

# Mark Harman's CV Summary (2 pages)

**Independent data sources on Mark:** Google Scholar; DBLP; Semantic Scholar; EPSRC.

## Research Grants

Total funding as lead investigator (PI): **£12,927,806**

Career EPSRC funding proposal success rate: **74%** (17/23)

(EPSRC is the UK's primary science funder. National average success rate ~ 20%)

**5** of my projects were ranked in first place by the prioritization panel

I lead **platform (2009-2014)** and **programme (2012-2018)** grant projects

(These grants are awarded only to undisputedly world-leading researchers)

## PhD Supervision

Successfully completed: **23** (15 as first supervisor; 8 as second supervisor)

Current (first supervisor): **9**

Current (second supervisor): **3**

## Peer reviewed papers

Total: 279

Journals: 93

Conferences: 186

## Principal Peer Esteem Indicators

**Editorial boards:** TSE, TOSEM, JSS, EMSE, SEJ, STVR, SQJ, IST, JSEP.

**Program chair:** ICSE '18, FSE '15, ISSTA '13, ICST '11, ICSME '04 and others.

Program committee membership: **243**

Program chair: **13**

General chair: **8**

Special issue editor: **17**

Keynotes and invited conference talks: **35**

Best paper awards: **11**

H-index on Google Scholar: **62 (15,710 citations; 27th November 2016)**

Member of the EPSRC college since 2003 & ICT Strategic Advisory Team (SAT) 2008–2013.

I have 3 papers in the all-time top 100 highly cited papers on Software Engineering<sup>1</sup> and 5 of the top 10 on Search based Software Engineering<sup>2</sup>.

## Current/Recent Management and Leadership Roles

CREST centre director (30 staff recursively reporting to me). Head of Software Systems Engineering. I co-founded the field of Search Based Software Engineering (SBSE), which has ~ 1600 active researchers in 40 different countries. Departmental Research Excellence Framework (REF2014) Submission Lead: I was the principal architect of UCL CS's first place ranking in the 2014 Research Excellence Framework.

## Scientific Advisory Roles and Notable Awards/Prizes

I am a member of the scientific advisory board of the Swedish Wallenberg \$100M Autonomous Systems Program (WASP) and the University of Durham Department of Computer Science. GECCO human competitive results (HUMIES), Gold Medal and Bronze Medal 2016. GECCO human competitive results, Silver Medal 2014.

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<sup>1</sup>I&ST 2016

<sup>2</sup>SSBSE 2011

# Mark Harman's CV Summary (Industry Page)

## Vision for the Software Industry

My life's mission is AI-based software systems optimisation. Current near-market work uses computational search to automate software test case design. My team and I build AI-TIGERS: Artificially Intelligent — Test Input Generation, Execution and Re-execution Systems. I use computational search as my primary Artificial Intelligence technique to design test cases that optimise functional and performance testing.

## Example Current Industrial Projects

**Huawei; 2015–:** I lead a team of 6 working on the transfer of Search Based Software Engineering into Huawei's 2012 labs, focusing on testing and programmer productivity improvement.

**JP Morgan; 2016–:** I lead a team of 4 working on automated feature extraction from natural language, and software portfolio analysis and optimisation.

**Amazon; 2016–:** I work with a team of 3 investigating improvements to modern code review processes.

## Example Completed Industrial Projects

Results of my previous scientific work with Daimler, Ericsson, Google, IBM, Microsoft and Motorola have been published in the (peer-reviewed) scientific literature.

**Visa Inc; 2014–2016:** I led a team of 4 working on metamorphic testing and test case prioritisation for fraud detection systems, and the application of game theory to ameliorate the fault-severity inflation problem.

**Google; 2009-2011:** I worked with my PhD student Shin Yoo (now associate prof. at KAIST) on optimised regression testing. The work demonstrated how SBSE techniques could reduce time needed to find regressions faults. Its findings were published at FSE 2011 and Google's conference GTAC. Subsequent work on regression optimisation at Google is ongoing, but now led by others in the research community.

**Microsoft; 2007-2008:** I worked with my PhD student Kiran Lakhota (now CTO at KyePot) on search based software testing, which was incorporated into the Pex tool, and subsequently released as part of Visual Studio in 2012. This work has been cited by Microsoft for its research impact (at ASE 2014) and was one of the research impact case studies included in the UK Research Excellence Framework 2014.

**DaimlerChrysler; 2001-2009:** I led a team 5 working on incorporating static analysis and search based software testing into DaimlerChrysler's automated testing framework. We had a series of projects, many of which led to highly-cited and influential research publications. I designed and implemented the variable dependence analysis system, VADA, which was successfully deployed to developers.

## Start-ups and Spin-outs

I co-founded the automated test optimisation start-up MAJICKE and the app analytics spin-out APPREDICT.

# Mark Harman's CV (Details)

## Contact Details

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## Qualifications

The Emmbrook Comprehensive School, Wokingham, Berkshire. 1977-1984  
**8 O'Levels, 2 A/O Levels and 3 A'levels (all grade A).**

Imperial College of Science & Technology, University of London. 1984-1988.  
**M.Eng. (2:1) in Software Engineering.**

Polytechnic of North London. 1988-1992.

**Ph.D. in Computer Science.**

Thesis title: *Functional Models of Procedural Programs.*

Examiners: John Darlington (Imperial) & Dan Simpson (Brighton).

## Employment History

<b>Institution</b>	<b>Dates</b>	<b>Position</b>
Polytechnic of North London	9/1988 – 1/1991	Research Assistant
Polytechnic of North London	1/1991 – 7/1995	Lecturer in Computing
University of North London	7/1995 – 7/1997	Departmental Director of Research
University of North London	7/1997 – 1/1998	Head of Department
Goldsmiths College	1/1998 – 4/2000	Lecturer in Computer Science
Brunel University	4/2000 – 8/2003	Lecturer in Computing
Brunel University	9/2003 – 9/2004	Reader in Computing
Brunel University	9/2004 – 8/2004 <sup>†</sup>	Professor of Computing
King's College, London	8/2004 – 8/2010	Professor of Software Engineering
University College London	8/2010 –	Professor of Software Engineering

<sup>†</sup>I moved to KCL before the promotion took effect.

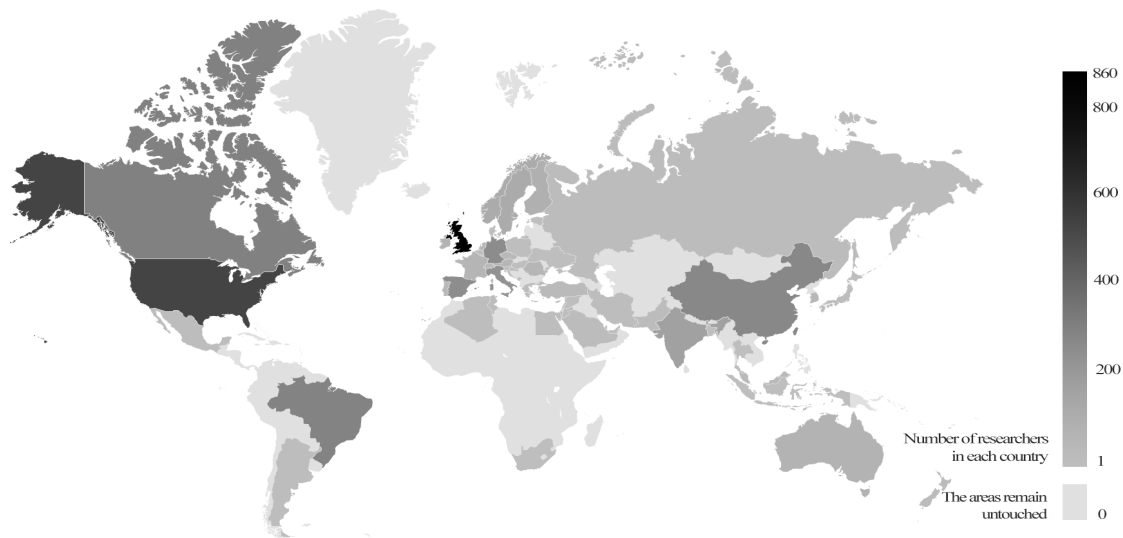


Figure 1: The Global Spread of SBSE Authorship 2001-2014

## Research Overview and Principal Contributions

My principal research contributions lie in the areas of Source Code Analysis (notably slicing), Testing and Search Based Software Engineering (SBSE). Of the three, SBSE will probably prove to have the greatest long term impact.

