

Larch: Languages and Tools for Formal Specification



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6.853 Lecture

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Larch Languages And Tools For Formal Specification

Marie-Claude Gaudel, Jim Woodcock



Larch Languages And Tools For Formal Specification:

Larch: Languages and Tools for Formal Specification John V. Guttag, James J. Horning, 2012-12-06 Building software often seems harder than it ought to be. It takes longer than expected, the software's functionality and performance are not as wonderful as hoped, and the software is not particularly malleable or easy to maintain. It does not have to be that way. This book is about programming and the role that formal specifications can play in making programming easier and programs better. The intended audience is practicing programmers and students in undergraduate or basic graduate courses in software engineering or formal methods. To make the book accessible to such an audience, we have not presumed that the reader has formal training in mathematics or computer science. We have, however, presumed some programming experience. The roles of formal specifications. Designing software is largely a matter of combining inventing and planning the implementation of abstractions. The goal of design is to describe a set of modules that interact with one another in simple, well-defined ways. If this is achieved, people will be able to work independently on different modules, and yet the modules will fit together to accomplish the larger purpose. In addition, during program maintenance, it will be possible to modify a module without affecting many others. Abstractions are intangible, but they must somehow be captured and communicated. That is what specifications are for. Specification gives us a way to say what an abstraction is independent of any of its implementations.

Larch: Languages and Tools for Formal Specification John V. Guttag, James J. Horning, 2012-01-25 Building software often seems harder than it ought to be. It takes longer than expected, the software's functionality and performance are not as wonderful as hoped, and the software is not particularly malleable or easy to maintain. It does not have to be that way. This book is about programming and the role that formal specifications can play in making programming easier and programs better. The intended audience is practicing programmers and students in undergraduate or basic graduate courses in software engineering or formal methods. To make the book accessible to such an audience, we have not presumed that the reader has formal training in mathematics or computer science. We have, however, presumed some programming experience. The roles of formal specifications. Designing software is largely a matter of combining inventing and planning the implementation of abstractions. The goal of design is to describe a set of modules that interact with one another in simple, well-defined ways. If this is achieved, people will be able to work independently on different modules, and yet the modules will fit together to accomplish the larger purpose. In addition, during program maintenance, it will be possible to modify a module without affecting many others. Abstractions are intangible, but they must somehow be captured and communicated. That is what specifications are for. Specification gives us a way to say what an abstraction is independent of any of its implementations.

ZUM '95: The Z Formal Specification Notation Jonathan P. Bowen, 1995-08-23 This book presents the proceedings of the 9th International Conference of Z Users, ZUM 95, held in Limerick, Ireland, in September 1995. The book contains 34 carefully selected papers on Z, including Z applications, Z proof, testing, industrial usage, object orientation.

animation of specification method integration and teaching formal methods Of particular interest is the inclusion of an annotated Z bibliography listing 544 entries While focussing on Z by far the most commonly used formal method both in industry and application the volume is of high relevance for the whole formal methods community

Formal Specification Techniques for Engineering Modular C Programs Tan Yang Meng, 2012-12-06 Software is difficult to develop maintain and reuse Two factors that contribute to this difficulty are the lack of modular design and good program documentation The first makes software changes more difficult to implement The second makes programs more difficult to understand and to maintain Formal Specification Techniques for Engineering Modular C Programs describes a novel approach to promoting program modularity The book presents a formal specification language that promotes software modularity through the use of abstract data types even though the underlying programming language may not have such support This language is structured to allow useful information to be extracted from a specification which is then used to perform consistency checks between the specification and its implementation Formal Specification Techniques for Engineering Modular C Programs also describes a specification driven software re engineering process model for improving existing programs The aim of this process is to make existing programs easier to maintain and reuse while keeping their essential functionalities unchanged Audience Suitable as a secondary text for graduate level courses in software engineering and as a reference for researchers and practitioners in industry

Foundations of Algebraic Specification and Formal Software Development Donald Sannella, Andrzej Tarlecki, 2012-01-05 This book provides foundations for software specification and formal software development from the perspective of work on algebraic specification concentrating on developing basic concepts and studying their fundamental properties These foundations are built on a solid mathematical basis using elements of universal algebra category theory and logic and this mathematical toolbox provides a convenient language for precisely formulating the concepts involved in software specification and development Once formally defined these notions become subject to mathematical investigation and this interplay between mathematics and software engineering yields results that are mathematically interesting conceptually revealing and practically useful The theory presented by the authors has its origins in work on algebraic specifications that started in the early 1970s and their treatment is comprehensive This book contains five kinds of material the requisite mathematical foundations traditional algebraic specifications elements of the theory of institutions formal specification and development and proof methods While the book is self contained mathematical maturity and familiarity with the problems of software engineering is required and in the examples that directly relate to programming the authors assume acquaintance with the concepts of functional programming The book will be of value to researchers and advanced graduate students in the areas of programming and theoretical computer science

