>Ajeet Kumar Pandey and Neeraj Kumar Goyal</i>	
Estimation of Probability of Failure using Bootstrap Methods	143
<i>Brij Kumar and D Datta</i>	
Bayesian Approach of Reliability Parameter Estimation Using WinBUGS.....	147
<i>Rajeev Nama, A. K. Vijaya, Rajee Guptan, P. K. Malhotra and S. G. Ghadge</i>	
Bayesian Analysis for Parameter Estimation for Use in PSA - A Case Study	151
<i>M. Hari Prasad, V. V. S. Sanyasi Rao, A. K. Verma and A. Srividya</i>	
Processing of Raw Data-for Reliability Parameter Estimation	156
<i>P. Anita, A. L. V. V. Reddy, Vineet Kumar, G. Srinivas and Rajee Guptan</i>	
A System Thinking Approach for Time Dependent Availability Analysis of Multi Component Systems	162
<i>Meesala Srinivasa Rao and V. N. Achutha Naikan</i>	
Optimization of Binary Decision Diagram Using Genetic Algorithm	168
<i>Awinash Kumar, Ajit Kumar, Soumik Choudhary and P. V. Varde</i>	
Databases and Their Analysis for Applications in Quantitative Risk Analysis of NPP.....	176
<i>Upkar Rastogi and V. K. Jain</i>	
Application of PSA Based Operational Event Analysis to Indian Nuclear Power Plants	181
<i>R. B. Solanki and S. K. Gupta</i>	
Surveillance Test Interval Optimization For Nuclear Plants Using Real Parameter Genetic Algorithms.....	188
<i>Soumik Chowhury and P. V. Varde</i>	
Risk Based Maintenance Decision for Periodically Tested Repairable Components Subject to Hidden Failure	197
<i>Alireza Ahmadi, Uday Kumar and Behzad Ghodrati</i>	
Risk-based Technical Specification Optimisation Methodology for Complex Systems	205
<i>Sqn. Ldr. R. S. Rana, Mayank Agarwal and P. V. Varde</i>	
State-of-Art in Regulatory Decision making Process for a Nuclear Fuel Cycle Facility	213
<i>Ramprasad K. and Bhattacharya R.</i>	

Effect of Class-IV Power Supply Failure Frequency on Core Damage Frequency (CDF)	219
<i>J. K. Jena, R. M. Nachammai, M. Rama Somayajulu, C. D. Rajput and K. Ramamurthy</i>	
NAPS PSA Application Allowed Outage Time Optimisation	222
<i>Nipu Phukan, Bhim Singh, L. K. Jain, A. K. Vijaya and Rajee Guptan</i>	
Risk Assessment of Operational Events - Methodology for Indian Nuclear Power Plants	226
<i>A. K. Vijaya, Rajee Guptan, S. P. Dharne and S. G. Ghadge</i>	
“Level-1 PSA of RAPS-2 : Review of the Safety of the First Indian PHWR by Probabilistic Method”	230
<i>K. K. Jha, V. K. Budhiraja, A. K. Vijaya and Rajee Guptan</i>	
Level-1 PSA for KAPS-1&2 –An Overview of Plant Specific Improvements	234
<i>Yashpalsinh Mahida, Manoj Pareek, S. K. Tiwary, A. K. Vijaya and Rajee Guptan</i>	
Level-1 Probabilistic Safety Analysis of Prototype Fast Breeder Reactor	239
<i>M. Ramakrishnan, Pramod Kumar Sharma, A. John Arul, V. Bhuvana, P. Mohanakrishnan and S. C. Chetal</i>	
Plant Specific Fire PSA Considering Measures Taken to Lower Fire Hazard and Improved Core Damage Frequency in a Model Plant	242
<i>D. Chatterjee, Rajee Guptan, S. P. Dharne and S. G. Ghadge</i>	
A Multi-segment Probabilistic Fatigue Crack Growth Model to Account for Reliability in Design of Components	248
<i>Raghu V. Prakash and K. Hariharan</i>	
A Comparative Study of Probabilistic Structural Safety Analysis	256
<i>P. Bhattacharjee, K. Ramesh Kumar, T. A. Janardhan Reddy</i>	
Insights into Corium Coolability Phenomena- Top Flooding Vs. Bottom Flooding	263
<i>R. K. Singh, P. P. Kulkarni, A. K. Nayak, P. K. Vijayan and D. Saha</i>	
Reliability Studies of Decay Heat Removal System	270
<i>Avinash J. Gaikwad, M. Hari Prasad, Rajesh Kumar, A. Srivastava, A. D. Contractor, V. V. S. Sanyasi Rao, H. G. Lele and K. K. Vaze</i>	
Severe Accident Analysis to evolve Insight for Severe Accident Management Guidelines for Large Pressurised Heavy Water Reactor	276
