

Software Engineering Experimentation

An Experimental Framework

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Experimentation In Software Engineering Experimentation In Software Engineering

Marvin Zelkowitz



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Experimentation in Software Engineering Claes Wohlin, Per Runeson, Martin Höst, Magnus C. Ohlsson, Björn Regnell, Anders Wesslén, 2012-06-16 Like other sciences and engineering disciplines software engineering requires a cycle of model building experimentation and learning Experiments are valuable tools for all software engineers who are involved in evaluating and choosing between different methods techniques languages and tools The purpose of Experimentation in Software Engineering is to introduce students teachers researchers and practitioners to empirical studies in software engineering using controlled experiments The introduction to experimentation is provided through a process perspective and the focus is on the steps that we have to go through to perform an experiment The book is divided into three parts The first part provides a background of theories and methods used in experimentation Part II then devotes one chapter to each of the five experiment steps scoping planning execution analysis and result presentation Part III completes the presentation with two examples Assignments and statistical material are provided in appendixes Overall the book provides indispensable information regarding empirical studies in particular for experiments but also for case studies systematic literature reviews and surveys It is a revision of the authors book which was published in 2000 In addition substantial new material e g concerning systematic literature reviews and case study research is introduced The book is self contained and it is suitable as a course book in undergraduate or graduate studies where the need for empirical studies in software engineering is stressed Exercises and assignments are included to combine the more theoretical material with practical aspects Researchers will also benefit from the book learning more about how to conduct empirical studies and likewise practitioners may use it as a cookbook when evaluating new methods or techniques before implementing them in their organization

Experimentation in Software Engineering Claes Wohlin, Per Runeson, Martin Höst, Magnus C. Ohlsson, Björn Regnell, Anders Wesslén, 2024-08-11 This textbook which has become the leading source for empirical software engineering research through its earlier editions provides an in depth introduction to experimentation in software engineering The focus is on the steps to go through when conducting experiments It also introduces a structure for selecting a research design and an introduction to systematic literature reviews surveys and case study research Experiments are valuable tools for all software engineers who evaluate and choose between different solutions methods techniques languages and tools The book has three main parts Part I introduces empirical research through a structure for selecting a research design and explains several essential areas related to empirical research Moreover it provides introductions to systematic literature reviews experiments surveys and case studies Part II devotes one chapter to each of the five experiment steps scoping planning execution analysis and result presentation Part III completes the presentation with two examples Assignments and statistical material are provided in appendixes The book provides indispensable information regarding empirical studies particularly for experiments but also for systematic literature studies surveys and case studies This new edition comprises substantial new material This includes a

chapter on selecting a research design which helps put experimentation into a broader context of other research approaches Furthermore a new chapter on survey research has been added Novel contributions concerning A B testing replications open science validity threats paired comparison design and tools for statistical analysis have been added Moreover systematic literature studies experiments and case study research descriptions have been consolidated The book has also been updated based on the evolution of software engineering since the previous edition s publication The book is intended for students teachers researchers and practitioners who would like to compare different options for example feature designs or different development methods techniques languages or tools Teachers can use the book for undergraduate or graduate students the book can be used as a course book on experimentation and empirical studies in general Researchers will also benefit from the book by learning more about how to conduct empirical studies Likewise practitioners may use it as a cookbook when evaluating different solutions alternatively for evaluating new methods or techniques before implementing them in their organisation

Experimentation in Software Engineering Claes Wohlin, Per Runeson, Martin Höst, Magnus C. Ohlsson, Björn Regnell, Anders Wesslén, 2024-09-03 This textbook which has become the leading source for empirical software engineering research through its earlier editions provides an in depth introduction to experimentation in software engineering The focus is on the steps to go through when conducting experiments It also introduces a structure for selecting a research design and an introduction to systematic literature reviews surveys and case study research Experiments are valuable tools for all software engineers who evaluate and choose between different solutions methods techniques languages and tools The book has three main parts Part I introduces empirical research through a structure for selecting a research design and explains several essential areas related to empirical research Moreover it provides introductions to systematic literature reviews experiments surveys and case studies Part II devotes one chapter to each of the five experiment steps scoping planning execution analysis and result presentation Part III completes the presentation with two examples Assignments and statistical material are provided in appendices The book provides indispensable information regarding empirical studies particularly for experiments but also for systematic literature studies surveys and case studies This new edition comprises substantial new material This includes a chapter on selecting a research design which helps put experimentation into a broader context of other research approaches Furthermore a new chapter on survey research has been added Novel contributions concerning A B testing replications open science validity threats paired comparison design and tools for statistical analysis have been added Moreover systematic literature studies experiments and case study research descriptions have been consolidated The book has also been updated based on the evolution of software engineering since the previous edition s publication The book is intended for students teachers researchers and practitioners who would like to compare different options for example feature designs or different development methods techniques languages or tools Teachers can use the book for undergraduate or graduate students the book can be used as a course book on experimentation and empirical studies in