In 2001 I published the paper on Search based Software Engineering (SBSE) that coined the term and, essentially, founded the discipline. Other researchers played critical roles in founding this field of study and there were also papers on the application of computational search to aspects of Software Engineering prior my 2001 paper. However, my 2001 paper was the first to argue that computational search (metaheuristic algorithms) could and should be applied right across the spectrum of software engineering activities. In this paper and my subsequent work, I demonstrated that there is a strong intellectual and technical fit between the problems in Software Engineering and their potential solution using computational search algorithms.

From 1998 to 2002, I was the director of the SEMINAL network (Software Engineering using Metaheuristic INnovative ALgorithms) and, since 1998, had spent several years developing a network of software engineers who were interested in applying computational search to software engineering problems. Since then, I have devoted a large part of my effort to developing the SBSE agenda, providing methods, tools and techniques for SBSE.

Figures 1 and 2 show the growth and global spread of authorship of scientific papers on SBSE since my 2001 paper. As can be seen, there has been an explosion of SBSE activity. SBSE is already sufficiently large a topic to warrant more than 12 detailed surveys and analyses of aspects of the literature. It has been applied to diverse software engineering problems, such as requirements, project management, predictive modelling, design, debugging, maintenance, re-engineering and testing.

There are also a number of SBSE tools that build on the scientific foundations of SBSE and which support SBSE applications right across the range of software engineering activities, from release planning, through design to testing refactoring and patching. My team and I contributed several of these, notably in the area of testing, where our tools have been used by Daimler, Google and Microsoft among others.

Recent surveys of the SBSE literature covering specific subareas such as estimation, non-functional properties, requirements, project management, software design, software product lines and testing as well as more general topics in software engineering. The prevalence of these surveys demonstrates that the general area of SBSE, is already developing flourishing and growing sub-areas and associated research communities.

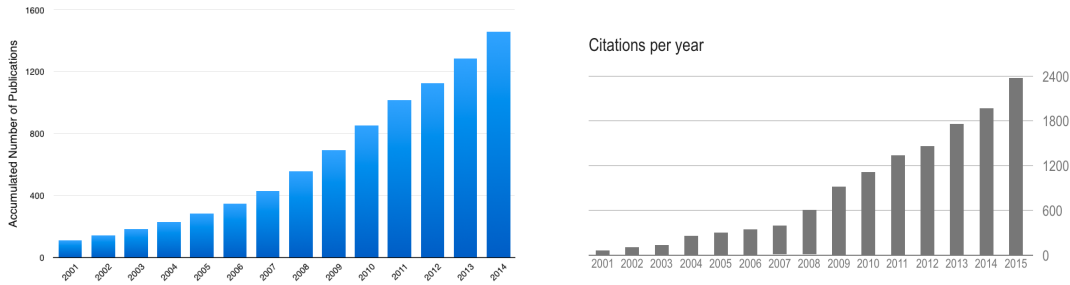


Figure 2: **Left: Growth in SBSE publications; 2001–2014 (source: SBSE repository). Right: Annual Growth in citations to my work since 2001 (source: Google Scholar, Nov. 2016)**

As well as the international conferences and workshops on SBSE, there are also regional workshops on SBSE in Brazil (founded in 2010), China (founded in 2012) and North America (founded in 2015), indicating uptake of SBSE ideas and techniques in the world’s emerging economies. A recent retrospective<sup>3</sup> on the growth of SBSE in Brazil published in the *Journal of Systems and Software* highlights the key role played by my work in founding and leading the development of the international SBSE research agenda.

I have successfully supervised many PhD students. Among them are many excellent scientists, who are developing as leaders in their own right. For example:

**Shin Yoo**, who is now a lecturer (assistant professor) at KAIST and a world-leading expert on SBSE for regression testing. Dr. Yoo was SBSE track co-chair for the ACM Genetic and Evolutionary Computation Conference (GECCO 2012) and program chair for the 7th International Symposium on Search Based Software Engineering (SSBSE 2014). His 2012 Software Testing, Verification and Reliability paper (co-authored with me) on Regression Testing has over 500 citations.

**Zheng Li**, who is now full professor at Beijing University of Chemical Technology and a leader of the Chinese SBSE community. Prof. Li was the chair of the 1st Chinese SBSE workshop (CSBSE 2012) and the 12th IEEE Working Conference on Source Code Analysis and Manipulation. His 2007 paper (co-authored with me) on test case prioritisation in *IEEE Transactions on Software Engineering* already has over 500 citations.

**Yuanyuan Zhang**, who is now a research associate in my research centre at UCL and world-leading authority of SBSE for requirements. Dr. Zhang was the program co-chair for the 5th International Symposium on Search Based Software Engineering (SSBSE 2013). Her 2009 ACM Surveys paper on SBSE (co-authored with me) has over 500 citations (including its previous TR version).

**Yue Jia**, who is a lecturer (aka Assistant Professor) at UCL and also a world-leading mutation testing expert. Dr. Jia has been program chair for two IEEE Mutation Testing workshops and guest editor of a special issue of *Software Testing, Verification and Reliability* on Mutation Testing. His 2011 paper (co-authored with me) on Mutation Testing in *IEEE Transactions on Software Engineering* already has over 700 citations.

<sup>3</sup> *Search Based Software Engineering: Review and analysis of the field in Brazil* by Thelma Elita Colanzi, Silvia Regina Vergilio, Wesley Klewerton Guez Assuncao and Aurora Pozo. *Journal of Systems and Software*, 86(4):970984; April 2013.

## Quantitative Evidence for Research Quality

My **H index is 62** and I have **over 15,000 citations** to my work according to Google Scholar. Based on the past ten years' research, in 2012, Microsoft Academic Search<sup>4</sup> ranked me in **2nd place in the world for Software Engineering (out of 80,155 software engineers)** and its 5 year ranking placed me in **1st place (out of 27,262 software engineers)**. The Microsoft Academic Search system was decommissioned in 2012, but I believe these rankings have held up or improved since then.

A 2011 ten-year retrospective<sup>5</sup> on SBSE work since I coined the term in 2001 ranked me first place among the (800 then, now more than 1,600) authors in the field of SBSE. The same survey reported that 5 of my papers occupied positions in the international top 10 papers over all authors by citation count.

A more recent survey of the 'top 100 papers' in Software Engineering<sup>6</sup>, listed three of my papers in the top 100 (only one scholar, Vic Basili, had more, with four, according to the survey).

I have given **35 keynotes** at international scientific conferences and workshops (most recently including CBSoft 2016, ICST 2015, SPLC 2014, WCRE 2013, GECCO 2013, ASE 2012 and ESEM 2012), and many other invited talks. I have published widely on SBSE across a variety of software engineering applications from requirements engineering and software management through to software maintenance and testing. Many of my papers are in the top 1% of all cited papers in Computer Science, with several in the top 0.1% (according to Thomson Reuters Essential Science Indicators) and my co-authors and I have received 11 best paper awards, 2 SSBSE challenge track winners, an ACM distinguished paper award (2015) and three GECCO Humie medals (Gold and Bronze in 2016 and Silver in 2014).

## Research Excellence Framework (REF 2014)

I the leader and principal architect of the University College London Computer Science submission to the Research Excellence Framework (REF 2014). We moved up in research ranking from equal **5th (out of 81) in 2008 to 1st place (out of 89) in 2014** according to grade point average (3.57/4) and percentage of 4\* research (61%). These are the two criteria used by HEFCE itself, the funding body that implements REF, to identify high-performing units of assessment.

This performance improvement was undoubtedly largely the product of hard work and the department's excellent environment and its recruitment and retention of world-leading faculty members. Nevertheless, I believe my own skills in optimisation, management and leadership played an important role in ensuring that we achieved the best possible outcome.

I was a **co-author of 13 of the research papers submitted** to the exercise by UCL, and was also the **author of an impact case study** submitted by King's College London Department of Informatics (which also performed well in the assessment, moving from 31st place to 14th place according to GPA).

Since REF 2014, I have already had **7 papers accepted for ICSE (2 on 2016, 3 in 2015 and 2 in 2014); 3 for FSE (1 in 2016 and 2 on 2014) 7 for ISSTA (4 in 2016, 2 in 2015, 1 in 2014) 1 for RE and 6 for IEEE Transactions (2 are to appear, 3 were published in 2015 and 1 on 2014)**. All 24 of these papers are in undisputedly first-tier venues, so I am already able to make a strong contribution to the next REF.

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<sup>4</sup>URL: <http://academic.research.microsoft.com/RankList?entitytype=2&topdomainid=2&subdomainid=4&last=10>

<sup>5</sup>F. G. Freitas and J. T. Souza: *Ten years of search based software engineering*, 3rd International Symposium on Search based Software Engineering (SSBSE 2011), pages 18-32, Springer LNCS, 2011.