<i>Onkar Gokhale, Mithilesh Kumar, A. J. Gaikwad, Rajesh Kumar, D. Mukhopadhyay, H. G. Lele and K. K. Vaze</i>	
Verification of Severe Accident Management Strategies for VVER 1000 (V320) Reactor	280
<i>B. Chatterjee, D. Mukhopadhyay H. G. Lele, B. Atanasova and Pavlin Groudev</i>	
Compressible Flow Behaviour through Wavy Channels	288
<i>Ravi K., Gupta S. K., Atul Sharma and Kannan Iyer</i>	
Development of Core Disassembly Model for PHWRs under Severe Accidents	294
<i>Ritu J. Singh, Ravi K. and S. K. Gupta</i>	
Issues on Containment Integrity During Severe Accidents	300
<i>L. R. Bishnoi and S. K. Gupta</i>	
Remaining Life Prediction of Irradiated Fuel Channels for Boiling Water Reactor by Ultrasonic Testing	306
<i>S. P. Srivastava, S. P. Pandarkar, T. G. Unni, R. L. Suthar and A. Ramu</i>	

Imperfect Repair Accelerated Failure Time Processes for Maintained Systems	313
<i>A. Syamsundar, E. Vijay Kumar and V. N. A. Naikan</i>	
Accelerated Tests on Gamma Compensated Boron Lined Ionisation Chamber for Reactor Safety and Control Applications	319
<i>Mary Alex, R. Ayyappan, J. P. Singh, D. N. Prasad, D. Das, C. K. Pithawa and R. K. Patil</i>	
Thermal Ageing Predictions of Polymeric Insulation Cables from Arrhenius Plot Using Short-term Test Values.....	325
<i>P. K. Ramteke, A. K. Ahirwar, N. B. Shrestha, V. V. S. Sanyasi Rao, K. K. Vaze and A. K. Ghosh</i>	
Accelerated Life Testing of Field Programmable Gate Arrays.....	329
<i>L. Srivani, B. KrishnaKumar, S. A. V. Satya Murty and P. Swaminathan</i>	
Reliability Improvement of Process Equipment: A Case of Rolling Mill Application.....	335
<i>Tarapada Pyne, Mritunjay Kumar Pathak and Vinod Raj</i>	
Reliability Centre Maintenance: An Experience at TAPS 1&2	341
<i>S. K. Acharya, B. H. Thakkar, R. H. Patil, S. K. Gupta, V. S. Daniel, K. A. David, Ravindranath, S. Bhattacharjee, Vibha Hari and G Rajee</i>	
Piping Reliability Analysis of AHWR Down-Comer Piping Using PFM	348
<i>Jadhav P. A., Rastogi Rohit, Bhasin Vivek and K. K. Vaze</i>	
Time Variant Reliability Analysis Under Random Loads.....	354
<i>M. Hari Prasad, G. Rami Reddy, A. Srividya and A. K. Verma</i>	
Probabilistic Characterization of Primary Stress Index B_2 for Nuclear Pipe Bends Subjected to In-Plane Opening Moment	358
<i>Pronab Roy and Siddhartha Ghosh</i>	
Identification of Seismic Structures, Systems and Components of PHEC System of Fast Breeder Test Reactor	364
<i>S. Usha, C. Senthil Kumar, G. Srinivasan and P. C. Basu</i>	
Possibilistic Safety Assessment of Structures under Hybrid Uncertainty	368
<i>Palash Chandra Sam and Subrata Chakraborty</i>	
Stochastic Finite Element Analysis in Computation of Reliability of Frames	375
<i>Suraj S. Rane, A. Srividya and A. K. Verma</i>	
A Centralized on-line Monitoring System for Damage Assessment of Critical Components of Multiple Thermal Powerplant Units.....	379
<i>P. V. Durgaprasad, B. K. Dutta, K. K. Vaze, R. Daga, G. Bandyopadhyay and A. K. Mohindru</i>	
Electricity Outage Cost Estimation for Government Offices, Institutions and Few Other Specific Customers	386
<i>Nava Raj Karki, Ajit Kumar Verma, Deependra Kumar Jha, Rajesh Karki and Arabind Kumar Mishra</i>	
Reliability Trending for Nuclear Power Plant Relicensing	391
<i>B. Vinod Kumar, M.Srinivas, H. N. Bhat, J. P. Gupta, G. Srinivas and Rajee Guptan</i>	
Improving Operational Reliability of Indus Accelerators by Implementation of EPICS Based Control System for Microtron Injector.....	395
<i>P. Chitnis, P. Fatnani, Y. M. Sheth, B. N. Merh and P. V. Varde</i>	

CFMEA: Concurrent Failure Mode and Effect Analysis.....	399
