4 an Ellaborating overview of Configurable software: a Tertiary Study

FOSD 2023 Meeting | **Rahel Arens**, Thomas Thüm | March 31, 2023

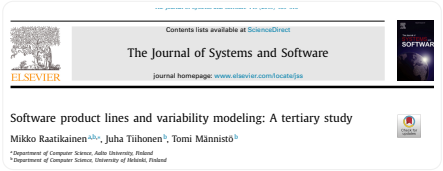
universität ulm

4 an Ellaborating overview of Configurable software: a Tertiary Study - 4 ECTS

FOSD 2023 Meeting | **Rahel Arens**, Thomas Thüm | March 31, 2023

universität ulm

Motivation



Contents lists available at ScienceDirect

The Journal of Systems and Software

journal homepage: www.elsevier.com/locate/jss

Software product lines and variability modeling: A tertiary study

Mikko Raatikainen [a,b,*], Juha Tiihonen [b], Tomi Männistö [b]

[a] Department of Computer Science, Aalto University, Finland
[b] Department of Computer Science, University of Helsinki, Finland

Systematic Studies in Software Product Lines: A Tertiary Study

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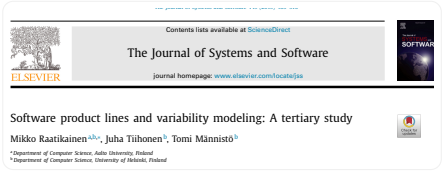
kchnitk@ieee.org

Trends in Software Reuse Research: A Tertiary Study

José L. Barros-Justo[1], Fabiane B.V. Benitti[2], Santiago Matalonga[3]

Motivation



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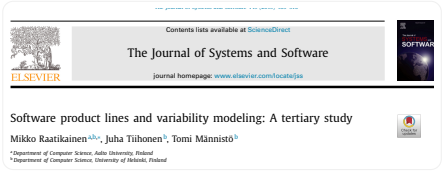
Trends in Software Reuse Research: A Tertiary Study

José L. Barros-Justo[1], Fabiane B.V. Benitti[2], Santiago Matalonga[3]

Raatikainen et al. 2019
Resulted in 86 found studies

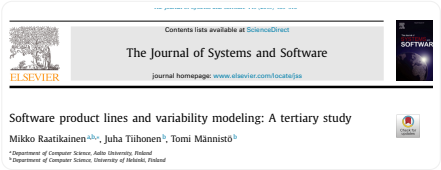
Motivation



Raatikainen et al. 2019
Resulted in 86 found studies

Marimuthu and Chandrasekaran 2017
Resulted in 60 found studies

Motivation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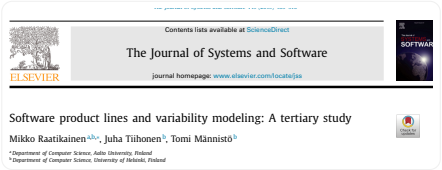
Trends in Software Reuse Research: A Tertiary Study

José L. Barros-Justo[1], Fabiane B.V. Benitti[2], Santiago Matalonga[3]

Barros-Justo et al. 2019
Resulted in 56 found studies

Motivation

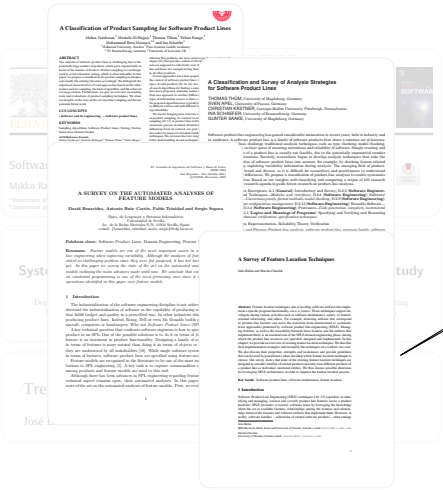


Raatikainen et al. 2019
Resulted in 86 found studies

Marimuthu and Chandrasekaran 2017
Resulted in 60 found studies

Barros-Justo et al. 2019
Resulted in 56 found studies

Motivation


A Classification of Product Sampling for Software Product Lines
A Classification and Survey of Analysis Strategies for Software Product Lines
A SURVEY ON THE AUTOMATED ANALYSES OF FEATURE MODELS
A Survey of Feature Location Techniques
And what about us?

Methodology

1. Created Golden Sample (38 publications)

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2. Forward and Backward snowballing for all publications after 2013 (19/38 publications)

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   - 33 publications found with forward snowballing

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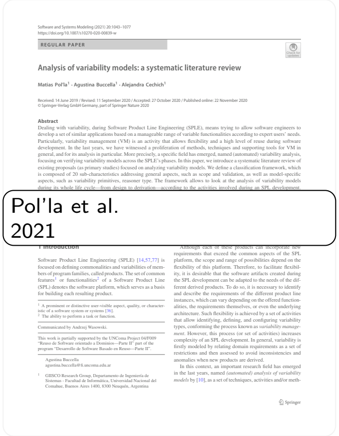
$\Rightarrow$ Overall a collection of literature reviews containing 144 publications

1. (Software) Product Lines

(Software) Product Lines

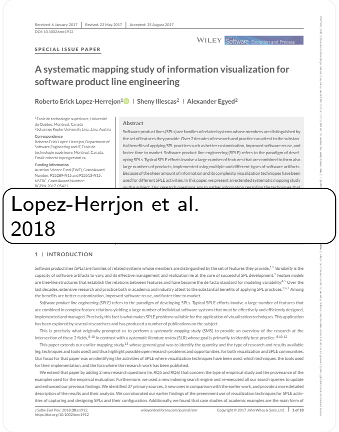

Software and Systems Modeling (2021) 20:1043–1077
https://doi.org/10.1007/s10270-020-00839-w

REGULAR PAPER

Analysis of variability models: a systematic literature review

Matias Pol'la[1] · Agustina Buccella[1] · Alejandra Cechich[1]

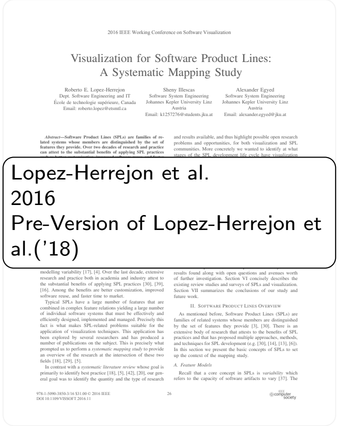
Pol'la et al.
2021


SPECIAL ISSUE PAPER

A systematic mapping study of information visualization for software product line engineering

Roberto Erick Lopez-Herrejon[1] | Sheny Illescas[2] | Alexander Egyed[2]

Lopez-Herrjon et al.
2018

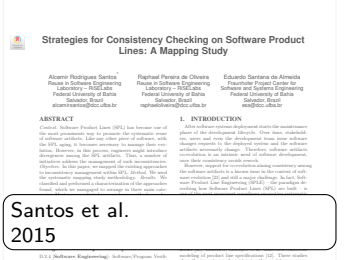

2016 IEEE Working Conference on Software Visualization

Visualization for Software Product Lines: A Systematic Mapping Study

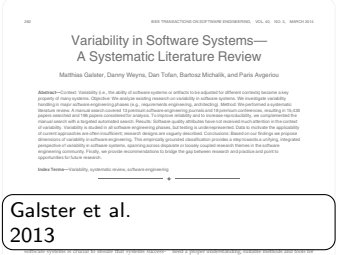
Lopez-Herrejon et al.
2016
Pre-Version of Lopez-Herrejon et al.('18)

(Software) Product Lines

Heradio et al.
2016



Santos et al.
2015



Galster et al.
2013

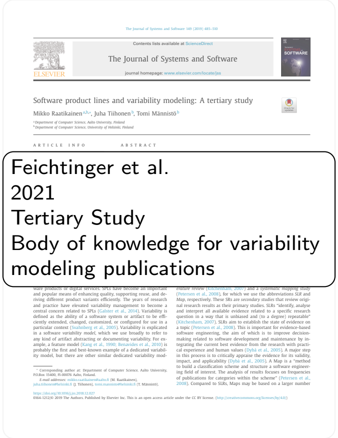
(Software) Product Lines

Author & Venue	Title
Pol'la et al. (SoSyM'21)	Analysis of variability models: a systematic literature review
Yousaf et al. (JSEA'19)	Investigation of Tools, Techniques and Languages for Model Driven Software Product Lines (SPL): A Systematic Literature Review
Lopez-Herrejon et al. (Journal of Software: Evolution and Process'18)	A systematic mapping study of information visualization for software product line engineering
Lopez-Herrejon et al. (VISSOFT'16)	Visualization for Software Product Lines: A Systematic Mapping Study
Heradio et al. (INST'16)	A bibliometric analysis of 20 years of research on software product lines
Santos et al. (EASE'15)	Strategies for consistency checking on software product lines: A mapping study
Galster et al. (TSE'13)	Variability in Software Systems—A Systematic Literature Review
Holl et al. (IST'12)	A systematic review and an expert survey on capabilities supporting multi product lines
Schaefer et al. (STTT'12)	Software Diversity: State of the Art and Perspectives

(Software) Product Lines

Author & Venue	Title
Chen and Babar ('11)	A systematic review of evaluation of variability management approaches in software product lines
Istoan et al. ('11)	A Metamodel-based Classification of Variability Modeling Approaches
Rabiser et al. ('10)	Requirements for product derivation support: Results from a systematic literature review and an expert survey
Chen et al. ('09)	Variability management in software product lines: a systematic review
Chen et al. ('09)	A status report on the evaluation of variability management approaches
Chen and Ali Babar ('09)	A survey of scalability aspects of variability modeling approaches
Günter and Kühn (XPS'99)	Knowledge-Based Configuration: Survey and Future Directions
Sabin and Weigel (IS'98)	Product Configuration Frameworks: A Survey

(Software) Product Lines Tertiary Studies


The Journal of Systems and Software 149 (2019) 485–510

Contents lists available at ScienceDirect

The Journal of Systems and Software

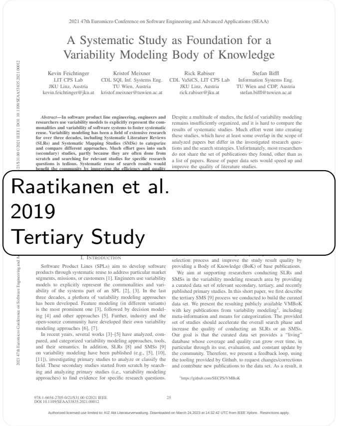
journal homepage: www.elsevier.com/locate/jss

Software product lines and variability modeling: A tertiary study

Mikko Raatikainen[a,b,*], Juha Tiihonen[b], Tomi Männistö[b]

ARTICLE INFO ABSTRACT

Feichtinger et al.
2021
Tertiary Study
Body of knowledge for variability modeling publications

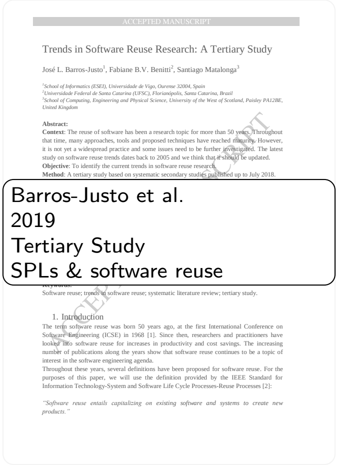

2021 47th Euromicro Conference on Software Engineering and Advanced Applications (SEAA)

A Systematic Study as Foundation for a Variability Modeling Body of Knowledge

Kevin Feichtinger, LIT CPS Lab, JKU Linz, Austria, kevin.feichtinger@jku.at
Kristof Meixner, CDL SQI, Inf. Systems Eng., TU Wien, Austria, kristof.meixner@tuwien.ac.at
Rick Rabiser, CDL VaSiCS, LIT CPS Lab, JKU Linz, Austria, rick.rabiser@jku.at
Stefan Biffl, Information Systems Eng., TU Wien and CDP, Austria, stefan.biffl@tuwien.ac.at

Raatikanen et al.
2019
Tertiary Study

(Software) Product Lines Tertiary Studies


ACCEPTED MANUSCRIPT

Trends in Software Reuse Research: A Tertiary Study

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[1]School of Informatics (ESEI), Universidade de Vigo, Ourense 32004, Spain
[2]Universidade Federal de Santa Catarina (UFSC), Florianópolis, Santa Catarina, Brazil
[3]School of Computing, Engineering and Physical Science, University of the West of Scotland, Paisley PA12BE, United Kingdom

Abstract:
Context: The reuse of software has been a research topic for more than 50 years. Throughout that time, many approaches, tools and proposed techniques have reached maturity. However, it is not yet a widespread practice and some issues need to be further investigated. The latest study on software reuse trends dates back to 2005 and we think that it should be updated.
Objective: To identify the current trends in software reuse research.
Method: A tertiary study based on systematic secondary studies published up to July 2018.