<sup>6</sup>V. Garousi and J. M. Fernandes: *Highly-cited papers in software engineering*, Information and Software Technology, Volume 71, Pages 108128, 2016.

# Funding

## Quantitative Overview

Project Title	Source of Funding	year awarded	Principal or Co Investigator	Amount of Funding
SEMINAL	EPSRC	1999	Principal	£51,112
GUSTT	EPSRC	2000	Principal	£135,111
TeTra	EPSRC	2003	Principal	£173,998
SBSE	EPSRC	2003	Principal	£10,319
ASTRENet	EPSRC	2004	Principal	£60,372
CONTRACTS	EPSRC	2004	Principal*	£381,347
Two development grants	DaimlerChrysler	2001–2004	Principal	£29,000
SEBASE	EPSRC	2006	Principal	£1,145,357
EvoTest	EU STReP	2006	Principal	£251,000
Osaka Collaboration	Diawa Foundation	2006	Principal	£3,900
TAIC PART 2006	EPSRC	2006	Principal	£15,208
Dependence Analysis	DaimlerChrysler	2006	Principal	£25,000
CREST support grant	Vizuri	2006	Principal	£5,000
TAIC PART 2007	EPSRC	2007	Principal	£27,531
A-Club	EPSRC	2007	Principal	£59,898
SLIM	EPSRC	2008	Principal	£593,000
SCALE	PMI	2008	Principal	£35,000
Motorola Foundation	Motorola	2009	Principal	£20,000
SSBSE	EPSRC	2009	Principal	£17,398
CREST platform grant	EPSRC	2009	Principal	£1,130,441
MOERTest	Google	2010	Principal**	£5,533
FITTEST	EU	2010	Principal	£480,000
RECAST	EPSRC	2010	Principal	£353,915
GISMO	EPSRC	2011	Principal	£502,415
SCARTO	Google	2012	Principal	£24,517
DAASE	EPSRC	2012	Principal	£6,809,874
GGGP	EPSRC	2015	Principal	£581,560
<b>TOTAL for which I am Principal Investigator</b>				<b>£12,927,806</b>
<b>TOTAL income for my own institution and for which I am Principal Investigator</b>				<b>£8,417,932</b>

Project Title	Source of Funding	year awarded	Principal or Co Investigator	Amount of Funding
FORTEST	EPSRC	2001	Co	£59,385
TestCom	EPSRC	2004	Co	£9,297
Linear Schemas	EPSRC	2006	Co	£301,452
Hewlett Packard FOSSOLOGY	HP	2010	Co	£25,000
InfoTestSS: Info. theory & Test Suite Selection	EPSRC	2016	Co	£448,002
<b>TOTAL for which I am Co-Investigator</b>				<b>£843,136</b>

## Current Funded Projects for which I am Principal Investigator

### **GGGP: Grow and Graft Genetic Programming: EP/M025853/1: 28th October 2015 - 27th October 2019**

The GGGP project is motivated by the frustration often expressed as questions such as "Why do software engineers spend so long repeatedly performing the same tedious low level software development tasks?" and "How many times do programmers work out how to express the idea of null pointer checking in a particular context or adapt existing code for searching an iterated data structure?" We propose a new approach to software development: Grow and Graft Genetic Programming (GGGP), in which a new feature is grown (using genetic programming) and subsequently grafted into an existing system. This grow and graft development approach aims to reduce the amount of tedious effort required by human programmer in order to develop and add new functionality into an existing system. Our initial proof of concept work found that surprisingly little human guidance and domain knowledge is required from the programmer to guide Grow and Graft Genetic Programming. The funding is primarily for the support of the senior research fellow, Bill Langdon, who will develop this grow and graft genetic programming research agenda. The initial industrial partners are Microsoft and Visa Europe Limited.

### **DAASE: Dynamic Adaptive Automated Software Engineering: EP/J017515/1: 1st June 2012– 30th November 2018**

The aim of this project is to develop dynamic optimisation techniques that will provide automated adaptivity for both software products and the processes that produce them. This will establish a whole new way of making and deploying software. DAASE is an EPSRC programme grant for which I am PI and for which UCL is the lead institution. The total is £6.8m. Though all of the funding comes to UCL in the first instance, as is standard practice with programme grants, the lead institution contracts out research to the other sites. Therefore, of the overall £6.8m, only approximately £2.5m will be spent at UCL. The CIs who will lead at the other three sites are Profs. John Clark (York), Xin Yao (Birmingham) and Edmund Burke (Stirling). The local team at UCL also includes Drs. Bentley, Black, Krinke and Yoo. We will hire 22 three year RAs (or equivalent) over the 6 years of the project and also recruit 26 PhD students. We also expect to appoint at least 6 lectureships and a business development manager. The initial industrial partners were ABB, Berner and Mattner, BT, Ericsson, GCHQ, Honda, IBM, Microsoft, Motorola and NorthropGrumman, though we expect to add more as the project progresses.

### **SCARTO: 2012–**

This is a Google award to develop techniques for optimised regression testing and dependence analysis. Like the MORETest project that preceded it, this is a proposal I wrote with Dr. Yoo and though I am officially the PI, I regard him as joint PI.

### **GISMO: Genetic Improvement of Software for Multiple Objectives: EP/I033688/1: 2011–2015**

This project will develop a new way of automatically generating software to meet non-functional requirements from software that already largely meets functional requirements. I believe that our approach has tremendous potential to achieve many of the original hoped-for goals of genetic programming. Bill Langdon is the named Senior Research Fellow and I am the PI. Our industrial partners are IBM UK, Motorola UK and nVidia USA.

### **Motorola Foundation grant: 2009 –**

This was a gift of £20k from Motorola USA to support the work of the CREST lab I lead.



## Completed Projects for which I was Principal Investigator

### **CREST platform: EP/G060525: 2009–2014**

This project is a prestigious EPSRC platform grant for the CREST centre that I direct. To be successful, applicants have to satisfy EPSRC peer review of their internationally leading status. In the words of the EPSRC: “Applicants are required to have an internationally leading reputation and a high international profile.”.

### **RE-COST: REducing the Cost of Oracles for Software Testing: EP/I010165/1: 2010–2013**

This project developed techniques to balance the benefits of software testing against the costs involved using multi objective search based software engineering. Previous work on automated test data generation had only focused on the benefits to be gained, which, we argued was unrealistic. Our industrial partners are Berner and Mattner, Berlin, Motorola UK, and Sogeti UK Ltd. I was the PI for the UCL component, and overall project lead, while Dr. Phil McMinn was the PI for the Sheffield component. The UCL income from the grant was £353,915. We opened up a new field of research in *realistic* test case generation that I believe will prove to be important in making automated test generation techniques more effective. Too often automated test systems generate tests which no human tester can understand; we showed how we can enhance automated testing with realistic test case generation.

### **FITTEST: EU grant agreement 257574: 2010–2013**

This project extended and applied the work of the Evotest project to Future internet testing. I was the PI for UCL and I was one of the four primary authors of the proposal (though all partners contributed). My part of the project funded two post doctoral RAs for three years each. We developed and deployed tools for search based testing which have been used by the partners (and others) to find previously unknown bugs in their systems. The project had several practical contributions to better testing. My colleagues and I developed new ways to combine Dynamic Symbolic Execution and Search Based Software Testing that combine the strengths of both and which I hope and believe open up new avenues of research.

### **SLIM: EP/F059442: 2008-2011**

The project developed algorithms and theory for slicing Extended Finite State Machines. Slicing had been well-studied for programs, but less so for state machines. The project employed two post-doctoral researchers, and was supported by industrial partners: Berner and Mattner and Motorola and visiting fellow Prof. Bogdan Korel from Illinois Institute of Technology. We developed new techniques for slicing systems at the model level which extended slicing to system models. I believe that these techniques are particularly effective since they reduce models from unmanageable size to those that can be fitted onto a single side of A4 paper.

### **SEBASE: Submitted Jan 2005. Revised and resubmitted July 2005. Funded Nov 2005. EP/D050863: 2006-2011**

This was a project in collaboration with Professor Xin Yao (Birmingham), Professor John Clark (York), IBM, DaimlerChrysler and Motorola. I was the PI for the King’s College (then UCL, when I moved) part of the project and was also overall project director. The project was for a major research programme in Search Based Software Engineering for £2.7M over five years. The King’s portion of the grant was £1,145,357. SEBASE provided scientific evidence for SBSE’s applicability throughout the wide spectrum of software engineering activities. The project attracted significant international interest and follow-on work from other researchers. The tools and techniques were developed and deployed in several companies including Google and Microsoft. The project was a finalist for the Times Higher Education Supplement’s “Project of the year” award in November 2012.