<i>Nitin Upadhyay, Bharat M. Deshpande and Vishnu P. Agrawal</i>	
Comparison of Morlet Wavelet Filter for Defect Diagnosis of Bearings	406
<i>Sreejith B., Verma A. K. and Srividya A.</i>	
Reliability Analysis of Safety Logic with Fine Impulse Test System of Indian Prototype Fast Breeder Reactor.....	412
<i>M. K. Misra, N. Sridhar, B. Krishnakumar, S. A. V. Satya Murty and P. Swaminathan</i>	
Interconnect Reliability Assessment of High Power Light Emitting Diodes (LEDs) through Simulation	418
<i>M. H. Chang, D. Das and M. Pecht</i>	
A Study of Failure Mechanisms in CMOS & BJT ICs and Their Effect on Device Reliability.....	425
<i>M. G. Rajesh, Gopika Vinod, D. Das, P. V. Bhatnagar, C. K. Pithawa, Aditya Thaduri and A. K. Verma</i>	
Reliability Analysis of Control Rod Drive Mechanisms of FBTR for Reactor Startup and Power Control	431
<i>E. Ramesh and S. Usha</i>	
Regulatory and Safety Aspects of Control Room Design in Indian NPPs - Criteria & Practices	436
<i>S. Mukherjee, Sonal Gandhi, J. Koley and S. N. Rao</i>	
Finite Element Based Thermal Analysis of Sealed Electronic Rack and Validation.....	443
<i>S. S. Taliyan, Suman Sarkar, B. B. Biswas and Manoj Kumar</i>	
Hardware Reliability Assessment of Safety Related and Safety Critical Systems in Nuclear Power Plants	448
<i>G. Srinivas, Rajee Guptan, S. P. Dharne, S. G. Ghadge and Umesh Chandra</i>	
Reliability Comparison of Computer Based Core Temperature Monitoring System with Two and Three Thermocouples Per Sub-Assembly for Fast Breeder Reactors.....	455
<i>Dheenadhayalan R., Sakthivel M., John Arul A., Madhusoodanan K. and Mohanakrishnan P.</i>	
Modeling of Timeliness Hazard Rate for Networked Real-time Systems.....	462
<i>Manoj Kumar, U. Mahapatra, G. P. Srivastava, A. K. Verma</i>	
Multi Up-gradation Software reliability Model.....	468
<i>P. K. Kapur, Abhishek Tandon and Gurjeet Kaur</i>	
Regulatory Review of Computer Based Systems: Indian Perspectives.....	475
<i>Neeraj Kumar, J. Koley, P. R. Krishnamurthy and S. N. Rao</i>	
A Reliability Growth Model for Object Oriented Software Developed under Concurrent Distributed Development Environment	479
<i>V. B. Singh, Sujata Khatri and P. K. Kapur</i>	
Development of Risk-Based Operation and Maintenance Management System for Nuclear Plants	485
<i>Mayank Agarwal and P. V. Varde</i>	
Reliability Analysis by FMEA Method for Object Oriented Distributed Digital Control System Design Model of Nuclear Power Plant	489
<i>Hemangi Laxman Gawand, N. Murali and P. Swaminathan</i>	
Automatic Test Case Generation in Model Based Software Design to Achieve Higher Reliability	493
<i>A. Wakankar, A. K. Bhattacharjee, S. D. Dhodapkar, P. K. Pandya and Kavi Arya</i>	

A Cryptographic Primitive Based Authentication Scheme for Run-Time Software of Embedded Systems.....	500
<i>Arindam Khan, Mukesh Kumar Sharma, G. Ganesh, S. D. Dhodapkar, B. B. Biswas and R. K. Patil</i>	
Innovation Diffusion of Successive Generations of High Technology Products.....	505
<i>P. K. Kapur, Udayan Chanda, Abhishek Tandon and Sameer Anand</i>	
Making Formal Software Specification Easy	511
<i>Arun Babu P., Murali N., Swaminathan P. and Senthil Kumar C.</i>	
Software Reliability Estimation Through Black Box and White Box Testing at Prototype Level.....	517
<i>K. Krishna Mohan, A. K. Verma and A. Srividya</i>	
A Generalized Reliability Growth Model for Open Source Software	523
<i>V. B. Singh, O. P. Singh, Ravi Kumar and P. K. Kapur</i>	
A Web Based Workplace Layout and Material Information System for Safety Management	529