general Researchers will also benefit from the book by learning more about how to conduct empirical studies Likewise practitioners may use it as a cookbook when evaluating different solutions alternatively for evaluating new methods or techniques before implementing them in their organisation

Basics of Software Engineering Experimentation Natalia Juristo, Ana M. Moreno, 2013-03-14 Basics of Software Engineering Experimentation is a practical guide to experimentation in a field which has long been underpinned by suppositions assumptions speculations and beliefs It demonstrates to software engineers how Experimental Design and Analysis can be used to validate their beliefs and ideas The book does not assume its readers have an in depth knowledge of mathematics specifying the conceptual essence of the techniques to use in the design and analysis of experiments and keeping the mathematical calculations clear and simple Basics of Software Engineering Experimentation is practically oriented and is specially written for software engineers all the examples being based on real and fictitious software engineering experiments

Experimental Software Engineering Issues: H. Dieter Rombach, Victor R. Basili, Richard W. Selby, 1993-08-30 This book was written primarily for all those DTP users and programmers who want to keep up with the rapid development of electronic publishing particular those who wish to develop new systems for the output of typefaces In this volume various formats are presented their properties discussed and production requirements analyzed Appendices provide readers additional information largely on digital formats for typeface storage

Guide to Advanced Empirical Software Engineering Forrest Shull, Janice Singer, Dag I. K. Sjøberg, 2007-11-21 Empirical studies have become an important part of software engineering research and practice Ten years ago it was rare to see a conference or journal article about a software development tool or process that had empirical data to back up the claims Today in contrast it is becoming more and more common that software engineering conferences and journals are not only publishing but eliciting articles that describe a study or evaluation Moreover a very successful conference International Symposium on Empirical Software Engineering and Measurement journal Empirical Software Engineering and organization International Software Engineering Research Network have all evolved in the last 10 years that focus solely on this area As a further illustration of the growth of empirical software engineering a search in the articles of 10 software engineering journals showed that the proportion of articles that used the term empirical software engineering doubled from about 6% in 1997 to about 12% in 2006 While empirical software engineering has seen such substantial growth there is not yet a reference book that describes advanced techniques for running studies and their application This book aims to fill that gap The chapters are written by some of the top international empirical software engineering researchers and focus on the practical knowledge necessary for conducting reporting and using empirical methods in software engineering The book is intended to serve as a standard reference

Handbook on Teaching Empirical Software Engineering Daniel Mendez, Paris Avgeriou, Marcos Kalinowski, Nauman Bin Ali, 2024-12-24 This handbook exploits the profound experience and expertise of well established scholars in the empirical software engineering community to provide guidance

and support in teaching various research methods and fundamental concepts A particular focus is thus on combining research methods and their epistemological settings and terminology with didactics and pedagogy for the subject The book covers the most essential contemporary research methods and philosophical and cross cutting concerns in software engineering research considering both academic and industrial settings at the same time providing insights into the effective teaching of concepts and strategies To this end the book is organized into four major parts In the first part the editors set the foundation with two chapters one laying out the larger context of the discipline for a positioning of the remainder of this book and one guiding the creation of a syllabus for courses in empirical software engineering The second part of the book lays the fundamentals for teaching empirical software engineering addressing more cross cutting aspects from theorizing and teaching research designs to measurement and quantitative data analysis In the third part general experiences and personal reflections from teaching empirical software engineering in different settings are shared Finally the fourth part contains a number of carefully selected research methods presented through an educational lens Next to the chapter contributions themselves that provide a more theoretical perspective and practical advice readers will find additional material in the form of for example slide sets and tools in an online material section The book mainly targets three different audiences 1