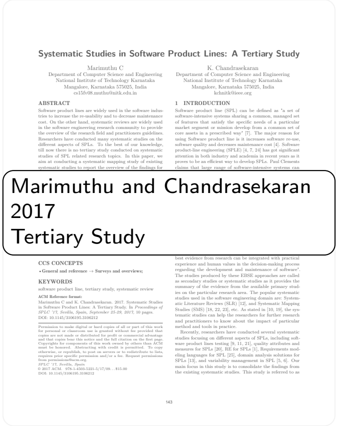
Keywords:
Software reuse; trends in software reuse; systematic literature review; tertiary study.

1. Introduction

The term software reuse was born 50 years ago, at the first International Conference on Software Engineering (ICSE) in 1968 [1]. Since then, researchers and practitioners have looked into software reuse for increases in productivity and cost savings. The increasing number of publications along the years show that software reuse continues to be a topic of interest in the software engineering agenda.
Throughout these years, several definitions have been proposed for software reuse. For the purposes of this paper, we will use the definition provided by the IEEE Standard for Information Technology-System and Software Life Cycle Processes-Reuse Processes [2]:

"Software reuse entails capitalizing on existing software and systems to create new products."

Barros-Justo et al.
2019
Tertiary Study
SPLs & software reuse


Systematic Studies in Software Product Lines: A Tertiary Study

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cs15fv08.muthu@nitk.edu.in

K. Chandrasekaran
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National Institute of Technology Karnataka
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ABSTRACT

Software product lines are widely used in the software industries to increase the re-usability and to decrease maintenance cost. On the other hand, systematic reviews are widely used in the software engineering research community to provide the overview of the research field and practitioners guidelines. Researchers have conducted many systematic studies on the different aspects of SPLs. To the best of our knowledge, till now there is no tertiary study conducted on systematic studies of SPL related research topics. In this paper, we aim at conducting a systematic mapping study of existing systematic studies to report the overview of the findings for

CCS CONCEPTS

• **General and reference → Surveys and overviews;**

KEYWORDS

software product line, tertiary study, systematic review

ACM Reference format:
Marimuthu C and K. Chandrasekaran. 2017. Systematic Studies in Software Product Lines: A Tertiary Study. In *Proceedings of SPLC '17, Sevilla, Spain, September 25-29, 2017,* 10 pages.
DOI: 10.1145/3106195.3106212

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SPLC '17, Sevilla, Spain
© 2017 ACM. 978-1-4503-5221-5/17/09...$15.00
DOI: 10.1145/3106195.3106212

1 INTRODUCTION

Software product line (SPL) can be defined as "a set of software-intensive systems sharing a common, managed set of features that satisfy the specific needs of a particular market segment or mission develop from a common set of core assets in a prescribed way" [7]. The major reason for using Software product line is it increases software re-use, software quality and decreases maintenance cost [4]. Software product-line engineering (SPLE) [4, 7, 24] has got significant attention in both industry and academia in recent years as it proves to be an efficient way to develop SPLs. Paul Clements claims that large range of software-intensive systems can

best evidence from research can be integrated with practical experience and human values in the decision-making process regarding the development and maintenance of software". The studies produced by these EBSE approaches are called as secondary studies or systematic studies as it provides the summary of the evidence from the available primary studies on the particular research area. The popular systematic studies used in the software engineering domain are: Systematic Literature Reviews (SLR) [12], and Systematic Mapping Studies (SMS) [18, 22, 23], etc. As stated in [10, 19], the systematic studies can help the researchers for further research and practitioners to know about the impact of particular method and tools in practice.

Recently, researchers have conducted several systematic studies focusing on different aspects of SPLs, including software product lines testing [9, 11, 21], quality attributes and measures for SPLs [20], RE for SPLs [1], Requirements modeling languages for SPL [25], domain analysis solutions for SPLs [13], and variability management in SPL [5, 6]. Our main focus in this study is to consolidate the findings from the existing systematic studies. This study is referred to as

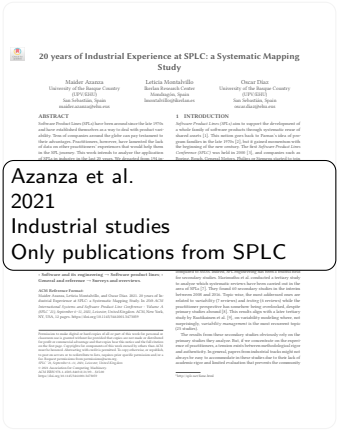
143

Marimuthu and Chandrasekaran
2017
Tertiary Study

(Software) Product Lines Tertiary Studies

Author & Venue	Title
Feichtinger et al. (SEAA'21)	A Systematic Study as Foundation for a Variability Modeling Body of Knowledge
Raatikainen et al. (JSS'19)	Software product lines and variability modeling: A tertiary study
Barros-Justo et al. (CSAI'19)	Trends in software reuse research: A tertiary study
Marimuthu and Chandrasekaran (SPLC'17)	Systematic Studies in Software Product Lines: A Tertiary Study

(Software) Product Lines Industrial Applications



20 years of Industrial Experience at SPLC: a Systematic Mapping Study

Maider Azanza, Leticia Montalvillo, Oscar Díaz

ABSTRACT

1 INTRODUCTION

Azanza et al.
2021
Industrial studies
Only publications from SPLC

Journal of Universal Computer Science, vol. 26, no. 10 (2020), 1242–1311
submitted: 26/2/20, accepted: 2/10/20, appeared: 28/10/20 CC BY-ND 4.0

How Variability Tools Fulfilled the Needs of the Software Industry?

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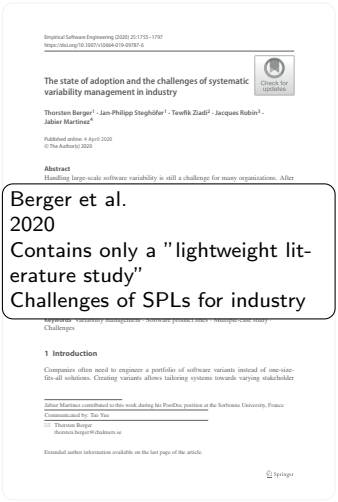
Edson Oliveira Jr
(State University of Maringá, Maringá, Brazil)
edsonjr@din.uem.br

Allian et al.
2020
Talk about tool support
Qualities that tools need for use in the industry



Empirical Software Engineering (2020) 25:1755–1797
https://doi.org/10.1007/s10664-019-09787-6

The state of adoption and the challenges of systematic variability management in industry

Thorsten Berger[1] · Jan-Philipp Steghöfer[1] · Tewfik Ziadi[2] · Jacques Robin[3] · Jabier Martinez[4]

Published online: 4 April 2020
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Abstract

Keywords

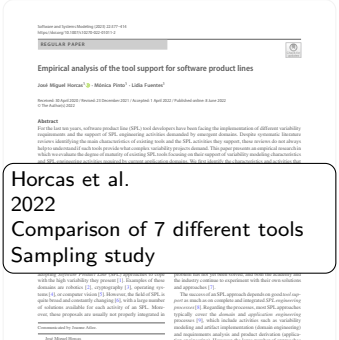
1 Introduction

Berger et al.
2020
Contains only a "lightweight literature study"
Challenges of SPLs for industry

(Software) Product Lines Industrial Applications

Author & Venue	Title
Azanza et al. (SPLC'21)	20 years of Industrial Experience at SPLC: a Systematic Mapping Study
Allian et al. (J.UCS.'20)	Have Variability Tools Fulfilled the Needs of the Software Industry?
Berger et al. (ESE'20)	The state of adoption and the challenges of systematic variability management in industry

(Software) Product Lines Tool Support

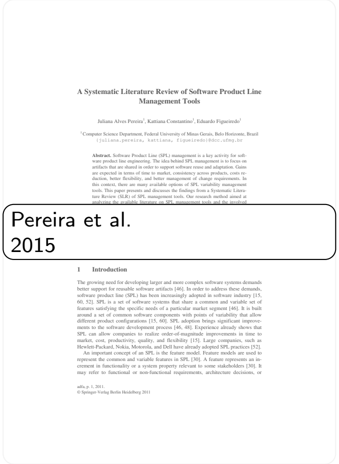


Horcas et al.
2022
Comparison of 7 different tools
Sampling study

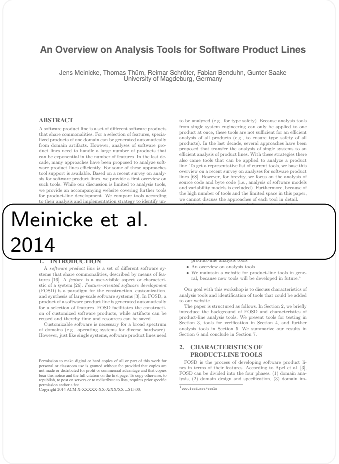
Horcas et al.
2019

Bashroush et al.
2017

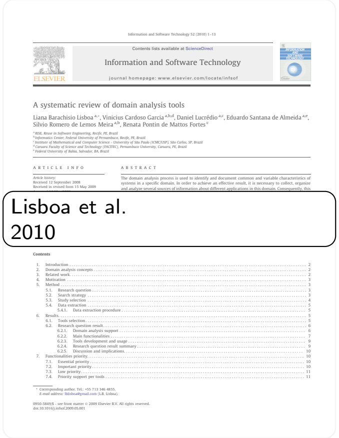
(Software) Product Lines Tool Support



Pereira et al. 2015



Meinicke et al. 2014

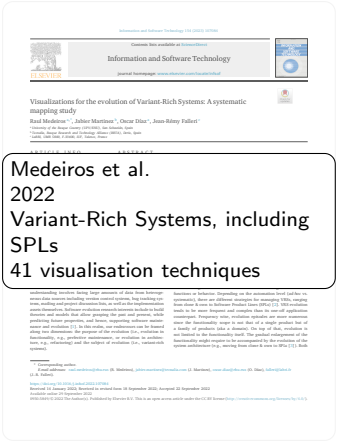


Lisboa et al. 2010

(Software) Product Lines Tool Support

Author & Venue	Title
Horcas et al. (SoSyM'22)	Empirical analysis of the tool support for software product lines
Horcas et al. (SPLC'19)	Software Product Line Engineering: A Practical Experience
Bashroush et al. (CSUR'17)	CASE Tool Support for Variability Management in Software Product Lines
Pereira et al. (ICSR'15)	A Systematic Literature Review of Software Product Line Management Tools
Meinicke et al. (SPLat'14)	An Overview on Analysis Tools for Software Product Lines
Lisboa et al. (INST'10)	A Systematic Review of Domain Analysis Tools