**(\*\*) Google Award: 2010**

This was an award to pay for a secondment of my then research associate, Shin Yoo, to work with Google on Automated Optimised Regression Testing. The project was called MORETEST (Multi Objective Regression Testing). The work is on-going and has already been published at the Google Testing conference GTAC 2010 (acceptance rate 10%). I wrote the proposal jointly with Dr. Yoo. (\*\*)Formally speaking, I am the principal investigator, but I regard his role as ‘joint PI’ in this case.

**SCALE: PMI25: 2008-2010**

SCALE was a project funded by the Prime Minister’s Initiative (PMI). It was a partnership between the British Council and the Prime Minister’s office. The project explored the link between Mega Software Engineering (as developed at Osaka University) and Search Based Software Engineering (introduced by Harman’s Group at King’s CREST). The project was primarily a grant for travel to support visits and a 6 month secondment from Osaka to CREST for Dr. Makoto Matsushita.

**SSBSE: EP/G04872X: 2009-2009**

This project was a small grant to run a symposium on SBSE. The symposium was an outstanding success, with over 60 participants from 14 different countries and helped to secure the UK’s leading role in the development of the rapidly growing field of SBSE. I was the general chair. It launched the SSBSE conference, which has continued to develop and grow since then.

**A-Club: EP/F010443: 2007-2009**

A visiting fellow grant to allow Professor Binkley to spend 6 months in the CREST lab, together with support for a further year of periodic travel to CREST. Dependence clusters were shown to be a major problem in our earlier collaborative work and in the Dependence Analysis project with DaimlerChrysler, 2006. The A-Club project developed techniques to identify the causes of these clusters and ways to remove them from program source code.

**Evolutionary Testing (EvoTest)** This is a STReP project, awarded in January 2006, with partners in DaimlerChrysler, Motorola, RILA (Bulgarian SME), Zenon (Greek SME), Fraunhofer, INRIA, University of Valencia and King’s College London. I was the leader for the King’s component of the project, while Tanja Vos, then at the University of Valencia, was the overall project co-ordinator. The King’s college portion supported one RA and one PhD and associated costs. The total finding is £2.1M, of which King’s received £251,000. The project developed evolutionary testing techniques and tools which were used to find bugs in systems at partner sites, with notable uptake by Daimler Chrysler.

**Osaka Collaboration: 2006-2007**

This was a small grant from the Diawa foundation to support collaboration with Professor Katsuro Inoue at Osaka University on Mega Software Engineering and Search Based Software Engineering. This pump-primed the larger SCALE project, currently funded by the PMI initiative for £35,000 for which I was also the PI.

**TAIC PART 2007: EP/F012535**

This was a grant from EPSRC to support the Testing Academia and Industry Conference - Practice and Research Techniques 2007, for which I was the general chair. I also secured sponsorship for TAIC PART 2007 from Ericsson, ElectroMind, Gerrard Consulting, Nokia LDRA and Vizuri. The conference website is at <http://www2007.taicpart.org/>.

**(\*)CONTRACTS: GR/T22865/01 (PI) GR/T22872/01 (CI): 2004-2007**

**Ranked number one by the prioritization panel.**

CONTRACTS (CONcept assignment To Raise the abstrACTION level of Slicing). This was a grant proposal (GR/T22865) in collaboration with Nicolas Gold at UMIST (GR/T22872). The proposal was for two research assistants, one based at each site. The idea was to combine the expressiveness of the extraction criterion of concept assignment with the semantic guarantees provided by slicing. \*I was the principal investigator for the King's portion (GR/T22865) of the grant, which was £174,000. The proposal went to the prioritization panel on 29/7/2004 and was ranked number one. Subsequently, I recruited Nicolas Gold to King's College as a lecturer (he is now SL). EPSRC does not allow two PIs within a single institution so I decided to let Nicolas be the PI for the combined project, which was re-costed as GR/T22872/01 at £381,347. However, we regarded ourselves as joint PIs throughout.

**ASTReNET GR/S93684/01: 2004-2007**

ASTRENET (Analysis, Slicing and Transformation REsearch NETwork) was network that I led. It received £60,372 from EPSRC. The network combined the analysis, slicing and transformation producer communities with the potential software engineering user communities. We held 22 workshops over a period of 3 years and helped to develop a relationship between software engineering and program analysis that is still evident in collaboration and interactions between the two communities.

**TAIC PART 2006: EP/D077095**

**Evaluated as 'Outstanding' by EPSRC**

A grant from EPSRC to support the Testing Academia and Industry Conference - Practice and Research Techniques 2006, for which I was the general chair. I also secured sponsorship for TAIC PART 2006 from DaimlerChrysler, Ericsson, Motorola, LDRA, IPL and Vizuri. The conference website is at <http://www2006.taicpart.org/>.

**TeTra: Testability Transformation GR/R98938/01: 2003-2006**

**Ranked number one by the prioritization panel.**

**Evaluated as 'Tending to Outstanding' by EPSRC**

The goal was to transform programs for which it is hard to automatically generate test data, into programs which are easier to test. This involved novel transformations that need not preserve functional equivalence, but that must preserve test adequacy criteria instead. The funding was for £173,998. The proposal went to the prioritization panel on 24/4/2002 and was ranked number one. It started on 1st Jan 2003. I was the principal investigator. Testability transformation is now an established and widely-used technique for extending the reach of automated test generation tools and techniques.

**GUSTT GR/M58719: 1999-2002.**

**Evaluated as 'Outstanding' by EPSRC**

The GUSTT project was a collaboration with Durham University which had a separate grant for £123,000 and for which Malcolm Munro was the Principal Investigator. The GUSTT project grew out of my work on amorphous slicing. It interleaved slicing and transformation with applications to comprehension, reuse, testing and debugging. I wrote the Case For Support and was the principal investigator for the Brunel half of the project (£135,111), where I was a lecturer (aka assistant professor) at the time. On completion, the project was rated 'outstanding' (the highest grade achievable) by the grant review panel that considered it. Amorphous slicing is now a widely studied and well-established part of the overall body of work on program slicing and dependence analysis.

**SEMINAL GR/M78083: 1999–2002.****Evaluated as ‘Tending to Outstanding’ by EPSRC**

SEMINAL (Software Engineering using Metaheuristic Innovative Algorithms) was a network project for which I was the Principal Investigator. The partners were Brunel University (where I was at the time), Bristol University, York University, Reading University, BAe, Goldsmiths College, University of Glamorgan, Bournemouth University, BT Labs, QMW, Strathclyde University and Daimler-Chrysler. The grant was held by Brunel and was for a total of £51,112. The aim of the SEMINAL project was to recast software engineering problems as search problems, for which the applicable trade-off criteria can be used to define fitness functions. This project started as an EPSRC Network, but is now an on-going international networked research community with a track in the main international conference on Evolutionary Computation (GECCO) and annual workshops and symposia on SBSE and specific subfields.

**SBSE: search Based Software Engineering, GR/S56177/01: 2003****Evaluated as ‘Outstanding’ by EPSRC**

This was a proposal to hold a workshop in September 2003 on Search-Based Software Engineering (SBSE). I was the principal investigator for the project and program and general chair of the workshop. The EPSRC APM handling the grant said that the referees’ comments were the best that he had ever seen. This reflected the growing appreciation of the importance of SBSE. The project was rated ‘outstanding’ and ‘internationally leading’ across the board on completion, with overall evaluation ‘outstanding’.

**CREST support grant: 2007**

A small grant from Vizuri limited to support the purchase of additional lighting and soft furnishings for the CREST laboratory, raising the standard of the working accommodation. Only a small amount, but vital, since this support was unavailable from any other source.

**Dependence Analysis: 2006**

A grant from DaimlerChrysler to allow myself and my colleagues, Dr. Gold, Mr Li and Professor Binkley to work on dependence analysis of Daimler’s third party software. This grant was a cross between research and consultancy and was charged accordingly.

**DaimlerChrysler Grant/Consultancy: Testability Transformation: 2001–2002**

Evolutionary testing is hard to apply in the presence of side effects, unstructuredness and flag variables. This project investigated ways in which program transformation can overcome these barriers to evolutionary program testing. It was funded by DaimlerChrysler. Brunel’s portion is €15,000. I was the principal investigator (and at Brunel University at the time).