Specification of Software Systems V.S. Alagar, K. Periyasamy, 2013-03-14 This is a textbook on software specification emphasizing formal methods that are relevant to requirements and design stages of software development The aim of the

book is to teach the fundamental principles of formal methods in the construction of modular and verifiable formal specifications. The book introduces several formal specification techniques and illustrates the expressive power of each technique with a number of examples.

General Characteristics Traditional textbooks on software engineering discuss the difficulties and challenges that lie on the path from requirements analysis to implementation of a software product. Most of these books describe some techniques in detail and give hints on implementation of these techniques. Only a few among them deal with important software engineering principles and techniques and discuss how a particular technique may be used to implement a given principle. There is very little exposure in these books to a rigorous approach to or a systematic study of the construction of verifiable software. Those who have acquired an understanding of the fundamental principles of software engineering from traditional textbooks will find the following characteristics of this book quite relevant to the practice of software engineering. The book deals with specification. The principal characteristic of this book is to discuss formalisms that provide a theoretical foundation for the principles of software engineering and are appropriate to the requirements and design stages of software development.

FME 2003: Formal Methods Keijiro Araki, 2003-08-27 This book constitutes the refereed proceedings of the International Symposium of Formal Methods Europe FME 2003 held in Pisa Italy in September 2003. The 44 revised full papers presented together with 5 invited papers were carefully reviewed and selected from 144 submissions. The papers are organized in topical sections on industrial issues, control systems and applications, communication system verification, co-specification and compilers, composition, Java object orientation and modularity, model checking, parallel processes, program checking and testing, B method and security.

FME '96: Industrial Benefit and Advances in Formal Methods Marie-Claude Gaudel, Jim Woodcock, 1996-03-06 This book presents the refereed proceedings of the Third International Symposium of Formal Methods Europe FME 96 held in Oxford UK in March 1996. FME 96 was co-sponsored by IFIP WG 14.3 and devoted to the application and demonstrated industrial benefit of formal methods, their new horizons and strengthened foundations. The 35 full revised papers included were selected from a total of 103 submissions; also included are three invited papers. The book addresses all relevant aspects of formal methods from the point of view of the industrial R & D professional as well as from the academic viewpoint and impressively documents the significant progress in the use of formal methods for the solution of real world problems.

A Formal Approach to Hardware Design Jørgen Staunstrup, 2012-12-06 A Formal Approach to Hardware Design discusses designing computations to be realised by application specific hardware. It introduces a formal design approach based on a high level design language called Synchronized Transitions. The models created using Synchronized Transitions enable the designer to perform different kinds of analysis and verification based on descriptions in a single language. It is for example possible to use exactly the same design description both for mechanically supported verification and synthesis. Synchronized Transitions is supported by a collection of public domain CAD tools. These tools can be used with the book in presenting a course on the subject. A Formal

Approach to Hardware Design illustrates the benefits to be gained from adopting such techniques but it does so without assuming prior knowledge of formal design methods The book is thus not only an excellent reference it is also suitable for use by students and practitioners

Formal Description Techniques IX R. Gotzhein, J. Brederke, 2016-01-09 This book is the combined proceedings of the latest IFIP Formal Description Techniques FDTs and Protocol Specification Testing and Verification PSTV series It addresses FDTs applicable to communication protocols and distributed systems with special emphasis on standardised FDTs It features state of the art in theory application tools and industrialisation of formal description

Formal Methods for Industrial Applications Jean-Raymond Abrial, Egon Börger, Hans Langmaack, 1996-10-30 This book with the CD ROM included is the documentation of a unique collaborative effort in evaluating formal methods for usage under industrial constraints the major techniques for formally supported specification design and verification of large programs and complex systems are applied to a non trivial and non academic problem which is typical for industrial informal requirements specifications The 21 papers included in the book together with an introduction and competition report were selected from 33 candidate solutions This book comes with a CD ROM containing besides the printed papers executable code full definitions of all parts of the specifications and detailed descriptions of foundational matters where appropriate

