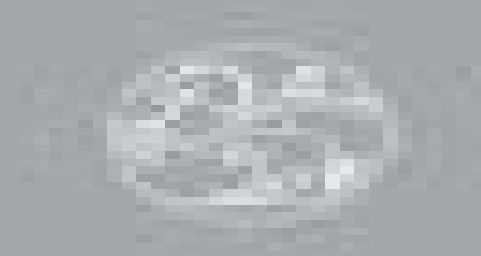


**Dependable Computing  
and Fault-Tolerant Systems  
Vol. 2**

**U. Schaefer (ed.)  
Software Diversity  
in Computerized  
Control Systems**



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# Software Diversity In Computerized Control Systems

**W. J. Quirk**



## **Software Diversity In Computerized Control Systems:**

Software Diversity in Computerized Control Systems Udo Voges, 2012-12-06 Software Diversity is one of the fault tolerance means to achieve dependable systems In this volume some experimental systems as well as real life applications of software diversity are presented The history the current state of the art and future perspectives are given Although this technique is used quite successfully in industrial applications further research is necessary to solve some open questions We hope to report on new results and applications in another volume of this series within some years Acknowledgements The idea of the workshop was put forward by the chairpersons of IFIP WG 10A J c Laprie J F Meyer and Y Tohma in January 1986 and the editor of this volume was asked to organize the workshop This volume was edited with the assistance of the editors of the series A Avizienis H Kopetz and J C Laprie who also had the function of reviewers Karlsruhe October 1987 U Voges Editor Table of Contents 1 1 Introduction U Voges 2 Railway Applications 7 ERICSSON Safety System for Railway Control 11 G Hagelin 3 Nuclear Applications 23 Use of Diversity in Experimental Reactor Safety Systems 29 U Voges The PODS Diversity Experiment 51 P G Bishop 4 Flight Applications 85 AIRBUS and ATR System Architecture and Specification 95 P Traverse 5 University Research 105 Tolerating Software Design Faults in a Command and Control System 109 T Anderson P A Barrett D N Halliwell M R Moulding DEDIX 87 A Supervisory System for Design Diversity Experiments at UCLA

**Software Diversity in Computerized Control Systems** Udo Voges, 1987-12-17 This book deals with the most important aspects of software diversity and its use in computerized control systems including theoretical background experiments and industrial realizations railway flight and nuclear applications Researchers describe their experiments with software diversity and explain their results including benefits and drawbacks Practitioners explain their use of it in real systems why they use this means of fault tolerance and how they incorporate it into their systems In addition to the papers the book contains a rather complete list of publications giving an overview on references about software diversity from its beginning until today Therefore this book is a complete description of the state of the art on the topic of software diversity

**Safety of Computer Control Systems 1985 (Safecomp '85)** W. J. Quirk, 2016-06-03 Safety of Computer Control Systems 1985 Safecomp 85 Achieving Safe Real Time Computer Systems presents the proceedings of the Fourth IFAC Workshop held in Como Italy on October 1 3 1985 This book discusses a wide range of topics ranging from direct process control through robotics to operator assistance Organized into 28 chapters this compilation of papers begins with an overview of the implementation of atomic actions by means of concurrent programming constructs This text then examines the safety related applications that usually demand the provision of redundant resources within the system Other chapters consider the safe performance of an industrial robot system that relies on several factors This book discusses as well the increasing demand for Computer Assisted Decision Making CADM both in engineering and service industries The final chapter deals with the ways of reducing the effects of an error introduced during the design of a program This book is a valuable resource for