(Software) Product Lines Evolution



Information and Software Technology 154 (2023) 107084

Contents lists available at ScienceDirect

Information and Software Technology

journal homepage: www.elsevier.com/locate/infsof

Visualizations for the evolution of Variant-Rich Systems: A systematic mapping study

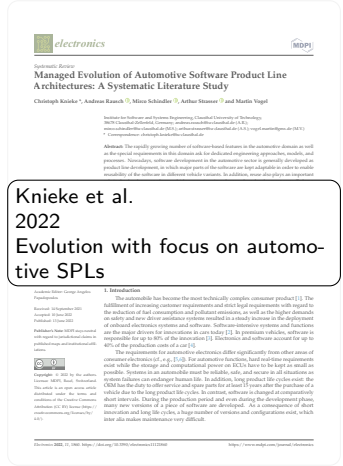
Raul Medeiros [a,*], Jabier Martinez [b], Oscar Díaz [a], Jean-Rémy Falleri [c]

[a] University of the Basque Country (UPV/EHU), San Sebastián, Spain
[b] Tecnalia, Basque Research and Technology Alliance (BRTA), Derio, Spain
[c] Bordeaux INP, CNRS, LaBRI, UMR 5800, Talence, France

ARTICLE INFO

ABSTRACT

Medeiros et al.
2022
Variant-Rich Systems, including SPLs
41 visualisation techniques



electronics

MDPI

Systematic Review

Managed Evolution of Automotive Software Product Line Architectures: A Systematic Literature Study

Christoph Knieke *, Andreas Rausch [†], Mirco Schindler [†], Arthur Stanware [†] and Martin Vogel

Abstract: The rapidly growing number of software-based features in the automotive domain as well as the special requirements in this domain ask for dedicated engineering approaches, models, and processes. Nowadays, software development in the automotive sector is generally developed as product line development, in which major parts of the software are kept adaptable in order to enable reusability of the software in different vehicle variants. In addition, reuse also plays an important

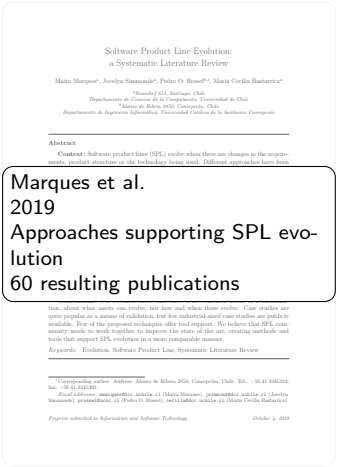
1. Introduction

The automobile has become the most technically complex consumer product [1]. The fulfillment of increasing customer requirements and strict legal requirements with regard to the reduction of fuel consumption and pollutant emissions, as well as the higher demands on safety and new driver assistance systems resulted in a steady increase in the deployment of onboard electronics systems and software. Software-intensive systems and functions are the driving force for innovations in cars today [2]. In premium vehicles, software is responsible for up to 80% of the innovations [3]. Electronics and software account for up to 40% of the production costs of a car [3–6].

The requirements for automotive electronics differ significantly from other areas of consumer electronics (cf., e.g., [7,8]). For automotive functions, hard real-time requirements exist while the storage and computational power on ECUs have to be kept as small as possible. Systems in an automobile must be reliable, safe, and secure in all situations as system failures can endanger human life. In addition, long product life cycles exist: the OEM has the duty to offer service and spare parts for at least 15 years after the purchase of a vehicle due to the long product life cycles. In contrast, software is changed at comparatively short intervals. During the production period and even during the development phase, many new versions of a piece of software are developed. As a consequence of short innovation and long life cycles, a huge number of versions and configurations exist, which inter alia makes maintenance very difficult.

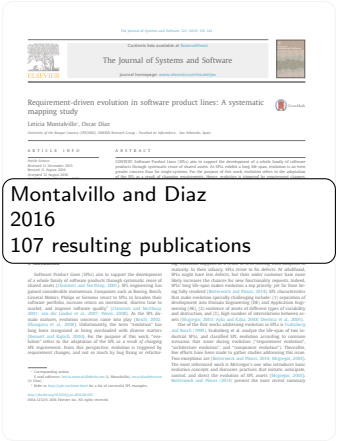
Knieke et al.
2022
Evolution with focus on automotive SPLs

(Software) Product Lines Evolution



Software Product Line Evolution:
a Systematic Literature Review

Marques et al.
2019
Approaches supporting SPL evolution
60 resulting publications



The Journal of Systems and Software

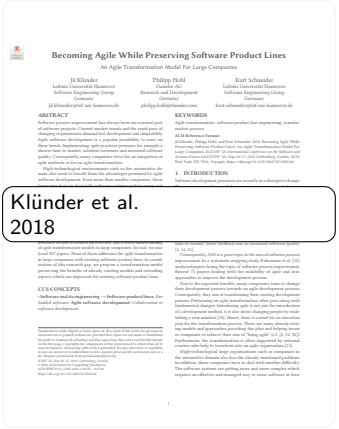
Requirement-driven evolution in software product lines: A systematic mapping study

Montalvillo and Diaz
2016
107 resulting publications

(Software) Product Lines Evolution

Author & Venue	Title
Medeiros et al. (INST'22)	Visualizations for the evolution of Variant-Rich Systems: A systematic mapping study
Knieke et al. (Electronics'22)	Managed Evolution of Automotive Software Product Line Architectures: A Systematic Literature Study
Marques et al. (INST'19)	Software product line evolution: A systematic literature review
Montalvillo and Diaz (JSSO'16)	Requirement-driven evolution in software product lines: A systematic mapping study

(Software) Product Lines Processes



Becoming Agile While Preserving Software Product Lines

An Agile Transformation Model For Large Companies

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Philipp Hohl
Daimler AG
Research and Development
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Kurt Schneider
Leibniz Universität Hannover
Software Engineering Group
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kurt.schneider@inf.uni-hannover.de

ABSTRACT

KEYWORDS

1 INTRODUCTION

Klünder et al.
2018

Searching for Common Ground: Existing Literature on Automotive Agile Software Product Lines

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philipp.hohl@daimler.com

Javad Ghofrani
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Jürgen Münch
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Michael Stupperich
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Kurt Schneider
Leibniz Universität Hannover, Germany
kurt.schneider@inf.uni-hannover.de

ABSTRACT

KEYWORDS

ACM Reference format:

Hohl et al.
2017

(Software) Product Lines Processes

SOFTWARE – PRACTICE AND EXPERIENCE
Softw. Pract. Exper. 2011; **41**:899–920
Published online 3 May 2011 in Wiley Online Library (wileyonlinelibrary.com). DOI: 10.1002/spe.1078

Agile software product lines: a systematic mapping study

Ivonei Freitas da Silva[1,3,*,†], Paulo Anselmo da Mota Silveira Neto[1,3], Pádraig O'Leary[2,3], Eduardo Santana de Almeida[2,3] and Silvio Romero de Lemos Meira[1]

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[2] *Computer Science Department, Federal University of Bahia, Salvador, BA, Brazil*
[3] *RiSE (Reuse in Software Engineering), Recife, PE, Brazil*

SUMMARY

Background: Software product lines and Agile methods have been an effective solution for dealing with the growing complexity of software and handling competitive needs of software organizations. They also share common goals, such as improving productivity, reducing time-to-market, decreasing development costs and increasing customer satisfaction. There has been growing interest in whether the integration of Agile and SPL could provide further benefits and solve many of the outstanding issues surrounding software development. *Objective*: This study investigates the state-of-the-art in Agile SPL approaches

da Silva et al.
2011

adoption of Agile practices. Copyright © 2011 John Wiley & Sons, Ltd.

Received 11 August 2010; Revised 29 November 2010; Accepted 22 February 2011

KEY WORDS: systematic mapping study; Agile methods; software product lines; Agile principles

1. INTRODUCTION

Software development is a complex composition of processes, technologies, tools and people, often in domains with volatile requirements. Furthermore, with the growing demand for higher quality software, reduced development costs and shorter time-to-market, the idea of leveraging the strengths of existing approaches has been raised as a possible solution. Whereas *Software Product Lines* (*SPL*) engineering provides a systematic approach to reuse common artifacts to facilitate the delivery of different products [1]; *Agile methods* focus on working code while reducing up-front design and process overhead of traditional approaches [2], through the adoption of fundamental values and principles [3]. Despite the differences in how both approaches perform software development, they propose to deliver common benefits, such as improving productivity, reducing time-to-market,

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SOFTWARE – PRACTICE AND EXPERIENCE
Softw. Pract. Exper. 2011; **41**:921–941
Published online 4 May 2011 in Wiley Online Library (wileyonlinelibrary.com). DOI: 10.1002/spe.1087

Agile product line engineering—a systematic literature review

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SUMMARY

Software Product Line Engineering (SPLE) demands upfront long-term investment in (i) designing a common set of core-assets and (ii) managing variability across the products from the same family. When anticipated changes in these core-assets have been predicted with certain accuracy, SPLE has proved significant improvements. However, when large/complex software product line projects have to deal with changing market conditions, alternatives to supplement SPLE are required. Agile Software Development (ASD) may be an alternative, as agile processes harness change for the customer's competitive advantage. However, when the aim is to scale Agile projects up to effectively manage reusability and variability across the products from the same family, alternatives to supplement agility are also required. As a result, a new approach called Agile Product Line Engineering (APLE) advocates integrating SPLE and ASD

Díaz et al.
2011

1. INTRODUCTION

Software product line engineering (SPLE) [1, 2] exploits the commonality and variability across products from the same family by an upfront long-term design of a common set of core-assets/platform (*Domain Engineering, DE*); then core-assets are assembled into customer-specific products by deriving the existing variability across the products (*Application Engineering, AE*). This means that SPLE takes advantage of common features among the products of a family through the systematic reuse of the core-assets and the effective management of variabilities across the products. Significant improvements have been made using SPLE, such as reducing cost and time-to-market, and providing flexibility to respond to *planned changes* [3] in contexts in which anticipated changes can be predicted with certain accuracy. However, when large/complex software product line (SPL) projects have to deal with changing market conditions, i.e. *unplanned changes*, alternatives to supplement SPLE are required [4]. Agile software development (ASD) may be one of these alternatives, since agile processes harness change for the customer's competitive advantage [5]. However, scalability is still a challenge in agile projects; hence, reusability and

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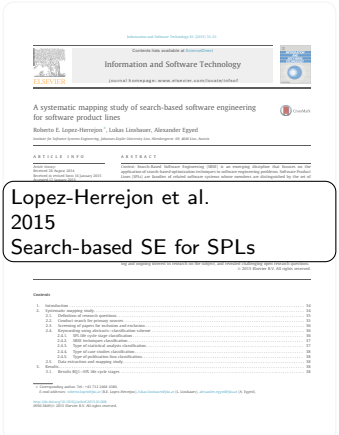
†E-mail: yesica.diaz@upm.es

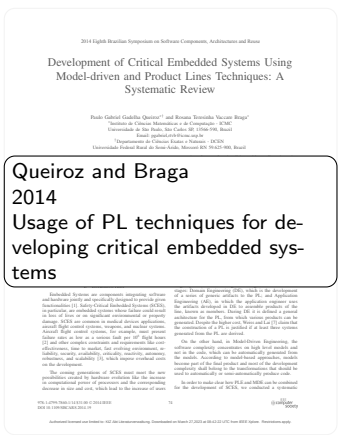
(Software) Product Lines Processes

Author & Venue	Title
Klünder et al. (ICSSP'18)	Becoming agile while preserving software product lines: An agile transformation model for large companies
Hohl et al. (ICSSP'17)	Searching for common ground: Existing literature on automotive agile software product lines
da Silva et al. (SPE'11)	Agile software product lines: A systematic mapping study
Díaz et al. (SPE'11)	Agile product line engineering - a systematic literature review