Formal Methods and Software Engineering Yamine Ait-Ameur, Shengchao Qin, 2019-10-28 This book constitutes the proceedings of the 21st International Conference on Formal Engineering Methods ICFEM 2019 held in Shenzhen China in November 2019 The 28 full and 8 short papers presented in this volume were carefully reviewed and selected from 94 submissions They deal with the recent progress in the use and development of formal engineering methods for software and system design and record the latest development in formal engineering methods

FM'99 - Formal Methods Jeannette M. Wing, Jim Woodcock, Jim Davies, 1999-09-13 Formal methods are coming of age Mathematical techniques and tools are now regarded as an important part of the development process in a wide range of industrial and governmental organisations A transfer of technology into the mainstream of systems development is slowly but surely taking place FM 99 the First World Congress on Formal Methods in the Development of Computing Systems is a result and a measure of this new found maturity It brings an impressive array of industrial and applications oriented papers that show how formal methods have been used to tackle real problems These proceedings are a record of the technical symposium offM 99 also the papers describing applications of formal methods you will find technical reports papers and abstracts detailing new advances in formal techniques from mathematical foundations to practical tools The World Congress is the successor to the four Formal Methods Europe Symposia which in turn succeeded the four VDM Europe Symposia This session reflects an increasing openness within the international community of researchers and practitioners papers were submitted covering a wide variety of formal methods and application areas The programme committee reflects the Congress's international nature with a membership of 84 leading researchers from 38 different countries The committee was divided into

19 tracks each with its own chair to oversee the reviewing process Our collective task was a difficult one there were 259 high quality submissions from 35 different countries

Handbook Of Software Engineering And Knowledge Engineering, Vol 2: Emerging Technologies Shi-kuo Chang, 2002-05-10 This is the first handbook to cover comprehensively both software engineering and knowledge engineering two important fields that have become interwoven in recent years Over 60 international experts have contributed to the book Each chapter has been written in such a way that a practitioner of software engineering and knowledge engineering can easily understand and obtain useful information Each chapter covers one topic and can be read independently of other chapters providing both a general survey of the topic and an in depth exposition of the state of the art Practitioners will find this handbook useful when looking for solutions to practical problems Researchers can use it for quick access to the background current trends and most important references regarding a certain topic The handbook consists of two volumes Volume One covers the basic principles and applications of software engineering and knowledge engineering Volume Two will cover the basic principles and applications of visual and multimedia software engineering knowledge engineering data mining for software knowledge and emerging topics in software engineering and knowledge engineering

Formal Methods and Software Engineering Jin Song Dong, Huibiao Zhu, 2010-11-09 This book constitutes the refereed proceedings of the 12th International Conference on Formal Engineering Methods ICFEM 2010 held in Shanghai China November 2010 The 42 revised full papers together with 3 invited talks presented were carefully reviewed and selected from 114 submissions The papers address all current issues in formal methods and their applications in software engineering They are organized in topical sections on theorem proving and decision procedures web services and workflow verification applications of formal methods probability and concurrency program analysis model checking object orientation and model driven engineering as well as specification and verification

CAFE: An Industrial-Strength Algebraic Formal Method K. Futatsugi, A.T. Nakagawa, T. Tamai, 2000-10-06 This book contains selected papers on the language applications and environments of CafeOBJ which is a state of the art algebraic specification language The authors are speakers at a workshop held in 1998 to commemorate a large industrial academic project dedicated to CafeOBJ The project involved more than 40 people from more than 10 organisations of which 6 are industrial The workshop attracted about 30 talks and more than 70 attendees The papers in the book however are either heavily revised versions presented at the workshop to reflect recent advancements or research or completely new ones written especially for this book In this regard the book is not a usual postpublication after a workshop Also although it is a compendium of papers that are related to CafeOBJ the book is not a manual reference or tutorial of CafeOBJ Probably the best description is that it is a collection of papers that investigate how to use or to make it easy to use CafeOBJ Reflecting the diverse nature of the project and its participants most of the authors are participants to the project the papers put together offer a comprehensive picture from this methodological perspective Some papers deal with various advanced aspects of the language such as rewriting logic and

behavioural logic For rewriting logic a couple of significant applications were reported In particular UML now considered de facto standard language for modelling systems is the subject of one paper For behavioural logic new methodological guidelines are presented Some papers shed new light on a more traditional paradigm in the language order sorted equational specifications One paper in particular deal with a way to associate CafeOBJ with object oriented programming The other papers deal with environments for writing and verifying specifications written in CafeOBJ Underlying those papers are two major considerations user interfaces for manipulating specifications and systematic supports for proofs All the environments explained in the papers assume and support distributed computing and de facto standard network technologies such as WWW and http are incorporated