software engineers      Safety of Computer Control Systems R. Lauber, 2014-05-19 Safety of Computer Control Systems is a collection of papers from the Proceedings of the IFAC Workshop held in Stuttgart Germany on May 16 18 1979 This book discusses the inherent problems in the hardware and software application of computerized control to automated systems safeguarding human life property and the environment The papers discuss more specific concerns such as railway systems aircraft landing systems nuclear power stations chemical reactors elevators and cranes The book also describes the safety and reliability of complex industrial computer systems together with an example showing the application of computers in power plants One paper presents guidelines in documenting safety related computer systems that will help various parties who are involved in their purchase and operation Another paper discusses how to detect failures in microcomputer systems such as memory violations and invalid operation code detectors This book then concludes by discussing the necessity of inspecting process computers used in nuclear power plants especially when computers are used in reactor protection control rod and authentication of log in systems This collection can be of interest for students of programming process computer analysts heads of computer technology departments and institutions and lecturers in industrial computer programming and design      Safety of Computer Control Systems 1986 (Safecomp '86) Trends in Safe Real Time Computer Systems W. J. Quirk, 2017-02-24 The proceedings of the fifth workshop in this subject continue the trend set by the previous four and discusses some of the current problems involved in the design and production of safe real time computer systems Topics covered include software quality assurance software fault tolerance design for safety and reliability and safety assessment Every paper details the theoretical and practical problems involved in the development of safe systems and should therefore be of interest to all those involved in systems design      Safety of Computer Control Systems 1990 (SAFECOMP'90) B.K. Daniels, 2014-06-28 The market for safe secure and reliable computer systems is expanding continuously and these Proceedings provide an opportunity to review the growth during the last decade and identify skills and technologies required for continued development in the area The papers cover the experiences gained from specifying creating operating and licensing computers in safety security and reliability related applications There are reviews of guidelines and industrial applications with a section covering methods and tools used in designing documenting analysing testing and assessing systems dependent on the SAFECOMP factors      *Software Fault Tolerance Techniques and Implementation* Laura L. Pullum, 2001 Look to this innovative resource for the most comprehensive coverage of software fault tolerance techniques available in a single volume It offers you a thorough understanding of the operation of critical software fault tolerance techniques and guides you through their design operation and performance You get an in depth discussion on the advantages and disadvantages of specific techniques so you can decide which ones are best suited for your work The book examines key programming techniques such as assertions checkpointing and atomic actions and provides design tips and models to assist in the development of critical fault tolerant software that helps ensure dependable performance From software reliability

recovery and redundancy to design and data diverse software fault tolerance techniques this practical reference provides detailed insight into techniques that can improve the overall dependability of your software

**Software Reliability Handbook** Rook,1990-03-31 The reliability of software is becoming increasingly important to a large range of industries that rely on complex computer systems and machinery with computer control The reliability of a system depends on both the hardware and the software that comprise the system Although faults in design can continue to give problems the issues and the techniques for meeting severe reliability requirements in hardware have been understood for some time In the case of software both the techniques and a positive attitude of software developers to the achievement of reliability are much less well established They are particularly crucial in the development of software dependent safety critical systems

**High-Integrity Software** C.T. Sennett,2012-12-06 4 3 The Gypsy language 72 4 4 The Gypsy Verification Environment 73 4 5 A simple example 81 4 6 Specification data types 91 4 7 Future directions 95 100 4 8 Conclusions 5 Reliable programming in standard languages 102 Bernard Carre Program Validation Ltd 5 1 Introduction 102 5 2 Language requirements for high integrity programming 103 5 3 The use of standard languages 108 5 4 Programming in Pascal and Ada 110 1 19 5 5 Practical experiences NewSpeak a reliable programming language 6 122 I F Currie Royal Signals and Radar Establishment 6 1 Introduction 122 6 2 Types and values 127 6 3 Declarations and variables 132 6 4 Guarded declarations 134 6 5 Cases and conditionals 136 6 6 Loops 138 6 7 Procedures 140 6 8 Assertions 145 6 9 Timing 147 6 10 Conclusion 149 6 11 Appendix 1 summary of syntax 150 6 12 Appendix 2 type lattice and widening 156 7 Program analysis and systematic testing 159 M A Hennell University of Liverpool and D Hedley and I J Riddell Liverpool Data Research Associates Ltd 7 1 Introduction 159 7 2 The basic requirement 160 7 3 The Liverpool experience 161 7 4 The Liverpool experiments 162 7 5 The LDRA Testbeds 163 Interpretation 169 7 6 7 7 Applicability and benefits 171 7 8 Safety critical systems 173 VI 8 Program analysis and verification 176 Bernard Carre Program Validation Ltd 8 1 Introduction 176 8