**DaimlerChrysler Grant/Consultancy: Search Space Reduction: 2002–2003**

Evolutionary testing effectiveness is reduced by large search spaces. Some variables which are apparently members of the search space, because they are input variables, do not contribute to the computation under test. Slicing can identify these variables. It was funded by DaimlerChrysler, which has provided €30,000. I was the principal investigator. Chris Fox, Essex University, was the co-investigator.

## Current Funded Projects for which I am a Co-Investigator

### **InfoTestSS: Information theory and Test Suite Selection: EP/P005888/1: 1st October 2016 – 31st March 2020**

The project aims to use information theory to understand test suite selection. I have long believed that information theory has a lot to teach us about software testing, and I'm delighted to have the opportunity to collaborate with David Clark and Rob Hierons on this through this project. This project is led by David Clark, in my group who is the PI for the UCL part of the grant. It is a collaboration with Brunel University, for which Rob Hierons is the PI. Industrial partners are Berner and Mattner and J.P. Morgan.

### **HP FOSSOLOGY project: 2010 –**

This project grew out of my work with Dr. Jens Krinke and my PhD student Yue Jia on clone detection. The project is mainly the work of Dr. Krinke. I provided some help and guidance with the application. We will use the funding to consider the provenance of open source code using clone detection techniques.

## Completed Projects for which I was a Co-Investigator

### **Linear Schemas for Program Dependence EP/E002919: 2006–2009**

This project grew out of my theoretical work with Dr. Danicic, my longest serving collaborator. The project reinvigorated research in program schemas, by connecting the theoretical outcomes of this work to practical questions about program analysis. A notable achievement was the demonstration that Weiser's slicing algorithm is minimal for linear, liberal, free schemas, which resolved a problem that had remained open since 1979. It was also possible to prove that equivalence is decidable for linear, liberal, free schemas. This was one of the first practical and positive decidability results since Ianov's foundational work in the early 1960s.

### **FORTEST GR/R43150: 2001–2004**

FORTEST (Formal Methods and Testing Network) was a collaborative network project, for which Rob Hierons (at Brunel) was the co-ordinator and principal investigator. I was a co-investigator and provided a significant contribution to the writing of the Case For Support.

### **IFIP TestCom Conference GR/S79015/01: 2004**

This was a project to support the IFIP TestCom conference which was held at St. Anne's College, Oxford, United Kingdom, 17-19th March 2004. Rob Hierons was the PI and I was the CI. The project was rated 'outstanding' on completion.

## Early Career Minor Travel Grants

For the first nine years of my career I was first PhD student, then lecturer and finally head of department (briefly) at the Polytechnic of North London (PNL), which was later the University of North London (UCL) and then subsequently to become London Metropolitan University (some time after I had departed). Until 1997, when modest success in the Research Assessment Exercise (RAE 1996) yielded a small amount of income (£31k per annum for the department), there was no support for research. Consequently there was little or no funding for travel to conferences. To overcome this difficulty, I applied for a number of small travel grants. I also managed and wrote the 1996 RAE submission for UNL's School of Computing.

<b>Organisation</b>	<b>Purpose</b>	<b>Year</b>	<b>Amount</b>
University of Southwestern Louisiana	Research Visit	1998	£400
EU (through TMR)	Conference attendance	1998	£400
The Corporation of London, HERSEF	Conference attendance	1997	£500
Kyoto University	Conference attendance	1996	£400
The Royal Society	Conference attendance	1996	£750
Bournemouth University	Conference attendance	1996	£200
US PDI	Conference attendance	1995	£350
<b>TOTAL</b>			<b>£3,000</b>

# Research Supervision

## Completed PhDs (first supervisor)

1. Sebastian Danicic. PhD, UNL, 1999: *Dataflow minimal slicing*.
2. Yoga Sivagurunathan. PhD, UNL, 2004: *Modelling dynamic memory allocation and deallocation using amorphous slicing*.
3. Lin Hu. PhD, Brunel, 2004: *Amorphous program slicing*.
4. Kiarash Mahdavi. PhD, Brunel, 2005: *A clustering genetic algorithm for software modularisation with a multiple hill climbing approach*.
5. Ayodeji Fatiregun. PhD, KCL, 2006: *Search-based program transformation for amorphous slicing and program comprehension*.
6. Tao Jiang. PhD, KCL, 2008: *Search based slicing for program dependency structures of interest*.
7. Zheng Li. PhD, KCL, 2009: *Identifying high-level dependence structures using slice-based dependence analysis*.
8. Kiran Lakhotia. PhD, KCL, 2009: *Search-based testing*.
9. Shin Yoo. PhD, KCL, 2009: *Extending the boundaries in regression testing: complexity, latency, and expertise*.
10. Yuanyuan Zhang. PhD, KCL, 2010: *Multi-objective search-based requirements selection and optimisation*.
11. Nadia Alshahwan. PhD, UCL, 2012: *Utilizing output in web application server-side testing*.
12. Jian Ren. PhD, UCL, 2013: *Search based software project management*.
13. Mustafa Bozkurt. PhD, UCL, 2013: *Automated realistic test input generation and cost reduction in service-centric system testing*.
14. Yue Jia. PhD, UCL, 2013: *Higher order mutation testing*.
15. Efstathios Panayi, PhD, UCL, 2015: *Modelling empirical features and liquidity resilience in the Limit Order Book*.  
(joint first supervisor with Gareth Peters, UCL Statistics).

## Completed PhDs (second supervisor)

1. Mike Laurence. PhD, Goldsmiths, 2004: *Program schematology*.  
First Supervisor: Sebastian Danicic.
2. Lahcen Ouarbya, PhD, Goldsmiths, 2005: *A lazy semantics for program slicing*.  
First Supervisor: Sebastian Danicic.
3. Qiang (Larry) Guo, Brunel, PhD, 2005: *Search-based testing*.  
First Supervisor: Robert Hierons.
4. Pauline Kan, PhD, KCL, 2006: *A method for safety critical software development*.  
First Supervisor: Kevin Lano.
5. Dave Daoudi, PhD, Goldsmiths, 2006: *Conditioned slicing using light-weight theorem proving*.  
First Supervisor: Sebastian Danicic.
6. Karnig Derderian, PhD, Brunel, 2007: *Search-based generation of UIOs for FSMs*.  
First Supervisor: Robert Hierons.
7. Marian Mohr, PhD, KCL, 2010: *Service oriented software engineering performance enhancement*.  
First Supervisor: Nicolas Gold.
8. Syed Islam, PhD, UCL, 2014: *Dependence Clusters*.  
First Supervisor: Jens Krinke.

### PhD students: Currently Principal Supervisor (3rd years)

None.

### PhD students: Currently Principal Supervisor (3rd years)

Fan Wu: *Genetic Improvement of Dynamic Memory Allocation*.

— funded with full overseas fees by the Chinese Scholarship Council (CSC).

(submitted) William Martin: *App Store Analysis and Mining*.

— funded by DAASE project GTA allocation.

Lingbo Li: *Search Based Requirements optimisation*.

— funded with full overseas fees by the Chinese Scholarship Council (CSC).

### PhD students: Currently Principal Supervisor (2nd years)

Afnan Al Subaihini: *Feature Movements in App Stores*.

— funded with full overseas fees by the Saudi Arabian Government Funding Council.

Bobby Bruce: *Genetic improvement to reduce energy consumption*.

— funded by DAASE project GTA allocation.

Ke Mao: *Crowdsourced software engineering*.

— funded by UCL graduate school.

Alexandru Marginean: *Automated software transplantation*. (Joint first supervisor with Earl Barr)

— funded by UCL department of computer science excellence award.

Matheus Paixao: *Search based requirements and architecture optimisation*.

— funded with full overseas fees by the Brazilian government's Science without Borders (SwB) programme.

Carlos Gavidia: *Game theoretic software engineering and metamorphic testing*. (Joint first supervisor with Earl Barr)

— funded by Visa-UCL impact studentship.

### PhD students: Currently Principal Supervisor (1st years)

Marco Micucci: *Automated experimentation as an underpinning of genetic improvement*.

— funded by DAASE project GTA allocation.

### Currently Second Supervisor

Zheng Gao: *Testing floating point computation*.

— Funded by Earl Barr's startup package.

First Supervisor: Earl Barr.

Gunel Jahangirova: *The Oracle problem in software testing*.

— funded by the FBK scholarship programme I set up in partnership with Paolo Tonella of FBK.

First Supervisor: David Clark.

Siti Omer: *Software analysis*.

— funded with full overseas fees by the Malaysian government.

First Supervisor: Jens Krinke.

Donggyun Han: *modern code review*.

