

Incremental Testing for Software Product Line

A Systematic Literature Review

Vanderson H. Fragal¹ Elisa Yumi Nakagawa, André Endo and
Adenilso da Silva Simão

¹Institute of Mathematics and Computational Sciences - ICMC
Department of Computer Systems - SSC
University of São Paulo - USP

Systematic Review: protocol and conduction 2013

Outline

- 1 Planning
 - Protocol

- 2 Conduction
 - First Selection
 - Second Selection

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Objectives

- Identify primary studies that uses incremental testing strategy for Software Product Lines.
- **RQ1:** Which studies report on the incremental testing strategy applied to SPL?
- **RQ2:** What are the development environments, frameworks and tools that support the development of SPLs using a regression technique?

PICO

- **Population:** primary studies that that make use of incremental testing strategy on SPLs;
- **Intervention:** the intervention of this systematic review is represented by incremental testing methods applied to SPLs;
- **Comparison:** in our case, it is not applicable; and
- **Outcomes:** an overview of the studies proposed in the literature that report on the use of incremental testing methods like regression testing applied during the development of SPLs. We also expect to identify related development environments, frameworks and tools, that support the development of regression testing applied to SPLs.

Databases

Table 1: Selected publications databases

Source	Location
ACM Digital Library	www.portal.acm.org
IEEE Xplore	www.ieeexplore.ieee.org
ScienceDirect	www.sciencedirect.com
Scopus	www.scopus.com
ISI Web of Knowledge	www.isiknowledge.com

Keywords

- **Testing:** “Test”;
- **Incremental:** “Regression”;
- **Software Product Line:** “Product Line”, “Product Lines”, “SPL”, “Product Family” and “Product Families”.

Search String

(“Testing” OR “test”) AND (“Incremental” OR “Regression”) AND (“Software Product Line” OR “SPL” OR “Product Line” OR “Product lines” OR “Product Family” OR “Product families”)

Inclusion Criteria

- **IC1:** the primary study proposes or reports on the incremental testing strategy applied to SPL; and
- **IC2:** the primary study that proposes or reports tools, frameworks or development environments for regression testing applied to SPLs.

Exclusion Criteria

- **EC1:** the primary study that reports on the incremental testing strategy and is not applied to SPLs;
- **EC2:** the primary study that presents principal contributions in areas other than incremental/regression testing;
- **EC3:** the study is a previous version of a more complete study about the same research; and
- **EC4:** the primary study is a table of contents, short course description, tutorial, copyright form or summary of an event (e.g., a conference or a workshop).

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ACM Digital Library

((**Title:**((“Testing” OR “test”) AND (“Incremental” OR “Regression”) AND (“Software Product Line” OR “SPL” OR “Product Line” OR “Product lines” OR “Product Family” OR “Product families”))))

or (**Abstract:**((“Testing” OR “test”) AND (“Incremental” OR “Regression”) AND (“Software Product Line” OR “SPL” OR “Product Line” OR “Product lines” OR “Product Family” OR “Product families”))))

or (**Keywords:** ((“Testing” OR “test”) AND (“Incremental” OR “Regression”) AND (“Software Product Line” OR “SPL” OR “Product Line” OR “Product lines” OR “Product Family” OR “Product families”))))

- As a result, 5 primary studies were obtained.

((“Testing” OR “test”) AND (“Incremental” OR “Regression”) AND (“Software Product Line” OR “SPL” OR “Product Line” OR “Product lines” OR “Product Family” OR “Product families”))

- As a result, 18 primary studies were obtained.

TITLE-ABSTR-KEY(("Testing" OR "test") AND ("Incremental" OR "Regression") AND ("Software Product Line" OR "SPL" OR "Product Line" OR "Product lines" OR "Product Family" OR "Product families"))

- As a result, 3 primary studies were obtained.