**Dependable and Historic Computing** Cliff B. Jones,John L. Lloyd,2012-01-24 This Festschrift volume published in honor of Brian Randell on the occasion of his 75th birthday contains a total of 37 refereed contributions Two biographical papers are followed by the six invited papers that were presented at the conference Dependable and Historic Computing The Randell Tales held during April 7 8 2011 at Newcastle University UK The remaining contributions are authored by former scientific colleagues of Brian Randell The papers focus on the core of Brian Randell s work the development of computing science and the study of its history Moreover his wider interests are reflected and so the collection comprises papers on software engineering storage fragmentation computer architecture programming languages and dependability There is even a paper that echoes Randell s love of maps After an early career with English Electric and then with IBM in New York and California Brian Randell joined Newcastle University His main research has been on dependable computing in all its forms especially reliability safety and security aspects and he has led several major European collaborative projects

**Architecting Dependable Systems II**

Rogério de Lemos,Cristina Gacek,Alexander Romanovsky,2004-11-29 As software systems become ubiquitous the issues of dependability become more and more critical Given that solutions to these issues must be taken into account from the very beginning of the design process it is appropriate that dependability is addressed at the architectural level This book results from an effort to bring together the research communities of software architectures and dependability Inspired by the ICSE 2003 Workshop on Software Architectures for Dependable Systems the book focuses on topics relevant to improving the state of the art in architecting dependable systems The 15 thoroughly reviewed papers originate partly from the workshop others were solicited in order to achieve complete coverage of all relevant aspects The papers are organized into topical sections on architectures for dependability fault tolerance in software architectures dependability analysis in software architectures and industrial experience

**Safety Aspects of Computer Control** Phil Bennett,2014-05-15 Safety Aspects of Computer Control focuses on the increased usage of computers and safety procedures for the control of their applications The selection first elaborates on software in safety related systems regulatory issues and legal liability Topics cover product liability liability under the contract law liability under the law of negligence methods of ensuring safety some aspects of regulation of software safety purpose and principles of regulation and direct regulation The book then examines standardization efforts worldwide real time software requirements specification and animation using extended Petri nets and independent software verification and validation in practice Discussions focus on verification and validation principles organizational principles specification language extended Petri nets environment history of software standards and standardization work realized through ISO or IEC The manuscript takes a look at design and licensing of safety related software fault tolerant control for safety and use and relevance for the development of safety critical systems Concerns include formal methods in the safety critical systems life cycle random and systematic failures hardware and systematic failures and software quality standards The book is highly recommended for computer science experts and researchers interested in the safety aspects of computer control

Dependable Computing Systems Hassan B. Diab,Albert Y. Zomaya,2005-10-05 A team of recognized experts leads the way to dependable computing systems With computers and networks pervading every aspect of daily life there is an ever growing demand for dependability In this unique resource researchers and organizations will find the tools needed to identify and engage state of the art approaches used for the specification design and assessment of dependable computer systems The first part of the book addresses models and paradigms of dependable computing and the second part deals with enabling technologies and applications Tough issues in creating dependable computing systems are also tackled including Verification techniques Model based evaluation Adjudication and data fusion Robust communications primitives Fault tolerance Middleware Grid security Dependability in IBM mainframes Embedded software Real time systems Each chapter of this contributed work has been authored by a recognized expert This is an excellent textbook for graduate and advanced undergraduate students in electrical engineering

computer engineering and computer science as well as a must have reference that will help engineers programmers and technologists develop systems that are secure and reliable

**Computer Safety, Reliability, and Security Floor**

Koornneef, Meine van der Meulen, 2003-06-29 This book constitutes the refereed proceedings of the 19th International Conference on Computer Safety Reliability and Security SAFECOMP 2000 held in Rotterdam The Netherlands in October 2000 The 33 revised full papers presented together with three invited papers were carefully reviewed and selected for inclusion in the book The papers are organized in topical sections on verification and validation software process improvement formal methods safety guidelines standards and certification hardware aspects safety assessment design for safety and transport and infrastructure