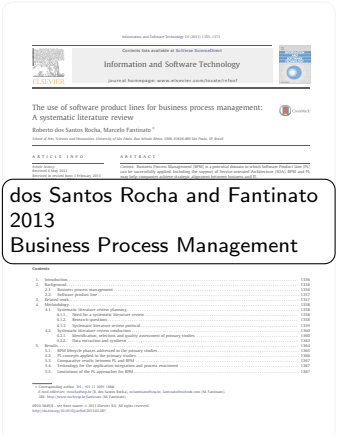
(Software) Product Lines Applications of Product Line Techniques



Lopez-Herrejon et al.
2015
Search-based SE for SPLs

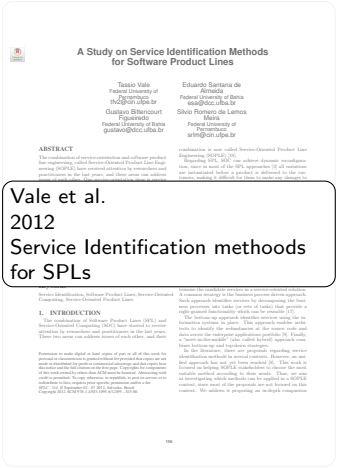


Queiroz and Braga
2014
Usage of PL techniques for developing critical embedded systems



dos Santos Rocha and Fantinato
2013
Business Process Management

(Software) Product Lines Applications of Product Line Techniques



A Study on Service Identification Methods for Software Product Lines

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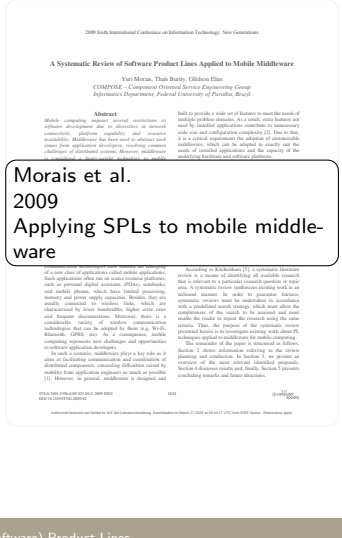
ABSTRACT

Service Identification, Software Product Lines, Service-Oriented Computing, Service-Oriented Product Lines

1. INTRODUCTION

Vale et al.
2012
Service Identification methoods for SPLs



2009 Sixth International Conference on Information Technology: New Generations

A Systematic Review of Software Product Lines Applied to Mobile Middleware

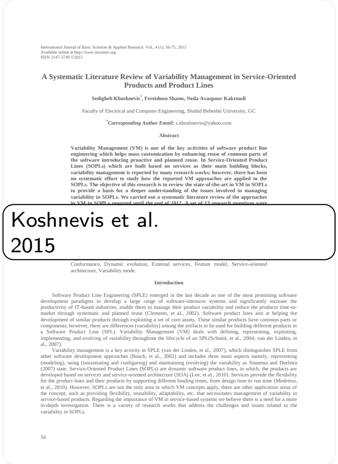
Yuri Morais, Thaís Batista, Gibeon Elias
COMPOSE – Component Oriented Service Engineering Group
Informatics Department, Federal University of Paraíba, Brazil

Abstract

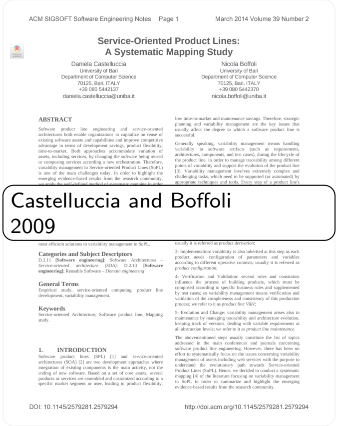
Morais et al.
2009
Applying SPLs to mobile middleware

Author & Venue	Title
Lopez-Herrejon et al. ('15)	A systematic mapping study of search-based software engineering for software product lines
Queiroz and Braga ('14)	Development of critical embedded systems using model-driven and product lines techniques: A systematic review
Santos Rocha and Fantinato ('13)	The use of software product lines for business process management: A systematic literature review
Vale et al. ('12)	A study on service identification methods for software product lines
Morais et al. ('09)	A systematic review of software product lines applied to mobile middleware

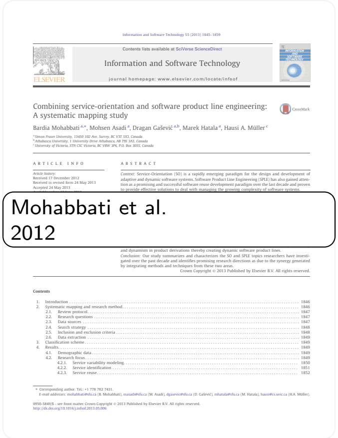
(Software) Product Lines Applications of Product Line Techniques - Service-Oriented Product Lines



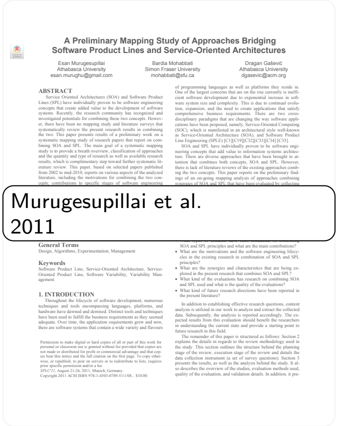
Koshnevis et al.
2015



Castelluccia and Boffoli
2009



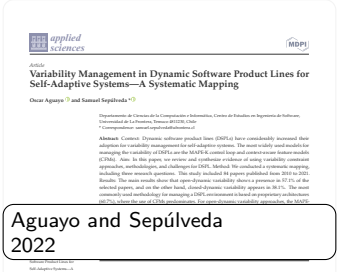
Mohabbati et al. 2012



Murugesupillai et al. 2011

Author & Venue	Title
Khoshnevis et al. ('15)	A Systematic Literature Review of Variability Management in Service-Oriented Products and Product Lines
Castelluccia and Boffoli ('14)	Service-oriented product lines: A systematic mapping study
Mohabbati et al. ('13)	Combining service-orientation and software product line engineering: A systematic mapping study
Murugesupillai et al. ('11)	A preliminary mapping study of approaches bridging software product lines and service-oriented architectures

(Software) Product Lines Applications of Product Line Techniques - Dynamic SPL

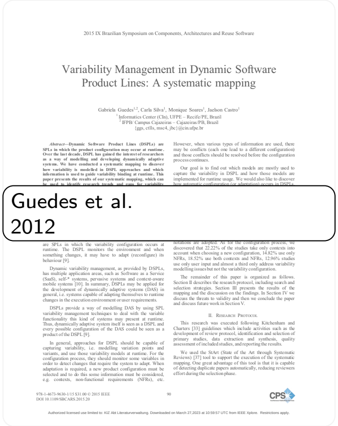


Aguayo and Sepúlveda 2022

Eleuterio et al. 2016

da Silva et al. 2016

(Software) Product Lines Applications of Product Line Techniques - Dynamic SPL


2015 IX Brazilian Symposium on Components, Architectures and Reuse Software

Variability Management in Dynamic Software Product Lines: A systematic mapping

Gabriela Guedes[1,2], Carla Silva[1], Monique Soares[1], Jaelson Castro[1]
[1] Informatics Center (CIn), UFPE – Recife/PE, Brazil
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{ggs, ctlls, msc4, jbc}@cin.ufpe.br

Guedes et al. 2012


Characterizing Dynamic Software Product Lines – A Preliminary Mapping Study

Vanilson Arruda Burégio and Silvio Lemos Meira
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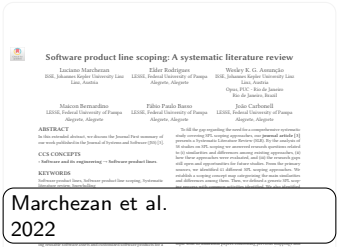
RiSE – Reuse in Software Engineering
Recife, Brazil
{vaab, srlm}@cin.ufpe.br

Eduardo Santana de Almeida
Federal University of Bahia,
RiSE – Reuse in Software Engineering
Salvador, Brazil
esa@dcc.ufba.br

Burégio et al. 2010

Author & Venue	Title
Aguayo and Sepúlveda ('22)	Variability Management in Dynamic Software Product Lines for Self-Adaptive Systems—A Systematic Mapping
Eleuterio et al. ('16)	On the dependability for dynamic software product lines: A comparative systematic mapping study
da Silva et al. ('16)	Requirements Engineering and Variability Management in DSPLs Domain Engineering: A Systematic Literature Review
Guedes et al. ('15)	Variability management in dynamic software product lines: A systematic mapping
Burégio et al. ('10)	Characterizing dynamic software product lines-a preliminary mapping study

(Software) Product Lines Management



Software product line scoping: A systematic literature review

Luciano Marchezan, Elder Rodrigues, Wesley K. G. Assunção

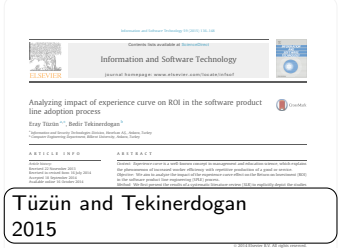
ABSTRACT

CCS CONCEPTS

• Software and its engineering → Software product lines.

KEYWORDS

Marchezan et al. 2022



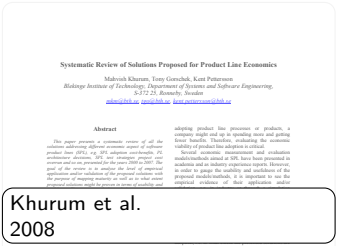
Information and Software Technology

Analyzing impact of experience curve on ROI in the software product line adoption lifecycle

Eray Tüzün, Bedir Tekinerdogan

ABSTRACT

Tüzün and Tekinerdogan 2015



Systematic Review of Solutions Proposed for Product Line Economics

Mahvish Khurum, Tony Gorschek, Kent Pettersson

Abstract

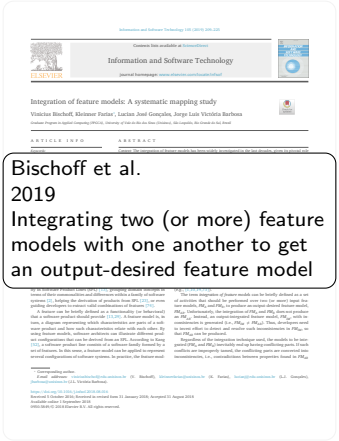
Khurum et al. 2008

(Software) Product Lines Management

Author & Venue	Title
Marchezan et al. ('22)	Software product line scoping: A systematic literature review
Tüzün and Tekinerdogan (INST'15)	Analyzing impact of experience curve on ROI in the software product line adoption process
Khurum et al. ('08)	Systematic review of solutions proposed for product line economics

2. Problem Space

Problem Space Representation


Information and Software Technology 110 (2019) 209–223

Contents lists available at ScienceDirect

Information and Software Technology

journal homepage: www.elsevier.com/locate/infsof

Integration of feature models: A systematic mapping study

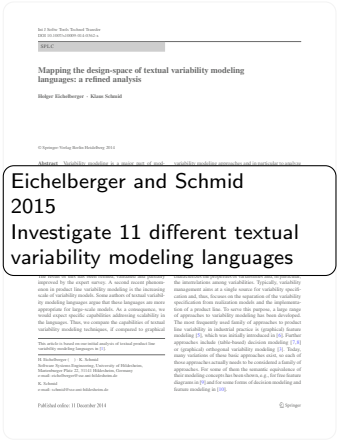
Vinicius Bischoff, Kleinner Farias*, Lucian José Gonçales, Jorge Luis Victória Barbosa

Graduate Program in Applied Computing (PIPCA), University of Vale do Rio dos Sinos (Unisinos), São Leopoldo, Rio Grande do Sul, Brazil