— funded by UCL department of computer science start-up grant (for Shin Yoo). First Supervisor: Jens Krinke.



## Research Seminars Given

I have given invited research seminars at the following institutions:

University of Bath,  
BCS FACS,  
BCS SIGIST,  
Beijing University of Chemical Technology  
(BUCT), Beijing, China,  
Beijing Institute of Technology (BIT), Bei-  
jing, China,  
Birkbeck,  
Birmingham University(2),  
Bournemouth University(4),  
Brighton University(2),  
Bristol University,  
Brunel University,  
University of Cambridge  
Cardiff University,  
City University,  
Coventry University,  
DeMontfort University (Milton Keynes),  
DeMontfort University (Leicester),  
DaimlerChrysler, Berlin, Germany (5),  
The University of Durham(3),  
Essex University,  
Exeter University  
ETH, Zurich, Switzerland,  
The University of Glamorgan,  
Goldsmiths College,  
University of Hertfordshire,  
IBM, Hursley (3)  
Illinois Inst. Tech., Chicago, USA,  
Imperial College (London),  
Institute of Software, Chinese Academy of  
Sciences (ISCAS), Beijing, China,

The University of Kent at Canterbury(2),  
King's College, London (2),  
Loyola College, Maryland, USA,  
Oxford Brookes University  
Peking University, Beijing, China (2),  
Royal Holloway University of Salerno,  
Italy,  
University of Sannio, Italy,  
The University of Sheffield(2),  
Simula Labs, Norway,  
The Southampton Institute,  
South Bank University(2),  
Stirling University  
Strathclyde University(2),  
Symbian, London,  
University College London,  
University of Trento, Italy,  
The University of Leicester,  
The University of Liverpool,  
UMIST,  
Microsoft, Cambridge  
Middlesex University,  
Motorola Labs Basingstoke(3),  
University of Nebraska Lincoln, USA,  
The University of North London,  
The University of Oxford,  
The University of Reading(2),  
Tsing Hua University, Beijing, China  
Vizuri Ltd., London,  
The University of Westminster,  
The University of York(2).

## Press and Media Coverage

**August 4th 2015:** BBC Radio programme 'Click': Live radio interview about automated software transplantation research.

**30th July 2015:** WIRED article about automated software transplantation. It was the most shared (on social media) of the WIRED articles that week.

**9th July 2013:** Pre-recorded interview by Frank Grotelschen for German National Radio concerning evolutionary computation for software engineering.

**May 5th and 6th 2012:** BBC TV programme 'Click'. Pre-recorded interview by Lara Lewington on "why technology appears to fail without explanation".

**5th April 2012:** BBC Radio 4 programme 'Material World'. Live radio interview by Quentin Copper on the alleged government plans to monitor internet communications data in real time. The five minute discussion briefly touched on issues of false positives and false negatives, recommender systems, Turing, Kafka and the Law of Tendency to Executability.

## Teaching

A summary of courses I have taught is given below:

<b>Subject</b>	<b>Level</b>
Software Engineering	B.Sc.
Introduction to Computer Science	B.Sc.
Algorithms and Data Structures	B.Sc.
Programming in Java, C, Modula-2 and Hope	B.Sc.
Distributed Systems	B.Sc.
Programming in C++	M.Sc.
Formal Methods (in Z)	M.Sc.
Testing	M.Sc.
Mathematics for Computer Science	B.Sc. and M.Sc.
Measurement and Testing	B.Sc. and M.Sc.

In 1996 I co-wrote an introductory textbook on Programming in C++ (269pp) aimed at beginners. Approx. 5,000 copies sold (1996-2006).

In 1998 I wrote a study guide (116pp) for the Software Engineering and Development module of the University of London External Programme in Computing and Information Systems (University of London press, 1999, ISBN 07187 1587X).

In 1999 I wrote a study guide (110pp) for the Introduction to Computing module of the University of London External Programme in Computing and Information Systems.

In January 2001 I co-developed and presented a one-week series of industry seminars and lectures to Motorola employees as part of an M.Sc. module on software verification, run by the University of Bath.

Since 1998 I have been an assessor for the University of London External programme, during which time I set and marked courseworks on software engineering and have marked many BSc final year projects.

In 2012 and 2013 I set up and was general chair for the Student Conference on Optimisation of Software (StuConOS) at UCL. In 2013 we combined this with a project prize competition for final year project students. We received 151 project reports and shortlisted 20 projects for the prize, running a two day workshop for the students to present their work.

In 2006 I received a King's College Teaching Excellence Award.

In 2009 I received a King's College Doctoral Supervisory Excellence Award.

## Conference Program Committee Memberships (last updated November 2016)

### 2018 So far

40th ACM/IEEE International Conference on Software Engineering (ICSE) — Program co-chair

### 2017 So far

24th IEEE International Conference on Software Analysis, Evolution, and Reengineering (SANER)

1st International Workshop on Testing Extra-Functional Properties and Quality Characteristics of Software Systems

9th International Symposium on Search Based Software Engineering (SSBSE)

39th ACM/IEEE International Conference on Software Engineering (ICSE) — Program Board

11th Joint Meeting of the European Software Engineering Conference and the ACM SIGSOFT Symposium on the Foundations of Software Engineering (FSE)

10th IEEE International Conference on Software Testing, Verification and Validation (ICST)

25th IEEE International Conference on Program Comprehension (ICPC)

39th ACM/IEEE International Conference on Software Engineering - New Ideas and Emerging Results (ICSE-NIER)

20th International Conference on Fundamental Approaches to Software Engineering (FASE)

International Genetic and Evolutionary Computation Conference (GECCO)

### 2016

38th ACM/IEEE International Conference on Software Engineering (ICSE) — Program Board

23rd IEEE International Conference on Software Analysis, Evolution, and Reengineering (SANER)

8th International Symposium on Search-based Software Engineering (SSBSE)

Empirical Software Engineering and Measurement (ESEM)

Automated Testing (A-TEST)

1st International Workshop on Software Refactoring (IWorR)

24th ACM SIGSOFT International Symposium on the Foundations of Software Engineering (FSE)

9th International Workshop on Search-Based Software Testing (SBST)

First International Workshop on Metamorphic Testing (Met)

The 11th IEEE/ACM International Workshop on Automation of Software Test (AST)

5th International Workshop on Realizing Artificial Intelligence Synergies in Software Engineering (RAISE)

The 11th Workshop on Testing: Academia-Industry Collaboration, Practice and Research Techniques (TAIC-PART)

16th IEEE International Working Conference on Source Code Analysis and Manipulation (SCAM)

24th International Conference on Program Comprehension (ICPC)

32nd IEEE International Conference on Software Maintenance and Evolution (ICSME)

IEEE International Conference on Software Testing, Verification and Validation (ICST)

International Genetic and Evolutionary Computation Conference (GECCO)

### 2015

11th Joint meeting of the European Software Engineering Conference (ESEC)

and the ACM SIGSOFT Symposium on the Foundations of Software Engineering (FSE) — Program co-chair

International Genetic and Evolutionary Computation Conference (GECCO)

IEEE 31st International Conference on Software Maintenance and Evolution (ICSME)

9th International Symposium on Empirical Software Engineering and Measurement (ESEM)

18th International Conference on Fundamental Approaches to Software Engineering (FASE)

IEEE 11th International Conference on Predictive Models in Software Engineering (PROMISE)

23rd International Conference on Program Comprehension (ICPC)

IEEE Automated Software Testing Workshop (AST)

10th International Workshop on Mutation Analysis

International Symposium on Software Crowdsourcing (ISSC)

First North American Search Based Software Engineering Symposium (NasBASE)

4th International Workshop on Realizing Artificial Intelligence Synergies in Software Engineering (RAISE)

IEEE 8th Search Based Software Testing workshop (SBST)

IEEE 15th International Working Conference on Source Code Analysis and Manipulation (SCAM)

IEEE 10th Testing Academia and Industry Conference - Practice and Research Techniques (TAIC PART)

Second Edition of the Workshop on Quality Assurance for Self-adaptive, Self-organising Systems (QA4SASO)

Automated Software Testing (A-TEST)  
3rd International Workshop on Software Development Lifecycle for Mobile (DeMobile)  
12th Working Conference on Mining Software Repositories (MSR)