<i>Dinesh M. Sarode, Rohitashva Sharma, R. S. Mundada, A. G. Apte, P. D. Bhatt, Dominic Mathew and Ram Kishan</i>	
Optimal Testing Resource Allocation for Modular Software Considering Imperfect Debugging and Change Point using Genetic Algorithm	535
<i>Anu G. Aggarwal, Gurjeet Kaur and P.K. Kapur</i>	
Nonlinear Control of a Magnetic Levitation System Using Quantitative Feedback Theory (QFT)	542
<i>P. S. V. Nataraj and Mukesh D. Patil</i>	
Safety Analysis of Hybrid Nuclear Desalination Plant Coupled to High Temperature Gas Cooled Reactor.....	548
<i>Abhijit Raha, I. S. Rao, V. K. Srivastava and P. K. Tewari</i>	
A Scilab Based Open Source Toolbox for Global Optimization Using the Bernstein Form.....	555
<i>Dhiraj B. Magare, Bhagyesh V. Patil, Vishwesh A. Vyawahare and P. S. V. Nataraj</i>	
Application of the Bernstein Form for Reliable Global Optimization of Mixed-Integer Problems in Process Synthesis and Design	562
<i>Bhagyesh V. Patil, P. S. V. Nataraj and S. Bhartiya</i>	
INDUS-2 LCW Plant Control System Using Redundant PC at Uppermost Layer	568
<i>Rishi Pal Yadav, Amit Chauhan, Pravin Fatnani and P. V. Varde</i>	
Neural Network based Diagnostic System for Accident Management in Nuclear Power Plants.....	572
<i>Santhosh, M. Kumar, I. Thangamani, D. Mukhopadhyay, V. Verma, V. V. S. Sanyasi Rao, K. K. Vaze and A. K. Ghosh</i>	
Evaluation of Operator Actions for Beyond Design Basis Events for AHWR.....	579
<i>Mithilesh Kumar, D. Mukhopadhyay, H. G. Lele and K. K. Vaze</i>	
Safety Study and Human Factor Assessment of End-Shield Draining Event for 220MWe Indian PHWRs.....	583
<i>A. P. Gautam, P. Krishnakumar, S. Hajela, A. K. Vijaya, R. K. Guptan, P. K. Malhotra, S. P. Dharne and S. G. Ghadge</i>	
A Hardware Technique Developed for Sub-Criticality Annunciation for PHWR.....	590
<i>Supratim Majumdar, Madan Mohan Maity and Shantanu Das</i>	

Radiological Impact Assessment of Opencast Uranium Mining for Large Reservoirs-Uncertainty Analysis Using Wilk's Method	594
<i>Manish Chopra, Rohit Rastogi, A. Vinod Kumar, Faby Sunny and R. N. Nair</i>	
Variance Quantification of Functional Reliability Estimates Using Re-sampling Techniques	597
<i>Sajith Mathews T., C. Senthil Kumar, K. V. Subbaiah and A. John Arul</i>	
Risk Analysis of Ingestion Dose Through Food Chain Using Imprecise Probability	604
<i>A. K. Ranade, M. Pandey, S. Paul, V. Suman, Brij Kumar and D. Datta</i>	
Quenching the Conducted Emission Hazards for Heliborne Time Domain Electromagnetic Exploration System	608
<i>Kumud Singh, R. T. Keshwani, Shantanu Das and S. Bhattacharya</i>	
Severe Accident Management	611
<i>A. K. Saxena, S. P. Limaye and P. K. Bhaumik</i>	
Insights of Level-2 PSA to Prevent and Mitigate Severe Accidents in IPHWR.....	615
<i>Vibha Hari, Rajee Guptan, S. P. Dharne and S. G. Ghadge</i>	
A Case Study on Application of HAZOP for Intermediate Level Radioactive Liquid Waste Treatment Facility.....	619
<i>Nilay J. Jasu, Kiran Kumar, Anand Gangadharan, Neelima S. Tomar, B. B.Verma and Kanwar Raj</i>	
Regulatory Issues Related to Risk Based Inspection (RBI)- A Case Study on a Hydrogen Sulphide Based Chemical Plant.....	626
<i>H. K. Kulkarni, P. Gupta, R. Bhattacharya and Gopika Vinod</i>	
Hierarchical Risk Assessment in Gas Pipelines Based on Fuzzy Aggregation	631
<i>Nadia Doremami, Ahmad Afshar and Ali Doust Mohammadi</i>	
Risk Analysis of Medical Instruments – Case Study of Cardiac Output Monitor	637
<i>Rajesh Kumar Jain, T. S. Ananthakrishnan, Sadhana A. Mandalik and G. D. Jindal</i>	
Reliability Assurance of Large Electric Motors in a Process Plant	642
<i>Edwin Vijay Kumar D. and Syam Sundar A.</i>	
Author Index	649