ARTICLE INFO

ABSTRACT

Bischoff et al.
2019
Integrating two (or more) feature models with one another to get an output-desired feature model


Int J Softw Tools Technol Transfer
DOI 10.1007/s10009-014-0362-x

SPLC

Mapping the design-space of textual variability modeling languages: a refined analysis

Holger Eichelberger · Klaus Schmid

© Springer-Verlag Berlin Heidelberg 2014

Abstract Variability modeling is a major area of soft-

H. Eichelberger (✉) · K. Schmid
Software System Engineering, University of Hildesheim, Marienburger Platz 22, 31141 Hildesheim, Germany
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K. Schmid
e-mail: schmid@sse.uni-hildesheim.de

Published online: 11 December 2014

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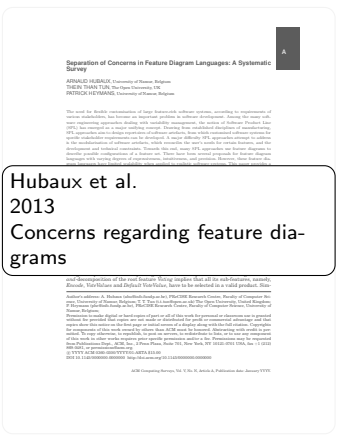
Eichelberger and Schmid
2015
Investigate 11 different textual variability modeling languages


A

Separation of Concerns in Feature Diagram Languages: A Systematic Survey

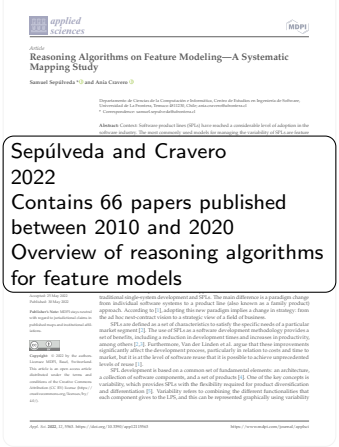
ARNAUD HUBAUX, University of Namur, Belgium
THIEN-THAN TUN, The Open University, UK
PATRICK HEYMANS, University of Namur, Belgium

Hubaux et al.
2013
Concerns regarding feature diagrams

Problem Space Representation

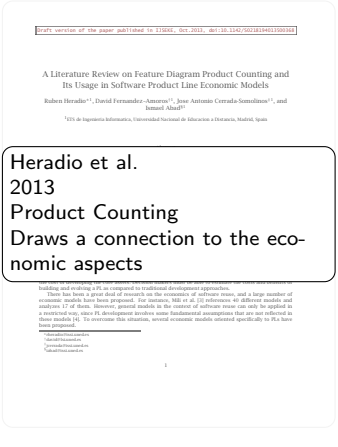
Author & Venue	Title
Bischoff et al. ('19)	Integration of feature models: A systematic mapping study
Eichelberger and Schmid ('15)	Mapping the design-space of textual variability modeling languages: a refined analysis
Hubaux et al. ('13)	Separation of Concerns in Feature Diagram Languages: A Systematic Survey
Czarnecki et al. ('12)	Cool Features and Tough Decisions: A Comparison of Variability Modeling Approaches
Schmid et al. ('11)	A comparison of decision modeling approaches in product lines
Hubaux et al. ('10)	A Preliminary Review on the Application of Feature Diagrams in Practice
Sinnema and Deelstra ('07)	Classifying variability modeling techniques
Schobbens et al. ('06)	Feature Diagrams: A Survey and a Formal Semantics

Problem Space Analysis



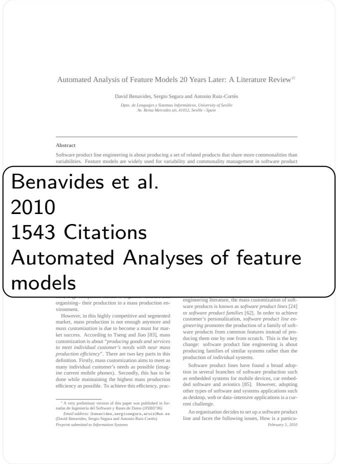
Sepúlveda and Cravero
2022
Contains 66 papers published between 2010 and 2020
Overview of reasoning algorithms for feature models

Galindo et al.
2019
Database search + snowballing + experience
Contains 423 publications published after 2010



Heradio et al.
2013
Product Counting
Draws a connection to the economic aspects

Problem Space Analysis



Automated Analysis of Feature Models 20 Years Later: A Literature Review☆

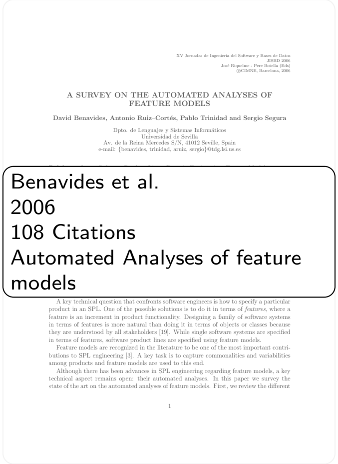
David Benavides, Sergio Segura and Antonio Ruiz-Cortés

Dpto. de Lenguajes y Sistemas Informáticos, University of Seville
Av. Reina Mercedes s/n, 41012, Seville - Spain

Abstract

Software product line engineering is about producing a set of related products that share more commonalities than variabilities. Feature models are widely used for variability and commonality management in software product

Benavides et al.
2010
1543 Citations
Automated Analyses of feature models



XV Jornadas de Ingeniería del Software y Bases de Datos
JISBD 2006
José Riquelme - Pere Botella (Eds)
©CIMNE, Barcelona, 2006

A SURVEY ON THE AUTOMATED ANALYSES OF FEATURE MODELS

David Benavides, Antonio Ruiz–Cortés, Pablo Trinidad and Sergio Segura

Dpto. de Lenguajes y Sistemas Informáticos
Universidad de Sevilla
Av. de la Reina Mercedes S/N, 41012 Seville, Spain
e-mail: {benavides, trinidad, aruiz, sergio}@tdg.lsi.us.es

Benavides et al.
2006
108 Citations
Automated Analyses of feature models

A key technical question that confronts software engineers is how to specify a particular product in an SPL. One of the possible solutions is to do it in terms of *features*, where a feature is an increment in product functionality. Designing a family of software systems in terms of features is more natural than doing it in terms of objects or classes because they are understood by all stakeholders [19]. While single software systems are specified in terms of features, software product lines are specified using feature models.

Feature models are recognized in the literature to be one of the most important contributions to SPL engineering [3]. A key task is to capture commonalities and variabilities among products and feature models are used to this end.

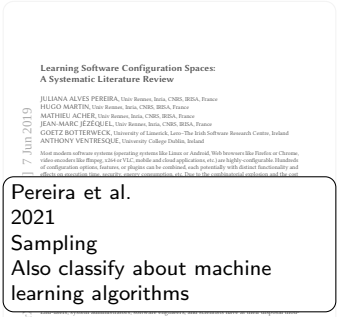
Although there has been advances in SPL engineering regarding feature models, a key technical aspect remains open: their automated analyses. In this paper we survey the state of the art on the automated analyses of feature models. First, we review the different

1

Problem Space Analysis

Author & Venue	Title
Sepúlveda and Cravero (Applied Sciences'22)	Reasoning Algorithms on Feature Modeling—A Systematic Mapping Study
Galindo et al. (Computing'19)	Automated analysis of feature models: Quo vadis?
Heradio et al. (IJSEKE'13)	A Literature Review on Feature Diagram Product Counting and Its Usage in Software Product Line Economic Models
Benavides et al. (Information Systems'10)	Automated Analysis of Feature Models 20 Years Later: A Literature Review
Benavides et al. (Jornadas de Ingeniera del Software y Bases de Datos'06)	A Survey on the Automated Analyses of Feature Models

Problem Space Configuration

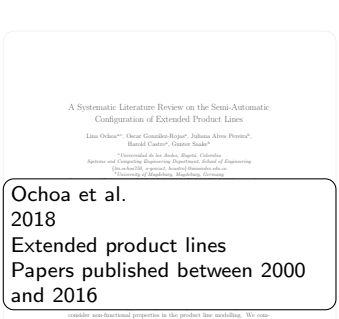


Learning Software Configuration Spaces:
A Systematic Literature Review

JULIANA ALVES PEREIRA, Univ Rennes, Inria, CNRS, IRISA, France
HUGO MARTIN, Univ Rennes, Inria, CNRS, IRISA, France
MATHIEU ACHER, Univ Rennes, Inria, CNRS, IRISA, France
JEAN-MARC JÉZÉQUEL, Univ Rennes, Inria, CNRS, IRISA, France
GOETZ BOTTERWECK, University of Limerick, Lero–The Irish Software Research Centre, Ireland
ANTHONY VENTRESQUE, University College Dublin, Ireland

Most modern software system (operating system like Linux or Android, Web browsers like Firefox or Chrome, video encoders like ffmpeg, x264 or VLC, mobile and cloud applications, etc.) are highly-configurable. Hundreds of configuration options, features, or plugins can be combined, each potentially with distinct functionality and effects on execution time, security, energy consumption, etc. Due to the combinatorial explosion and the vast

Pereira et al.
2021
Sampling
Also classify about machine learning algorithms



A Systematic Literature Review on the Semi-Automatic Configuration of Extended Product Lines

Lina Ochoa[a,c], Oscar González-Rojas[a], Juliana Alves Pereira[b], Harold Castro[a], Gunter Saake[b]

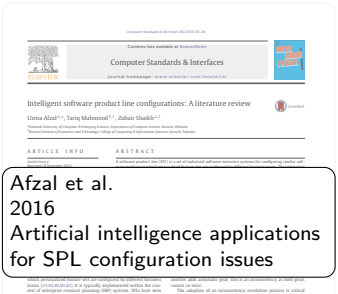
[a] Universidad de los Andes, Bogotá, Colombia
Systems and Computing Engineering Department, School of Engineering
{lm.ochoa1526, o.gonzalez, hcastro}@uniandes.edu.co
[b] University of Magdeburg, Magdeburg, Germany
[c] Universidad Nacional de Colombia, Bogotá, Colombia

consider non-functional properties in the product line modelling. We compare and classify a total of 66 primary studies from 2000 to 2016. Mainly, we give an in-depth view of techniques used by each work, how these techniques are evaluated and their main shortcomings. As main results, our review identified (i) the need to improve the quality of the evaluation of existing approaches, ii) a lack of hybrid solutions to support multiple configuration constraints, and iii) a need to improve scalability and performance conditions.