**2014 Program committee memberships:**

36th ACM/IEEE International Conference on Software Engineering (ICSE) – Program board  
28th IEEE/ACM International Conference on Automated Software Engineering (ASE) — ERP  
ACM SIGSOFT Symposium on the Foundations of Software Engineering (FSE)  
International Genetic and Evolutionary Computation Conference (GECCO)  
8th International Symposium on Empirical Software Engineering and Measurement (ESEM)  
IEEE 7th International Conference on Software Testing (ICST)  
11th Working Conference on Mining Software Repositories (MSR)  
IEEE 9th Mutation Workshop  
IEEE 7th Search Based Software Testing workshop (SBST) – Program co-chair  
IEEE Automated Software Testing Workshop (AST)  
IEEE 14th International Working Conference on Source Code Analysis and Manipulation (SCAM)  
6th International Workshop on Search based Software Engineering (SSBSE)  
IEEE 9th Testing Academia and Industry Conference - Practice and Research Techniques (TAIC PART)  
3rd International Workshop on Realizing Artificial Intelligence Synergies in Software Engineering (RAISE)  
1st International Workshop on Combining Modelling with Search- and Example-Based Approaches (CMSEBA 2014)

**2013 Program committee memberships:**

35th ACM/IEEE International Conference on Software Engineering (ICSE)  
28th IEEE/ACM International Conference on Automated Software Engineering (ASE)  
10th Joint meeting of the European Software Engineering Conference (ESEC)  
and the ACM SIGSOFT Symposium on the Foundations of Software Engineering (FSE)  
ACM International Symposium on Software Testing and Analysis, program chair (ISSTA)  
International Genetic and Evolutionary Computation Conference (GECCO) – SBSE track co-chair  
IEEE Automated Software Testing Workshop (AST)  
1st International Workshop on Combining Modelling and Search-Based Software Engineering (CMSBSE)  
IEEE 17th European Conference on Software Maintenance and Reengineering (CSMR)  
7th International Symposium on Empirical Software Engineering and Measurement (ESEM)  
IEEE 29th International Conference on Software Maintenance (ICSM)  
IEEE 6th International Conference on Software Testing (ICST)  
10th Working Conference on Mining Software Repositories (MSR)  
IEEE 8th Mutation Workshop  
IEEE 9th International Conference on Predictive Models in Software Engineering (PROMISE)  
IEEE 6th Search Based Software Testing workshop (SBST)  
IEEE 13th International Working Conference on Source Code Analysis and Manipulation (SCAM)  
5th International Workshop on Search based Software Engineering (SSBSE)  
IEEE 8th Testing Academia and Industry Conference - Practice and Research Techniques (TAIC PART)  
4th International Workshop on Emerging Trends in Software Metrics (WETSOM)  
2nd International Workshop on Realizing Artificial Intelligence Synergies in Software Engineering (RAISE)

**2012 Program committee memberships:**

34th ACM/IEEE International Conference on Software Engineering (ICSE)  
ACM International Genetic and Evolutionary Computation Conference (GECCO)  
ACM International Symposium on Software Testing and Analysis (ISSTA)  
IEEE 28th International Conference on Software Maintenance (ICSM)  
IEEE 19th Working Conference on Reverse Engineering (WCRE)  
IEEE 5th International Conference on Software Testing (ICST)  
IEEE 17th European Conference on Software Maintenance and Reengineering (CSMR)  
IEEE 20th International Conference on Program Comprehension (ICPC)  
IEEE 12th International Working Conference on Source Code Analysis and Manipulation (SCAM)

IEEE Automated Software Testing Workshop (AST)  
IEEE 7th Testing Academia and Industry Conference - Practice and Research Techniques (TAIC PART)  
IEEE 7th Mutation Workshop  
IEEE 8th International Conference on Predictive Models in Software Engineering (PROMISE)  
4th International Workshop on Search based Software Engineering (SSBSE)  
IEEE 5th Search Based Software Testing workshop (SBST)  
IEEE 2nd Workshop on Regression Testing (Regression 2012)  
34th ACM/IEEE International Conference on Software Engineering (ICSE)  
50th International Conference on Objects, Models, Components and Patterns (TOOLS Europe)  
3rd International Workshop on Automating Test Case Design, Selection and Evaluation (ATSE)  
6th International Symposium on Empirical Software Engineering and Measurement (ESEM)  
3rd International Workshop on Program Debugging (IWPDP)  
3rd International Workshop on Emerging Trends in Software Metrics (WETSOM)  
Aligning Enterprise, System, and Software Architectures (AESSA)  
8th Haifa Verification Conference (HVC)  
1st International Workshop on Realizing Artificial Intelligence Synergies in Software Engineering (RAISE)

**2011 Program committee memberships:**

ACM International Genetic and Evolutionary Computation Conference (GECCO)  
IEEE 27th International Conference on Software Maintenance (ICSM)  
IEEE 18th Working Conference on Reverse Engineering (WCRE)  
IEEE 4th International Conference on Software Testing (ICST)  
IEEE 16th European Conference on Software Maintenance and Reengineering (CSMR)  
IEEE 19th International Conference on Program Comprehension (ICPC)  
8th Workshop on Model Engineering, Verification, and Validation (MODEVVA)  
IEEE Automated Software Testing Workshop (AST)  
IEEE 6th Testing Academia and Industry Conference - Practice and Research Techniques (TAIC PART)  
IEEE 6th Mutation Workshop  
IEEE 7th International Conference on Predictive Models in Software Engineering (PROMISE)  
IEEE 3rd International Workshop on Search based Software Engineering (SSBSE)  
IEEE 4th Search Based Software Testing workshop (SBST)  
ACM International Symposium on the Foundations of Software Engineering (FSE)  
IEEE 11th International Workshop on Principles of Software Evolution (IWPSE)  
IEEE 1st Workshop on Refactoring and testing (REFTEST)  
IEEE 1st Workshop on Regression Testing (Regression 2011)  
1st International Workshop on End-to-end Test Script Engineering (ETSE)  
21st International Symposium on Logic-Based Program Synthesis and Transformation (LOPSTR)  
Quality Assurance for Service-based Applications (QASBA)  
37th International Conference on Current Trends in Theory and Practice of Computer Science (SOFSEM)  
ACM/IEEE 14th International Conference on Model Driven Engineering Languages and Systems (MODELS)

**2010 Program committee memberships:**

ACM International Genetic and Evolutionary Computation Conference (GECCO)  
ACM International Symposium on Software Testing and Analysis (ISSTA)  
IEEE 26th International Conference on Software Maintenance (ICSM)  
IEEE 17th Working Conference on Reverse Engineering (WCRE)  
IEEE 3rd International Conference on Software Testing (ICST)  
IEEE 15th European Conference on Software Maintenance and Reengineering (CSMR)  
IEEE 18th International Conference on Program Comprehension (ICPC)  
IEEE 10th International Working Conference on Source Code Analysis and Manipulation (SCAM)  
7th Workshop on Model Engineering, Verification, and Validation (MODEVVA)  
IEEE Automated Software Testing Workshop (AST)  
IEEE 5th Testing Academia and Industry Conference - Practice and Research Techniques (TAIC PART)  
IEEE 5th Mutation Workshop

IEEE 6th International Conference on Predictive Models in Software Engineering (PROMISE)  
IEEE ETOOLS workshop  
IEEE 1st Workshop on Quality of Model-Based Testing (QuoMBaT)  
IEEE 2nd International Workshop on Search based Software Engineering (SSBSE)  
IEEE 3rd Search Based Software Testing workshop (SBST)

**2009 Program committee memberships:**

ACM International Genetic and Evolutionary Computation Conference (GECCO)  
IEEE 25th International Conference on Software Maintenance (ICSM)  
IEEE 16th Working Conference on Reverse Engineering (WCRE)  
IEEE 2nd International Conference on Software Testing (ICST)  
IEEE 14th European Conference on Software Maintenance and Reengineering (CSMR)  
IEEE 17th International Conference on Program Comprehension (ICPC)  
Belgian Netherlands Evolution Conference (BENEVOL)  
ETAPS Fundamental Approaches to Software Engineering (FASE)  
IEEE 9th International Working Conference on Source Code Analysis and Manipulation (SCAM)  
6th Workshop on Model Engineering, Verification, and Validation (MODEVVA)  
IEEE 4th Testing Academia and Industry Conference - Practice and Research Techniques (TAIC PART)  
IEEE 4th Mutation Workshop  
IEEE WebTest 2009  
IEEE 2nd Search Based Software Testing workshop (SBST)  
IEEE Software Engineering and Knowledge Engineering (SEKE)  
IEEE 10th International Workshop on Principles of Software Evolution (IWPSE)