Teaching Formal Methods Jeremy Gibbons, Jose Nuno Oliveira, 2009-10-26 This book constitutes the refereed proceedings of the TFM 2009 held in Eindhoven The Netherlands in November 2009 The 10 revised full papers presented together with an abstracts of invited talk were carefully reviewed and selected from 19 submissions The papers presented explore the experiences of teaching FMs both successful and unsuccessful educational resources including the use of books case studies and the internet the education of weak and mathphobic students the integration or otherwise of FMs into the curriculum including contributions to the definition of a Formal Methods Body of Knowledge FMBOK the advantages of FM trained graduates in the workplace changing attitudes towards FMs in students academic staff and practitioners and the necessary mathematical background

Formal Engineering for Industrial Software Development Shaoying Liu, 2013-03-09 In any serious engineering discipline it would be unthinkable to construct a large system without having a precise notion of what is to be built and without verifying how the system is expected to function Software engineering is no different in this respect Formal methods involve the use of mathematical notation and calculus in software development such methods are difficult to apply to large scale systems with practical constraints e g limited developer skills time and budget restrictions changing requirements Here Liu claims that formal engineering methods may bridge this gap He advocates the incorporation of mathematical notation into the software engineering process thus substantially improving the rigor comprehensibility and effectiveness of the methods commonly used in industry This book provides an introduction to the SOFL Structured Object Oriented Formal Language method that was designed and industry tested by the author Written in a style suitable for lecture courses or for use by professionals there are numerous exercises and a significant real world case study so the readers are provided with all the knowledge and examples needed to successfully apply the method in their own projects

FME 2001: Formal Methods for Increasing Software Productivity Jose N. Oliveira, Pamela Zave, 2003-06-29 FME 2001 is the tenth in a series of meetings organized every eighteen months by Formal Methods Europe FME an independent association whose aim is to stimulate the use of and research on formal methods for software development It follows four VDM Europe Symposia four other Formal Methods Europe Symposia and the 1999 World Congress on Formal Methods in the Development of Computing Systems These meetings have been notably successful in bringing

gether a community of users researchers and developers of precise mathematical methods for software development FME 2001 took place in Berlin Germany and was organized by the Computer Science Department of the Humboldt University at Berlin The theme of the symposium was Formal Methods for Increasing Software Productivity This theme recognizes that formal methods have the potential to do more for industrial software development than enhance software quality they can also increase productivity at many different points in the software life cycle The importance of the theme is borne out by the many contributed papers showing how formal methods can make software development more efficient There is an emphasis on tools that find errors automatically or with relatively little human effort There is also an emphasis on the use of formal methods to assist with critical labor intensive tasks such as program design and test case generation **The Generic Development**

Language Deva Matthias Weber, Martin Simons, Christine Lafontaine, 1993-10-28 This book summarizes work done by the authors under the Esprit Tool Use project 1985-1990 at GMD in Karlsruhe and at Berlin University of Technology It provides a comprehensive description of the generic development language Deva designed by the authors Much of the research reported in this monograph is inspired by the work of Michel Sintzoff on formal program development he contributed an enlightening Foreword Deva is essentially a typed functional language with certain deduction rules The difference with ordinary languages is of course the application domain the types serve here to express propositions such as specifications or programs rather than just data classes Its practical applicability was tested on several non trivial case studies The whole book is written using the DVWEB system a WEB for Deva being implemented at the Berlin University of Technology

Reviewing **Larch Languages And Tools For Formal Specification**: Unlocking the Spellbinding Force of Linguistics

In a fast-paced world fueled by information and interconnectivity, the spellbinding force of linguistics has acquired newfound prominence. Its capacity to evoke emotions, stimulate contemplation, and stimulate metamorphosis is really astonishing. Within the pages of "**Larch Languages And Tools For Formal Specification**," an enthralling opus penned by a very acclaimed wordsmith, readers attempt an immersive expedition to unravel the intricate significance of language and its indelible imprint on our lives. Throughout this assessment, we shall delve to the book is central motifs, appraise its distinctive narrative style, and gauge its overarching influence on the minds of its readers.

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