Scopus

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TITLE-ABS-KEY(((({Testing} OR {Test}) AND ({incremental} OR {regression}) AND ({Software Product Line} OR {Product Line} OR {SPL} OR {Product Lines} OR {Product Family} OR {Product Families})))) AND (LIMIT-TO(SUBJAREA, "COMP")) AND (LIMIT-TO(LANGUAGE, "English"))
```

- As a result, 35 primary studies were obtained.

ISI Web of Knowledge

TI=((“Model-Based Testing” OR “Model Based Testing” OR “MBT” OR “Model-Driven Testing” OR “Model Driven Testing” OR “Test Generation” OR “Test Development” OR “Test Design” OR “SPL testing” OR “product line testing” OR “product testing”) AND (“Software Product Line” OR “SPL” OR “Product Line” OR “Product lines” OR “Product Family” OR “Product families”))

OR TS=((“Model-Based Testing” OR “Model Based Testing” OR “MBT” OR “Model-Driven Testing” OR “Model Driven Testing” OR “Test Generation” OR “Test Development” OR “Test Design” OR “SPL testing” OR “product line testing” OR “product testing”) AND (“Software Product Line” OR “SPL” OR “Product Line” OR “Product lines” OR “Product Family” OR “Product families”))

- As a result, 8 primary studies were obtained.

All Databases

ACM	IEEE	ISI Web of Knowledge	Science Direct	Scopus
5	18	8	3	35

- As a result, 69 primary studies were obtained.
- Removing repeated: 42;
- Mendeley tool.

Criteria Applied

Inclusion Criteria			Exclusion Criteria		
IC	#PS	%PS	EC	#EC	%EC
IC1	18	42.85%	EC1	1	2.38%
IC2	4	9.52%	EC2	6	14.28%
			EC3	1	2.38%
			EC4	12	28.57%
TOTAL	22	52.38%	TOTAL	20	47.62%

Primary Studies Obtained

Database	Obtained	Included	Exclusive	Precision Index	Rate Index
ACM Digital Library	5	3	0	0.6	0.13
IEEE Xplore	18	13	1	0.72	0.59
Science Direct	3	1	0	0.33	0.04
Scopus	35	21	2	0.6	0.95
ISI Web of Knowledge	8	7	0	0.87	0.31

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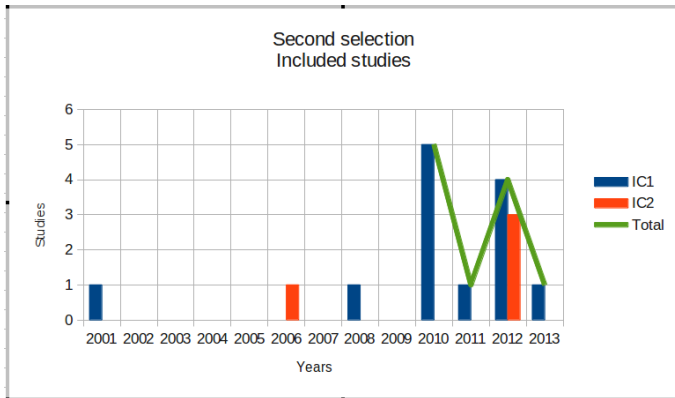
Full Read

- One study partially available (Runeson and Engström, 2012b).
Journal - Advances in Computing;
- Were evaluated 22 studies;
- After the criteria application 12 studies were included;
- One study was suggested by a specialist (Engström, 2010a).
Licentiate thesis - 4 published papers inside.
- Related work (McGregor, 2001) while reading Engström
(2010b). Conference Paper (excluded).

Included Primary Studies

ID	Author	Year	Type	Criteria	Source
S1	Silveira Neto et al. (2010)	2010	CP	IC1	IE,Sc
S2	Kim et al. (2006)	2006	CP	IC2	AC,Sc
S3	Striker et al. (2010)	2010	CP	IC1	Sc,Wb
S4	Engström and Runeson (2011)	2011	CP	IC1	IE,Sc
S5	Lochau et al. (2012)	2012	CP	IC1,IC2	Sc
S6	Uzuncaova et al. (2010)	2010	JA	IC1	IE,Sc,Wb
S7	Runeson and Engström (2012a)	2010	CP	IC1	IE,Sc
S8	Rommel et al. (2012)	2012	JA	IC1,IC2	IE,Sc
S9	Engström and Runeson (2013)	2013	JA	IC1	SD,Sc,Wb
S10	Jin-hua et al. (2008)	2008	CP	IC1	IE,Sc,Wb
S11	Muccini and van der Hoek (2003)	2003	CP	IC1	Sc
S12	Heider et al. (2012)	2012	CP	IC1,IC2	AC,Sc
S13	Runeson and Engström (2012b)	2012	JA	IC1	Sc,Wb
S14	McGregor (2001)	2001	TR	IC1	E7
S15	Engström (2010a)	2010	LT	IC1	Specialist

Included Studies x Years



Excluded Primary Studies

ID	Author	Year	Type	Criteria	RS	Source
E1	Silveira Neto et al. (2012)	2012	CP	EC3	S1	IE,Sc,Wb
E2	Oster et al. (2010)	2010	CP	EC2		Sc,Wb
E3	Houshmand et al. (2004)	2004	CP	EC1		IE,Sc
E4	Johansen et al. (2012)	2012	CP	EC2		AC,Sc
E5	Lity et al. (2012)	2012	CP	EC3	S5	IE,Sc
E6	Lamas et al (2010)	2010	CP	EC2		IE,Sc
E7	Engström (2010b)	2010	CP	EC3	S4,S7	IE,Sc
E8	Uzuncaova et al. (2008)	2008	CP	EC3	S6	IE,Sc
E9	Ullah and Ruhe (2006)	2006	CP	EC2		IE

Primary Studies Obtained

Database	Obtained	Included	Exclusive	Precision Index	Rate Index
ACM Digital Library	5	2	0	0.4	0.13
IEEE Xplore	18	6	0	0.33	0.4
Science Direct	3	1	0	0.33	0.06
Scopus	35	13	2	0.37	0.86
ISI Web of Knowledge	8	5	0	0.62	0.33

Quality Criteria

Group	ID	Quality criteria
1	1	Are there any roles described?
	2	Does it detail the test artefacts?
	3	Does it detail the validation phase?
	4	Does it detail the verification phase?
	5	Does it deal with any test measure?
2	6	Does it deal with Model-Based testing?
	7	Does it use a formal model?
	8	Does it use any coverage criteria?

Questions?