Keywords:
Extended product line, product configuration, systematic literature review

Preprint submitted to Journal of Systems and Software October 15, 2018

Ochoa et al.
2018
Extended product lines
Papers published between 2000 and 2016



Computer Standards & Interfaces 58 (2018) 55–69

Contents lists available at ScienceDirect

Computer Standards & Interfaces

journal homepage: www.elsevier.com/locate/csi

Intelligent software product line configurations: A literature review

Umna Afzal[a,b,*], Tariq Mahmood[a,1], Zubair Shaikh[a,2]

[a] National University of Computer & Emerging Sciences, Department of Computer Science, Karachi, Pakistan
[b] Karachi Institute of Economics and Technology, College of Computing & Information Science, Karachi, Pakistan

ARTICLE INFO

ABSTRACT

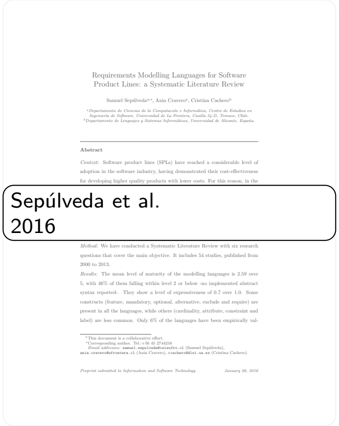
Afzal et al.
2016
Artificial intelligence applications for SPL configuration issues

Problem Space Configuration

Author & Venue	Title
Pereira et al. (JSSO'21)	Learning Software Configuration Spaces: A Systematic Literature Review
Ochoa et al. (JSSO'18)	A systematic literature review on the semi-automatic configuration of extended product lines
Afzal et al. (Computer Standards & Interfaces'16)	Intelligent software product line configurations: A literature review

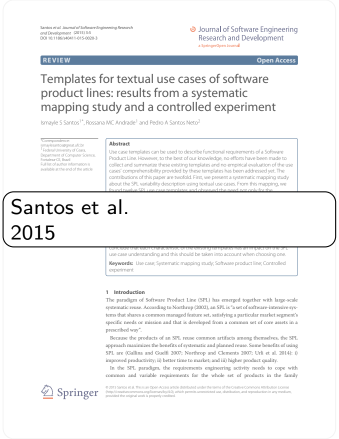
3. Solution Space

Solution Space Requirements


Requirements Modelling Languages for Software Product Lines: a Systematic Literature Review

Samuel Sepúlveda, Ania Cravero, Cristina Cachero

Sepúlveda et al. 2016


Journal of Software Engineering Research and Development

REVIEW Open Access

Templates for textual use cases of software product lines: results from a systematic mapping study and a controlled experiment

Ismayle S Santos, Rossana MC Andrade and Pedro A Santos Neto

Santos et al. 2015


2014 Eighth Brazilian Symposium on Software Components, Architectures and Reuse

How to Describe SPL Variabilities in Textual Use Cases: A Systematic Mapping Study

Ismayle S. Santos, Rossana M. C. Andrade, Pedro A. Santos Neto

Santos et al. 2014

Solution Space Requirements

Evaluating scenario-based SPL requirements approaches: the case for modularity, stability and expressiveness

Mauricio Alférez · Rodrigo Bonifacio · Leopoldo Teixeira · Paula Accioly · Uirá Kulesza · Ana Moreira · João Araújo · Paulo Borba

Abstract Software product lines (SPL) provide support for productivity gains through systematic reuse. Among the various quality attributes supporting these goals, modularity, stability and expressiveness of feature specifications, their composition and configuration knowledge emerge as

Keywords Software product lines · Variability modeling · Use scenarios · Requirements specification

Alférez et al.
2013

Information and Software Technology

Contents lists available at ScienceDirect

Information and Software Technology

journal homepage: www.elsevier.com/locate/infsof

Requirements engineering for software product lines: A systematic literature review

Vander Alves *, Nan Niu, Carina Alves, George Valença

Alves et al.
2010

The Journal of Systems and Software

Contents lists available at ScienceDirect

The Journal of Systems and Software

journal homepage: www.elsevier.com/locate/jss

A systematic review of domain analysis solutions for product lines

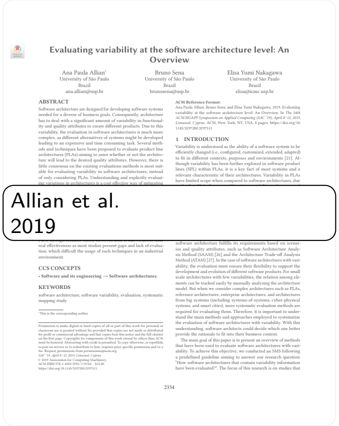
Mahvish Khurum *, Tony Gorschek

Khurum and Gorschek
2009

Solution Space Requirements

Author & Venue	Title
Sepúlveda et al. ('16)	Requirements modeling languages for software product lines: A systematic literature review
Santos et al. ('15)	Templates for textual use cases of software product lines: results from a systematic mapping study and a controlled experiment
Santos et al. ('14)	How to describe spl variabilities in textual use cases: A systematic mapping study
Alférez et al. ('13)	Evaluating Scenario-Based SPL Requirements Approaches — The Case for Modularity, Stability and Expressiveness
Alves et al. ('10)	Requirements engineering for software product lines: A systematic literature review
Khurum and Gorschek ('09)	A systematic review of domain analysis solutions for product lines

Solution Space Architecture & Design



Evaluating variability at the software architecture level: An Overview

Ana Paula Allian, University of São Paulo, Brazil, ana.allian@usp.br
Bruno Sena, University of São Paulo, Brazil, brunosena@usp.br
Elisa Yumi Nakagawa, University of São Paulo, Brazil, elisa@icmc.usp.br

ABSTRACT

1 INTRODUCTION

CCS CONCEPTS

KEYWORDS

Allian et al. 2019

Science of Computer Programming 123 (2016) 42–60

Contents lists available at ScienceDirect

Science of Computer Programming

www.elsevier.com/locate/scico

Basic behavioral models for software product lines: Expressiveness and testing pre-orders

Harsh Beohar, Mahsa Varshosaz, Mohammad Reza Mousavi

Centre for Research on Embedded Systems (CERES), School of IT, Halmstad University, Sweden

ARTICLE INFO

ABSTRACT

1. Introduction

1.1. Motivation

Beohar et al. 2016

A Systematic Review on Metamodels to Support Product Line Architecture Design

Crescencio Lima, Federal University of Bahia, Federal Institute of Bahia, Vitoria da Conquista, Brazil, crescencio@dcc.ufba.br
Christina Chavez, Federal University of Bahia, Salvador, Brazil, flach@ufba.br

ABSTRACT

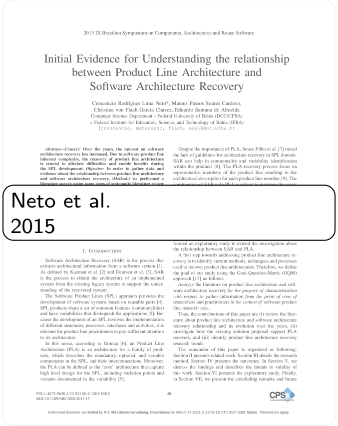
CCS Concepts

Keywords

1. INTRODUCTION

Heradio et al. 2016

Solution Space Architecture & Design


2015 IX Brazilian Symposium on Components, Architectures and Reuse Software

Initial Evidence for Understanding the relationship between Product Line Architecture and Software Architecture Recovery

Crescencio Rodrigues Lima Neto*, Mateus Passos Soares Cardoso, Christina von Flach Garcia Chavez, Eduardo Santana de Almeida
Computer Science Department - Federal University of Bahia (DCC/UFBA)
* Federal Institute for Education, Science, and Technology of Bahia (IFBA)
{crescencio, mateuspsc, flach, esa}@dcc.ufba.br

I. Introduction

978-1-4673-9630-1/15 $31.00 © 2015 IEEE
DOI 10.1109/SBCARS.2015.15

Neto et al.
2015


A Survey on Modeling Techniques for Formal Behavioral Verification of Software Product Lines

Fabian Benduhn, University of Magdeburg, Magdeburg, Germany, fabian.benduhn@ovgu.de
Thomas Thüm, University of Magdeburg, Magdeburg, Germany, tthuem@ovgu.de
Malte Lochau, TU Darmstadt, Darmstadt, Germany, malte.lochau@es.tu-darmstadt.de
Thomas Leich, METOP GmbH, Magdeburg, Germany, thomas.leich@metop.de
Gunter Saake, University of Magdeburg, Magdeburg, Germany, saake@ovgu.de

ABSTRACT

Keywords
Software Product Lines, Variability, Survey, Modeling, Verification

1. INTRODUCTION

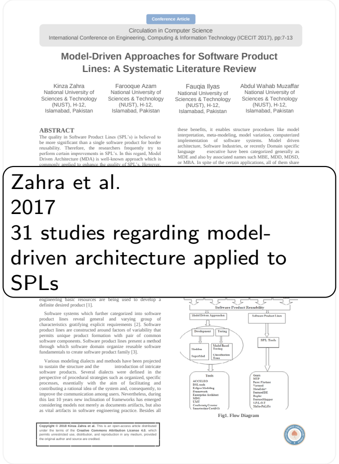
2. BACKGROUND

Benduhn et al.
2015

Solution Space Architecture & Design

Author & Venue	Title
Allian et al. ('19)	Evaluating variability at the software architecture level: An Overview
Beohar et al. ('16)	Basic behavioral models for software product lines: Expressiveness and testing pre-orders
Lima and Chavez ('16)	A systematic review on metamodels to support product line architecture design
Neto et al. ('15)	Initial evidence for understanding the relationship between product line architecture and software architecture recovery
Benduhn et al. ('15)	A Survey on Modeling Techniques for Formal Behavioral Verification of Software Product Lines
Groher and Weinreich ('15)	Variability support in architecture knowledge management approaches: A systematic literature review
Stephan and Cordy ('13)	A Survey of Model Comparison Approaches and Applications
Souza et al. ('08)	Evaluating domain design approaches using systematic review
Cabrero et al. ('07)	Understanding product lines through design patterns

Solution Space Implementation

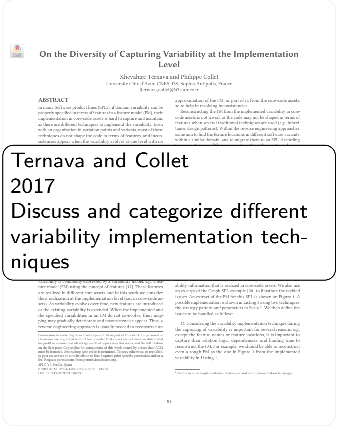

Conference Article

Circulation in Computer Science
International Conference on Engineering, Computing & Information Technology (ICECIT 2017), pp:7-13

Model-Driven Approaches for Software Product Lines: A Systematic Literature Review

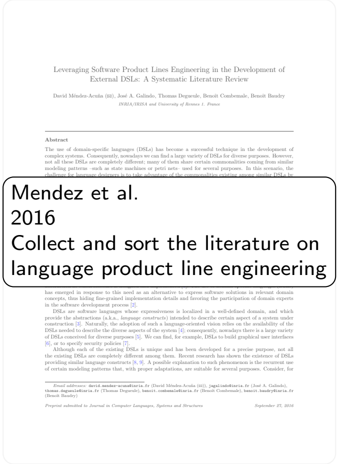
Kinza Zahra, Farooque Azam, Fauqia Ilyas, Abdul Wahab Muzaffar
National University of Sciences & Technology (NUST), H-12, Islamabad, Pakistan

Zahra et al.
2017
31 studies regarding model-driven architecture applied to SPLs


On the Diversity of Capturing Variability at the Implementation Level

Xhevahire Tërnava and Philippe Collet
Université Côte d'Azur, CNRS, I3S, Sophia Antipolis, France

Ternava and Collet
2017
Discuss and categorize different variability implementation techniques


Leveraging Software Product Lines Engineering in the Development of External DSLs: A Systematic Literature Review

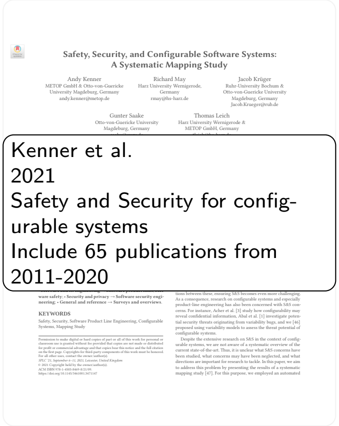
David Méndez-Acuña, José A. Galindo, Thomas Degueule, Benoît Combemale, Benoit Baudry
INRIA/IRISA and University of Rennes 1. France

Mendez et al.
2016
Collect and sort the literature on language product line engineering

Solution Space Implementation

Author & Venue	Title
Zahra et al. ('18)	Model-Driven Approaches for Software Product Lines: A Systematic Literature Review
Ternava and Collet ('17)	On the Diversity of Capturing Variability at the Implementation Level
Mendez et al. ('16)	Leveraging Software Product Lines Engineering in the development of external DSLs: A systematic literature review