educators teaching empirical software engineering to undergraduate postgraduate or doctoral students 2 professional trainers teaching the basic concepts of empirical software engineering to software professionals and 3 students and trainees attending such courses Requirements Targeting Software and Systems Engineering Manfred Broy, Bernhard Rumpe, 2005-06-30 This book constitutes the strictly refereed post workshop proceedings of the International Workshop on Requirements Targeting Software and Systems Engineering RTSE 97 held in Bernried Germany in October 1997 The 15 revised full papers presented in the book were carefully revised and reviewed for inclusion in the book Among the authors are internationally leading researchers The book is divided in sections on foundations of software engineering methodology evaluation and case studies and tool support and prototyping *Security on the Web* Marvin Zelkowitz, 2011-05-24 This is

volume 74 of *Advances in Computers* subtitled *Recent Advances in Software Development* This series which began in 1960 is the oldest continuously published series of books that has chronicled the ever changing landscape of information technology Each year three volumes are published each presenting five to seven chapters describing the latest technology in the use of computers today In this current volume we present six chapters that give an update on some of the major issues affecting the development of software today The six chapters in this volume can be divided into two general categories The first three deal with the increasing importance of security in the software we write and provide insights into how to increase that security The three latter chapters look at software development as a whole and provide guidelines in how best to make certain decisions on a project level basis Perspectives on the Future of Software Engineering Jürgen Münch, Klaus

Schmid, 2013-06-13 The dependence on quality software in all areas of life is what makes software engineering a key

discipline for today's society. Thus over the last few decades it has been increasingly recognized that it is particularly important to demonstrate the value of software engineering methods in real world environments a task which is the focus of empirical software engineering. One of the leading protagonists of this discipline worldwide is Prof. Dr. h.c. Dieter Rombach who dedicated his entire career to empirical software engineering. For his many important contributions to the field he has received numerous awards and recognitions including the U.S. National Science Foundation's Presidential Young Investigator Award and the Cross of the Order of Merit of the Federal Republic of Germany. He is a Fellow of both the ACM and the IEEE Computer Society. This book published in honor of his 60th birthday is dedicated to Dieter Rombach and his contributions to software engineering in general as well as to empirical software engineering in particular. This book presents invited contributions from a number of the most internationally renowned software engineering researchers like Victor Basili, Barry Boehm, Manfred Broy, Carlo Ghezzi, Michael Jackson, Leon Osterweil and of course by Dieter Rombach himself. Several key experts from the Fraunhofer IESE, the institute founded and led by Dieter Rombach, also contributed to the book. The contributions summarize some of the most important trends in software engineering today and outline a vision for the future of the field. The book is structured into three main parts. The first part focuses on the classical foundations of software engineering such as notations, architecture and processes while the second addresses empirical software engineering in particular as the core field of Dieter Rombach's contributions. Finally the third part discusses a broad vision for the future of software engineering.

Experimentation in Software Engineering Claes Wohlin, Per Runeson, Martin Host, 1999-12-01

Identifying Relevant Information for Testing Technique Selection Sira Vegas, Natalia Juristo, Victor R.

Basili, 2012-12-06. Engineering tasks are supposed to achieve defined goals under certain project constraints. Example goals of software engineering tasks include achieving a certain functionality together with some level of reliability or performance. Example constraints of software engineering tasks include budget and time limitations or experience limitations of the developers at hand. Planning of an engineering project requires the selection of techniques, methods and tools suited to achieve stated goals under given project constraints. This assumes sufficient knowledge regarding the process-product relationships or effects of candidate techniques, methods and tools. Planning of software projects suffers greatly from lack of knowledge regarding the process-product relationships of candidate techniques, methods and tools. Especially in the area of testing a project planner is confronted with an abundance of testing techniques but very little knowledge regarding their effects under varying project conditions. This book offers a novel approach to addressing this problem. First based on a comprehensive initial characterization scheme (see chapter 7) an overview of existing testing techniques and their effects under varying conditions is provided to guide the selection of testing approaches. Second the optimisation of this knowledge base is suggested based on experience from experts' real projects and scientific experiments (chapters 8, 9 and 10). This book is of equal interest to practitioners, researchers and students. Practitioners interested in identifying ways to organize their

company specific knowledge about testing could start with the schema provided in this book and optimise it further by applying similar strategies as offered in chapters 8 and 9