Dependable Computing - EDCC-1 Klaus Echte, Dieter Hammer, David

Powell, 1994-09-21 This book presents the proceedings of the First European Dependable Computing Conference EDCC 1 held in Berlin Germany in October 1994 EDCC is the merger of two former European events on dependable computing The volume comprises 34 refereed full papers selected from 106 submissions The contributions address all current aspects of dependable computing and reflect the state of the art in dependable systems research and advanced applications among the topics covered are hardware and software reliability safety critical and secure systems fault tolerance and detection verification and validation formal methods hardware and software testing and parallel and distributed systems

**Safe**

**Comp 96** Erwin Schoitsch, 2012-12-06 SAFECOMP 96 contains papers presented at the 15th International Conference on Computer Safety Reliability and Security held in Vienna Austria 23 25 October 1996 The conference aimed to provide an opportunity for technical developers and users to discuss and review their experiences to consider the best technologies currently available and to identify the skills and technologies required for the future SAFECOMP 96 focuses on critical computer applications and is intended as a platform for technology transfer between academia industry and research institutions SAFECOMP 96 will be of interest to all those in universities research institutions industry and business who want to be well informed about the current international state of the art in computer safety reliability and security

**Predictably Dependable Computing Systems** Brian Randell, Jean-Claude Laprie, Hermann Kopetz, Bev

Littlewood, 2013-11-11 **Fault Tolerance** Peter A. Lee, Thomas Anderson, 2012-12-06 The production of a new version of any book is a daunting task as many authors will recognise In the field of computer science the task is made even more daunting by the speed with which the subject and its supporting technology move forward Since the publication of the first edition of this book in 1981 much research has been conducted and many papers have been written on the subject of fault tolerance Our aim then was to present for the first time the principles of fault tolerance together with current practice to illustrate those principles We believe that the principles have so far stood the test of time and are as appropriate today as they were in 1981 Much work on the practical applications of fault tolerance has been undertaken and techniques have been developed for ever more complex situations such as those required for distributed systems Nevertheless the basic principles

remain the same      *Dependable Computing for Critical Applications 4* Flaviu Cristian, Gerard LeLann, Teresa Lunt, 2012-12-06 This volume contains the articles presented at the Fourth International FIP Working Conference on Dependable Computing for Critical Applications held in San Diego California on January 4-6 1994 In keeping with the previous three conferences held in August 1989 at Santa Barbara USA in February 1991 at Tucson USA and in September 1992 at Mondello Italy the conference was concerned with an important basic question can we rely on computer systems for critical applications This conference like its predecessors addressed various aspects of dependability a broad term defined as the degree of trust that may justifiably be placed in a system's reliability availability safety security and performance Because of its broad scope a main goal was to contribute to a unified understanding and integration of these concepts The Program Committee selected 21 papers for presentation from a total of 95 submissions at a September meeting in Menlo Park California The resulting program represents a broad spectrum of interests with papers from universities corporations and government agencies in eight countries The selection process was greatly facilitated by the diligent work of the program committee members for which we are most grateful As a Working Conference the program was designed to promote the exchange of ideas by extensive discussions All paper sessions ended with a 30 minute discussion period on the topics covered by the session In addition three panel sessions have been organized

**Fehlertolerierende Rechensysteme / Fault-tolerant Computing Systems** Winfried Görke, Holger Sörensen, 2012-12-06 Dieses Buch enthält die Beiträge der 4 GI ITG GMA Fachtagung über Fehlertolerierende Rechensysteme die im September 1989 in einer Reihe von Tagungen in München 1982 Bonn 1984 sowie Bremerhaven 1987 veranstaltet wurde Die 31 Beiträge darunter 4 eingeladene sind teils in deutscher überwiegend aber in englischer Sprache verfaßt Insgesamt wird durch diese Beiträge die Entwicklung der Konzeption und Implementierung fehlertoleranter Systeme in den letzten zwei Jahren vor allem in Europa dokumentiert Somitliche Beiträge berichten über neue Forschungs- oder Entwicklungsergebnisse



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