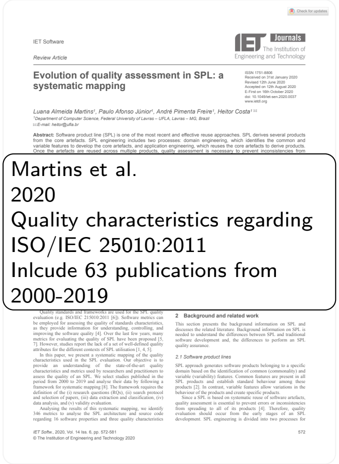
Solution Space Quality Assurance



Safety, Security, and Configurable Software Systems: A Systematic Mapping Study

Andy Kenner, Richard May, Jacob Krüger, Gunter Saake, Thomas Leich

Kenner et al.
2021
Safety and Security for configurable systems
Include 65 publications from 2011-2020



IET Software

Review Article

Evolution of quality assessment in SPL: a systematic mapping

Luana Almeida Martins, Paulo Afonso Júnior, André Pimenta Freire, Heitor Costa

Martins et al.
2020
Quality characteristics regarding ISO/IEC 25010:2011
Inlcude 63 publications from 2000-2019

2016 42th Euromicro Conference on Software Engineering and Advanced Applications

Functional Safety in Product Lines - A Systematic Mapping Study

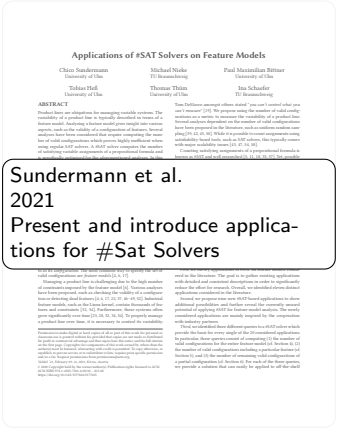
Stephan Baumgart, Joakim Fröberg

Baumgart and Fröberg
2016
Functional safety in product lines

Solution Space Quality Assurance

Author & Venue	Title
Kenner et al. ('21)	Safety, Security, and Configurable Software Systems: A Systematic Mapping Study
Martins et al. ('20)	Evolution of quality assessment in SPL: a systematic mapping
Baumgart and Fröberg ('16)	Functional Safety in Product Lines - A Systematic Mapping Study
Bezerra et al. ('14)	Measures for Quality Evaluation of Feature Models
Soares et al. ('14)	Analysis of non-functional properties in software product lines: A systematic review
Montagud et al. ('12)	A systematic review of quality attributes and measures for software product lines
Myllärniemi et al. ('12)	A systematically conducted literature review: Quality attribute variability in software product lines
Montagud and Abrahao ('09)	Gathering Current Knowledge about Quality Evaluation in Software Product Lines
Etxeberria et al. ('08)	Quality aware Software Product Line Engineering
Calder et al. ('03)	Feature interaction: a critical review and considered forecast

Solution Space Quality Assurance - Static Analysis



Applications of #SAT Solvers on Feature Models

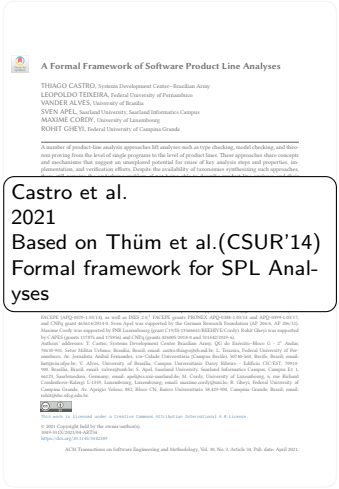
Chico Sundermann, Michael Nieke, Paul Maximilian Bittner
University of Ulm, TU Braunschweig, University of Ulm

Tobias Heß, Thomas Thüm, Ina Schaefer
University of Ulm, TU Braunschweig, TU Braunschweig

ABSTRACT

Product lines are ubiquitous for managing variable systems. The variability of a product line is typically described in terms of a feature model. Analyzing a feature model gives insight into various properties of the product line, such as the number of valid products. Analyses have been considered that require computing the number of valid configurations which proves highly inefficient scheme using regular SAT solvers. A #SAT solver computes the number of satisfying variable assignments of a propositional formula and is therefore optimized for the aforementioned analyses. In this

Sundermann et al.
2021
Present and introduce applications for #Sat Solvers



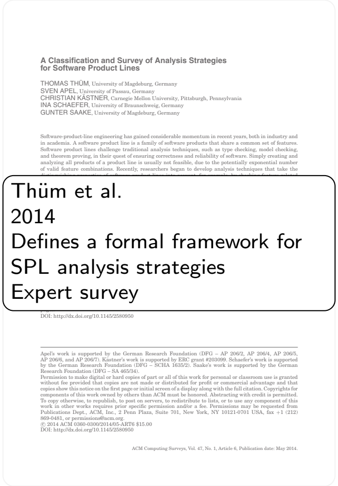
A Formal Framework of Software Product Line Analyses

THIAGO CASTRO, Systems Development Center–Brazilian Army
LEOPOLDO TEIXEIRA, Federal University of Pernambuco
VANDER ALVES, University of Brasília
SVEN APEL, Saarland University, Saarland Informatics Campus
MAXIME CORDY, University of Luxembourg
ROHIT GHEYI, Federal University of Campina Grande

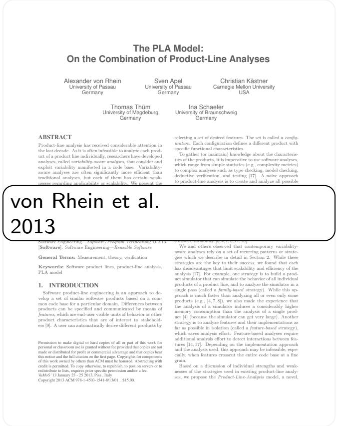
A number of product-line analysis approaches lift analyses such as type checking, model checking, and theorem proving from the level of single programs to the level of product lines. These approaches share concepts and mechanisms that suggest an unexplored potential for reuse of key analysis steps and properties, implementation, and verification efforts. Despite the availability of taxonomies synthesizing such approaches,

Castro et al.
2021
Based on Thüm et al.(CSUR'14)
Formal framework for SPL Analyses

Solution Space Quality Assurance - Static Analysis



Thüm et al.
2014
Defines a formal framework for SPL analysis strategies
Expert survey

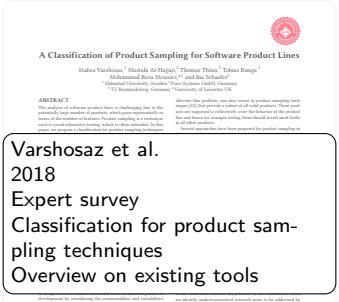


von Rhein et al.
2013

Solution Space Quality Assurance - Static Analysis

Author & Venue	Title
Sundermann et al. (VaMoS'21)	Applications of #SAT Solvers on Feature Models
Castro et al. (TOSEM'21)	A Formal Framework of Software Product Line Analyses
Thüm et al. ('14)	A Classification and Survey of Analysis Strategies for Software Product Lines
von Rhein et al. ('13)	The PLA Model: On the Combination of Product-Line Analyses

Solution Space Quality Assurance - Dynamic Analysis - Sampling

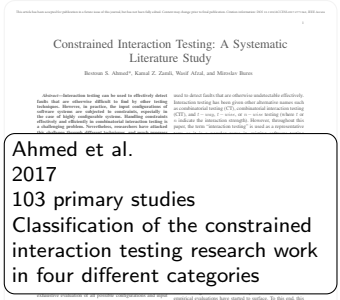


A Classification of Product Sampling for Software Product Lines

Mahsa Varshosaz,[1] Mustafa Al-Hajjaj,[2] Thomas Thüm,[3] Tobias Runge,[3] Mohammad Reza Mousavi,[4] and Ina Schaefer[3]
[1] Halmstad University, Sweden [2] Pure-Systems GmbH, Germany
[3] TU Braunschweig, Germany [4] University of Leicester, UK

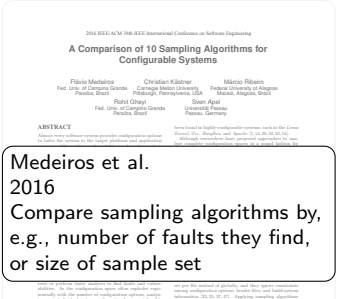
ABSTRACT

Varshosaz et al.
2018
Expert survey
Classification for product sampling techniques
Overview on existing tools



Constrained Interaction Testing: A Systematic Literature Study

Ahmed et al.
2017
103 primary studies
Classification of the constrained interaction testing research work in four different categories



2016 IEEE/ACM 38th IEEE International Conference on Software Engineering

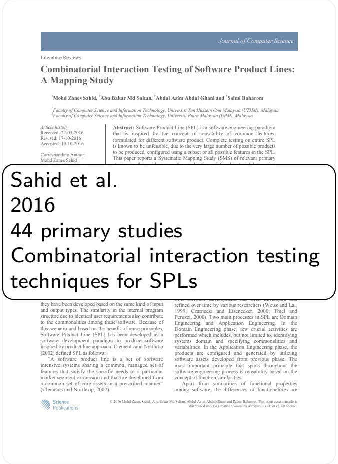
A Comparison of 10 Sampling Algorithms for Configurable Systems

Fláv io Medeiros, Christian Kästner, Márcio Ribeiro, Rohit Gheyi, Sven Apel

ABSTRACT

Medeiros et al.
2016
Compare sampling algorithms by, e.g., number of faults they find, or size of sample set

Solution Space Quality Assurance - Dynamic Analysis - Sampling

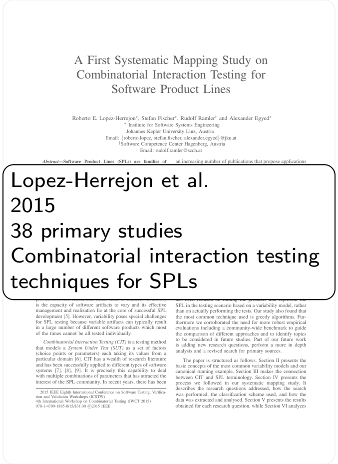

Journal of Computer Science

Literature Reviews

Combinatorial Interaction Testing of Software Product Lines: A Mapping Study

[1]Mohd Zanes Sahid, [2]Abu Bakar Md Sultan, [2]Abdul Azim Abdul Ghani and [2]Salmi Baharom

Sahid et al.
2016
44 primary studies
Combinatorial interaction testing techniques for SPLs


A First Systematic Mapping Study on Combinatorial Interaction Testing for Software Product Lines

Roberto E. Lopez-Herrejon*, Stefan Fischer*, Rudolf Ramler‡ and Alexander Egyed*

Lopez-Herrejon et al.
2015
38 primary studies
Combinatorial interaction testing techniques for SPLs

Solution Space Quality Assurance - Dynamic Analysis - Sampling

Author & Venue	Title
Varshosaz et al. (SPLC'18)	A Classification of Product Sampling for Software Product Lines
Ahmed et al. (AZAB'17)	Constrained Interaction Testing: A Systematic Literature Study
Medeiros et al. (ICSE'16)	A Comparison of 10 Sampling Algorithms for Configurable Systems
Sahid et al. (JcS'16)	Combinatorial interaction testing of software product lines: A mapping study
Lopez-Herrejon et al. (IWCT'15)	A First Systematic Mapping Study on Combinatorial Interaction Testing for Software Product Lines

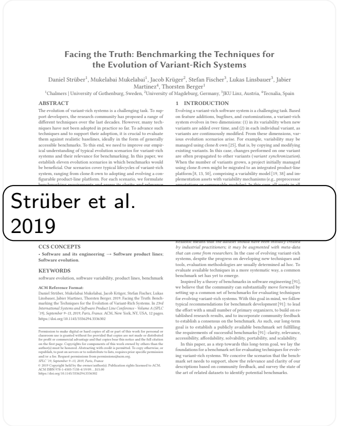
Solution Space Quality Assurance - Dynamic Analysis