Testing Software and Systems Burkhart Wolff, Fatiha Zaidi, 2011-10-21 This book constitutes the refereed proceedings of the 23rd IFIP WG 6.1 International Conference on Testing Software and Systems ICTSS 2011 held in Paris France in November 2011 The 13 revised full papers presented together with 2 invited talks were carefully selected from 40 submissions The papers address the conceptual theoretic and practical problems of testing software systems including communication protocols services distributed platforms middleware controllers and security infrastructures

Product Focused Software Process Improvement Frank Bomarius, Hajimu Iida, 2004-03-25 This book constitutes the refereed proceedings of the 5th International Conference on Product Focused Software Process Improvement PROFES 2004 held in Kansai Science City Japan in April 2004 The 41 revised full papers presented were carefully reviewed and selected and constitute a balanced mix of academic and industrial aspects The papers are organized in topical sections on software process improvement software quality measurement methods and tools experimental software engineering industrial experiences agile methods software process assessment requirements engineering and software reuse and COTS

Empirical Methods and Studies in Software Engineering Reidar Conradi, 2003-08-21 Nowadays societies crucially depend on high quality software for a large part of their functionalities and activities Therefore software professionals researchers managers and practitioners alike have to competently decide what software technologies and products to choose for which purpose For various reasons systematic empirical studies employing strictly scientific methods are hardly practiced in software engineering Thus there is an unquestioned need for developing improved and better qualified empirical methods for their application in practice and for dissemination of the results This book describes different kinds of empirical studies and methods for performing such studies e.g. for planning performing analyzing and reporting such studies Actual studies are presented in detail in various chapters dealing with inspections testing object oriented techniques and component based software engineering

Lecture Notes on Empirical Software Engineering Natalia Juristo, Ana M. Moreno, 2003 Empirical verification of knowledge is one of the foundations for developing any discipline As far as software construction is concerned the empirically verified knowledge is not only sparse but also not very widely disseminated among developers and researchers This book aims to spread the idea of the importance of empirical knowledge in software development from a highly practical viewpoint It has two goals 1 Define the body of empirically validated knowledge in software development so as to advise practitioners on what methods or techniques have been empirically analysed and what the results were 2 as empirical tests have traditionally been carried out by universities or research centres propose techniques applicable by industry to check on the software development technologies they use

Testing Software and Systems Franz Wotawa, Mihai Nica, Natalia Kushik, 2016-10-10 This book constitutes the refereed proceedings of the 27th IFIP WG 6.1 International Conference on Testing Software and Systems ICTSS 2016 held in Graz

Austria in October 2016 The 12 revised full papers and 6 short papers presented were carefully reviewed and selected from 41 submissions The papers are organized in topical sections on testing methodologies heuristics and non determinism in testing practical applications and short contributions **Testing Software and Systems** Hüsnu Yenigün,Cemal Yilmaz,Andreas Ulrich,2013-10-30 This book constitutes the refereed proceedings of the 25th IFIP WG 6.1 International Conference on Testing Software and Systems ICTSS 2013 held in Istanbul Turkey in November 2013 The 17 revised full papers presented together with 3 short papers were carefully selected from 68 submissions The papers are organized in topical sections on model based testing testing timed and concurrent systems test suite selection and effort estimation tools and languages and debugging *Experimental Software Engineering Issues* H.Dieter Rombach,Victor R. Basili,Richard W. Selby,2014-01-15 *Testing Software and Systems* Alexandre Petrenko,Adenilso Simao,José Carlos Maldonado,2010-10-25 Annotation This book constitutes the refereed proceedings of the 22nd IFIP WG 6.1 International Conference on Testing Software and Systems ICTSS 2010 held in Natal Brazil in November 2010 ICTSS 2010 is the merger of the 22nd IFIP International Conference on Testing of Communicating Systems TESTCOM and the 10th International Workshop on Formal Approaches to Testing of Software FATES The 16 revised full papers presented together with 2 invited presentations were carefully selected from 60 submissions The papers cover a wide range of topics in the field of testing of general software and systems such as test automation integration testing test case selection search based testing combinatorial testing inductive testing test architectures for large scale systems and end to end performance testing

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