Author & Venue	Title
Sulaiman et al. ('22)	Classification Trends Taxonomy of Modelbased Testing for Software Product Line: A Systematic Literature Review
Ferreira et al. ('21)	Evaluating T-wise Testing Strategies in a Community-wide Dataset of Configurable Software Systems
Petry et al. ('20)	Model-based testing of software product lines: Mapping study and research roadmap
Ferreira et al. ('20)	On the Proposal and Evaluation of a Test-enriched Dataset for Configurable Systems
Ferreira et al. ('19)	Testing Tools for Configurable Software Systems: A Review-based Empirical Study
Ruiz et al. ('19)	A general approach to Software Product Line testing
Sahak et al. ('17)	Evaluation of Software Product Line Test Case Prioritization Technique
Machado et al. ('14)	On Strategies for Testing Software Product Lines: A Systematic Literature Review

Solution Space Quality Assurance - Dynamic Analysis

Author & Venue	Title
Neto et al. ('12)	Mapping study on software product lines testing tools
Lee et al. ('12)	A Survey on Software Product Line Testing
Neto et al. ('11)	A systematic mapping study of software product lines testing
Engström and Runeson ('11)	Software product line testing – A systematic mapping study
Johansen et al. ('11)	A survey of empirics of strategies for software product line testing
Lamancha et al. ('09)	Software product line testing - a systematic review
Tevanlinna et al. ('04)	Product Family Testing – a Survey

Solution Space Reengineering

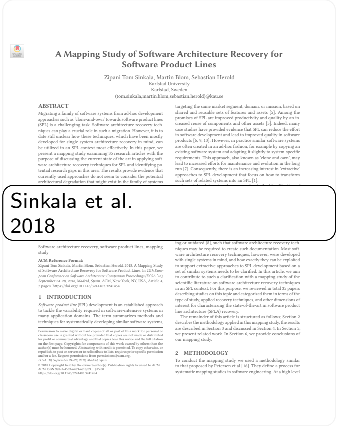


Facing the Truth: Benchmarking the Techniques for the Evolution of Variant-Rich Systems

Daniel Strüber[1], Mukelabai Mukelabai[1], Jacob Krüger[2], Stefan Fischer[3], Lukas Linsbauer[3], Jabier Martinez[4], Thorsten Berger[1]

[1]Chalmers | University of Gothenburg, Sweden, [2]University of Magdeburg, Germany, [3]JKU Linz, Austria, [4]Tecnalia, Spain

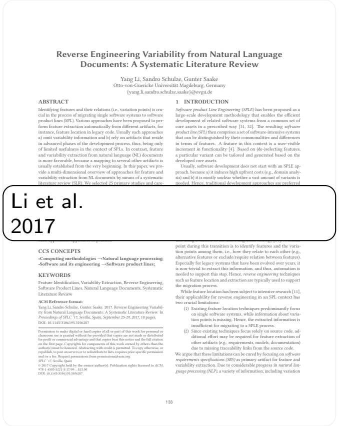
Strüber et al. 2019



A Mapping Study of Software Architecture Recovery for Software Product Lines

Zipani Tom Sinkala, Martin Blom, Sebastian Herold
Karlstad University
Karlstad, Sweden
(tom.sinkala,martin.blom,sebastian.herold)@kau.se

Sinkala et al. 2018



Reverse Engineering Variability from Natural Language Documents: A Systematic Literature Review

Yang Li, Sandro Schulze, Gunter Saake
Otto-von-Guericke Universität Magdeburg, Germany
{yang.li,sandro.schulze,saake}@ovgu.de

Li et al. 2017

Solution Space Reengineering

Author & Venue	Title
Strüber et al. ('19)	Facing the Truth: Benchmarking the Techniques for the Evolution of Variant-Rich Systems
Sinkala et al. ('18)	A mapping study of software architecture recovery for software product lines
Li et al. ('17)	Reverse engineering variability from natural language documents: A systematic literature review
Lopez-Herrejon et al. ('15)	Genetic Improvement for Software Product Lines: An Overview and a Roadmap
Vale et al. ('14)	Bad smells in software product lines: A systematic review
Fenske et al. ('14)	A Taxonomy of Software Product Line Reengineering
Laguna and Crespo ('13)	A systematic mapping study on software product line evolution: From legacy system reengineering to product line refactoring

Solution Space Reengineering - Migration

Empirical software product line engineering: A systematic literature review

Ana Ivo Chacón-Luna [...], Antonio Manuel Gutiérrez [...], José A. Galindo [...], David Benavides [...]

Chacón-Luna et al.
2020

Reengineering legacy applications into software product lines: a systematic mapping

Wesley K. G. Assunção [1,2] · Roberto E. Lopez-Herrejon [3] · Lukas Linsbauer [4] · Silvia R. Vergilio [1] · Alexander Egyed [4]

Assuncao et al.
2017

Feature extraction approaches from natural language requirements for reuse in software product lines: A systematic literature review

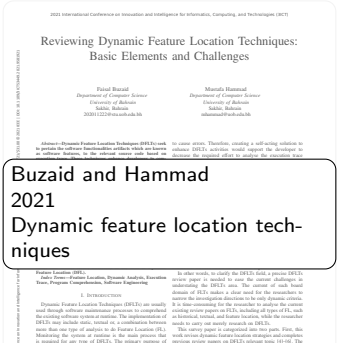
Noor Hasrina Bakar [...], Zarinah M. Kasirun [...], Norsaremah Salleh [...]

Bakar et al.
2015

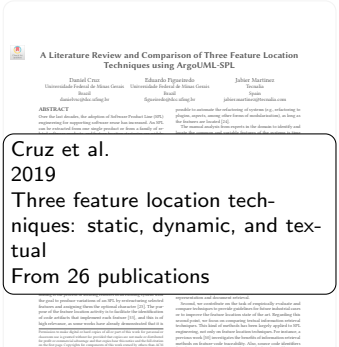
Solution Space Reengineering - Migration

Author & Venue	Title
Chacón-Luna et al. ('20)	Empirical software product line engineering: A systematic literature review
Assuncao et al. ('17)	Reengineering legacy applications into software product lines: A systematic mapping
Bakar et al. ('15)	Feature extraction approaches from natural language requirements for reuse in software product lines: A systematic literature review
Tüzün et al. ('15)	Empirical evaluation of a decision support model for adopting software product line engineering
Assunção and Vergilio ('14)	Feature Location for Software Product Line Migration: A Mapping Study
Ferreira Bastos et al. ('11)	Adopting software product lines: A systematic mapping study

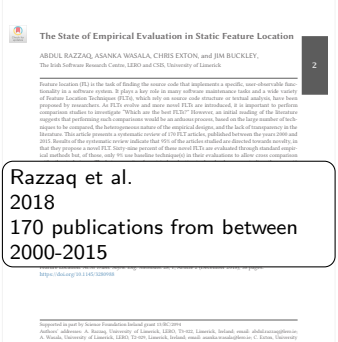
Solution Space Reengineering - Feature Location & Traceability



Buzaid and Hammad
2021
Dynamic feature location techniques



Cruz et al.
2019
Three feature location techniques: static, dynamic, and textual
From 26 publications



Razzaq et al.
2018
170 publications from between 2000-2015

Solution Space Reengineering - Feature Location & Traceability

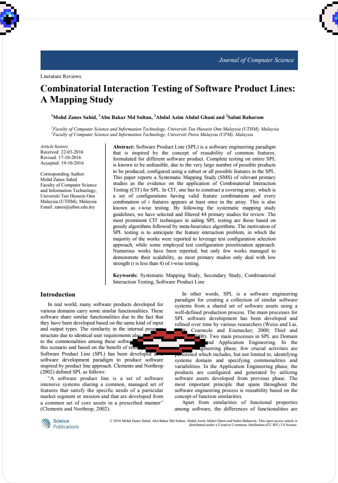
Author & Venue	Title
Buzaid and Hammad (3ICT'21)	Reviewing Dynamic Feature Location Techniques: Basic Elements and Challenges
Cruz et al. (VaMoS'19)	A Literature Review and Comparison of Three Feature Location Techniques using ArgoUML-SPL
Razzaq et al. (TOSEM'18)	The State of Empirical Evaluation in Static Feature Location
Vale et al. (INST'17)	Software product lines traceability: A systematic mapping study
Dit et al. (JSEP'13)	Feature Location in Source Code: A Taxonomy and Survey
Rubin and Chechik ('13)	A Survey of Feature Location Techniques

What next?

Applications of Product Line Techniques

Configuration

What next?



Journal of Computer Science

Literature Reviews

Combinatorial Interaction Testing of Software Product Lines: A Mapping Study

[1]Mohd Zanes Sahid, [2]Abu Bakar Md Sultan, [2]Abdul Azim Abdul Ghani and [2]Salmi Baharom

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Abstract: Software Product Line (SPL) is a software engineering paradigm that is inspired by the concept of reusability of common features, formulated for different software product. Complete testing on entire SPL is known to be unfeasible, due to the very large number of possible products to be produced, configured using a subset or all possible features in the SPL. This paper reports a Systematic Mapping Study (SMS) of relevant primary studies as the evidence on the application of Combinatorial Interaction Testing (CIT) for SPL.

Keywords: Systematic Mapping Study, Secondary Study, Combinatorial Interaction Testing, Software Product Line

Introduction

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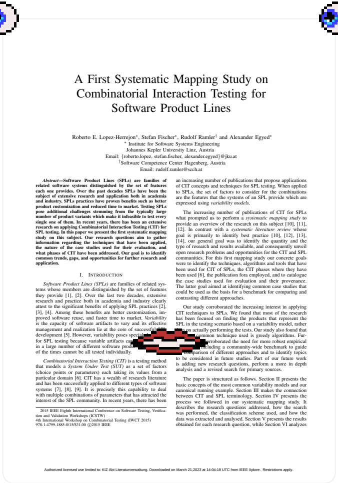


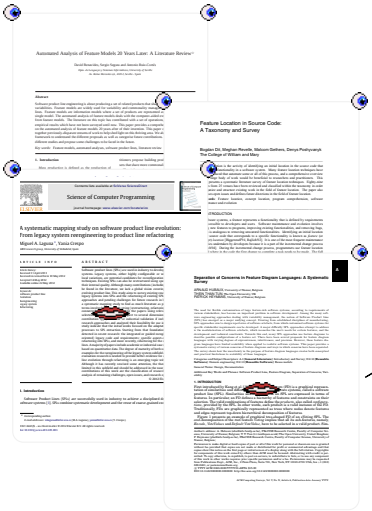
A First Systematic Mapping Study on Combinatorial Interaction Testing for Software Product Lines

Roberto E. Lopez-Herrejon*, Stefan Fischer*, Rudolf Ramler† and Alexander Egyed*
* Institute for Software Systems Engineering
Johannes Kepler University Linz, Austria
† Software Competence Center Hagenberg, Austria

I. Introduction

2015 IEEE Eighth International Conference on Software Testing, Verification and Validation Workshops (ICSTW)
4th International Workshop on Combinatorial Testing (IWCT 2015)

What next?



And what about us?

4 an Ellaborating overview of Configurable software: a Tertiary Study

1. **(Software) Product Lines**
   - Industrial Applications
   - Tool Support
   - Evolution
   - Processes
   - Applications of Product Line Techniques
     - Service-Oriented PL
     - Dynamic SPL
   - Management
2. **Problem Space**
   - Representation
   - Analysis
   - Configuration
3. **Solution Space**
   - Requirements
   - Architecture & Design
   - Implementation
   - Quality Assurance
     - Static Analysis
     - Dynamic Analysis
   - Reengineering
     - Migration
     - Feature Location & Traceability