**2008 Program committee memberships:**

ACM International Genetic and Evolutionary Computation Conference  
IEEE 24th International Conference on Software Maintenance  
IEEE 15th Working Conference on Reverse Engineering  
IEEE 1st International Conference on Software Testing  
IEEE 13th European Conference on Software Maintenance and Reengineering  
IEEE 16th International Conference on Program Comprehension  
IEEE Congress on Evolutionary Computation  
IEEE 8th International Working Conference on Source Code Analysis and Manipulation  
IEEE Automated Software Testing Workshop (co-located with ICSE 2008)  
IEEE 3rd Testing Academia and Industry Conference - Practice and Research Techniques

**2007 Program committee memberships:**

IEEE 23rd International Conference on Software Maintenance  
IEEE 12th European Conference on Software Maintenance and Reengineering  
IEEE 15th International Conference on Program Comprehension  
ACM International Genetic and Evolutionary Computation Conference  
IEEE 14th Working Conference on Reverse Engineering  
IEEE 7th International Working Conference on Source Code Analysis and Manipulation  
IEEE 2nd Testing Academia and Industry Conference - Practice and Research Techniques  
ACM Symposium on Software Testing and Analysis  
International Conference on Software Testing (ICSTEST)  
3rd Mutation Testing Workshop  
IEEE Automated Software Testing Workshop (co-located with ICSE 2007)

**2006 Program committee memberships:**

IEEE 22nd International Conference on Software Maintenance  
IEEE 11th European Conference on Software Maintenance and Reengineering  
IEEE 14th International Conference on Program Comprehension  
ACM International Genetic and Evolutionary Computation Conference

IEEE 13th Working Conference on Reverse Engineering  
IEEE 6th International Workshop on Source Code Analysis and Manipulation  
IEEE 1st Testing Academia and Industry Conference - Practice and Research Techniques  
IEEE ASTReNet Aspect Analysis Workshop  
ACM Symposium on Software Testing and Analysis  
LNCS Workshop on Computational Science in Software Engineering  
International Conference on Software Testing (ICSTEST)  
IBM Centre for Advanced Studies Conference (CASCON 2006)  
2nd Mutation Testing Workshop

**2005 Program committee memberships:**

IEEE 21st International Conference on Software Maintenance  
IEEE 10th European Conference on Software Maintenance and Reengineering  
IEEE 11th Software Metrics Symposium  
IEEE 12th Working Conference on Reverse Engineering  
IEEE 13th International Workshop on Program Comprehension  
ACM International Genetic and Evolutionary Computation Conference  
IEEE 5th International Workshop on Source Code Analysis and Manipulation  
6th Metaheuristics International Conference  
IEEE International Workshop on Principles of Software Evolution  
3rd UK Testing Workshop  
Dagstuhl Slicing Seminar - Dagstuhl 05451

**2004 Program committee memberships:**

IEEE 20th International Conference on Software Maintenance  
IEEE 9th European Conference on Software Maintenance and Reengineering  
IEEE 12th International Workshop on Program Comprehension  
AAAI International Genetic and Evolutionary Computation Conference  
IEEE 10th Software Metrics Symposium  
IEEE 11th Working Conference on Reverse Engineering  
IEEE 4th International Workshop on Source Code Analysis and Manipulation

**2003 Program committee memberships:**

IEEE 19th International Conference on Software Maintenance  
IEEE 8th European Conference on Software Maintenance and Reengineering  
IEEE 7th European Conference on Software Maintenance and Reverse Engineering  
2nd UK Testing workshop  
IEEE 11th International Workshop on Program Comprehension  
IEEE 3rd International Workshop on Source Code Analysis and Manipulation  
AAAI International Genetic and Evolutionary Computation Conference  
IEEE 1st International Workshop on Web Based Systems and Applications  
IEEE 10th Working Conference on Reverse Engineering

**2002 Program committee memberships:**

IEEE 18th International Conference on Software Maintenance  
IEEE 10th International Workshop on Program Comprehension  
IEEE 26th International Symposium on Applied Computing  
IEEE 2nd International Workshop on Source Code Analysis and Manipulation  
IEEE 9th International Working Conference on Reverse Engineering  
IEEE 8th Workshop on Empirical Studies of Software Maintenance  
IEEE 4th International Workshop on Web Site Evolution  
AAAI International Genetic and Evolutionary Computation Conference  
14th Psychology of Programmers Interest Group workshop



**2001 Program committee memberships:**

IEEE 17th International Conference on Software Maintenance  
IEEE 8th International Working Conference on Reverse Engineering  
IEEE 9th International Workshop on Program Comprehension  
IEEE 7th Workshop on Empirical Studies of Software Maintenance  
IEEE 1st Workshop on Source Code Analysis and Manipulation  
IEEE 1st Workshop on Software Engineering using Metaheuristic Innovative Algorithms

**2000 Program committee memberships:**

IEEE 16th International Conference on Software Maintenance  
IEEE 6th Workshop on Empirical Studies of Software Maintenance  
IEEE 8th International Workshop on Program Comprehension

**1999 Program committee memberships:**

IEEE 15th International Conference on Software Maintenance  
IEEE 5th Workshop on Empirical Studies of Software Maintenance

# Conference Management and Leadership

## General chair for

IEEE 1st International Conference on Software Engineering SEMINAL workshop (2001)  
IEEE 1st Source Code Analysis and Manipulation Workshop (2001)  
AAAI 1st Genetic and Evolutionary Computation Conference track on Search-Based Software Engineering (2002)  
IEEE ASTReNet Aspect Analysis Workshop (2006)  
IEEE Testing Academic and Industry Conference - Practice and Research Techniques (2006)  
IEEE Testing Academic and Industry Conference - Practice and Research Techniques (2007)  
IEEE Mutation 2007  
IEEE 1st Symposium on Search Based Software Engineering (2009)

## Program chair for

40th International conference on software engineering (ICSE 2018)  
11th Joint meeting of the European Software Engineering Conference and the ACM SIGSOFT Symposium on the Foundations of Software Engineering (ESEC-FSE 2015)  
IEEE 7th Search Based Software Testing workshop (SBST)  
1st International Workshop on Combining Modelling and Search-Based Software Engineering (CMSBSE 2013)  
ACM Genetic and Evolutionary Computation Conference track on Search-Based Software Engineering (GECCO 2013)  
ACM International Symposium on Software Testing and Analysis (ISSTA 2013)  
IEEE 4th International Conference on Software Testing (ICST 2011)  
AAAI Genetic and Evolutionary Computation Conference track on Search-Based Software Engineering (GECCO 2004)  
IEEE 20th International Conference on Software Maintenance (ICSM 2004)  
2nd UK Testing workshop (UKTest 2003)  
AAAI Genetic and Evolutionary Computation Conference track on Search-Based Software Engineering (GECCO 2003)  
IEEE 10th International Workshop on Program Comprehension (IWPC 2002)  
IEEE 1st International Workshop on Source Code Analysis and Manipulation (SCAM 2001)

## Steering committee for

ACM International Symposium on Software Testing and Analysis (ISSTA)  
ACM SIGSOFT Symposium on the Foundations of Software Engineering (FSE)  
ACM/IEEE International conference on software engineering (ICSE)  
International Conference on Software Maintenance (2001–2004)  
International Working Conference on Source Code Analysis and Manipulation (SC chair 2001-2004, re-elected 2004-2007)  
International Conference on Software Testing (2008-2010)  
Awarded leadership award by Steering committee of International Working Conference on Source Code Analysis and Manipulation in 2007.  
International Symposium on Search Based Software Engineering (SC chair: 2009, re-elected 2013–)

## Other conference chairs

FSE 2011 Doctoral Symposium Chair  
ICST 2009 Workshops chair

## Journal Editorial Work

### Editorial Boards:

ACM Transactions on Software Engineering and Methodology (2013 – )  
IEEE Transactions on Software Engineering (2005 – 2009)  
IET Proceedings — Software (2005 – )  
Information and Software Technology (2005 – )  
Journal of Empirical Software Engineering (2005 – )  
Journal of Software Testing Verification and Reliability (2002 – )  
Journal of Software Maintenance and Evolution (2002 – )  
Software Quality Journal (2003 – )  
Journal of Systems and Software (2010 – )

### Guest editor journal special issues:

Information and Software Technology (December 1998) on Program Slicing.  
Information and Software Technology (October 2002) on Source Code analysis and Manipulation.  
Software Quality Journal special issue of best papers from SCAM 2003 (2004).  
Software Testing, Verification and Reliability special issue of best papers from UK testing workshop (2004).  
IEEE Transactions on Software Engineering special issue on Software Maintenance (2006).  
Formal Aspects of Computing special issue on Formal Approaches to Testing (2006).  
Journal of Systems and Software special issue on Source Code Analysis and Manipulation (2006).  
Journal of Empirical Software Engineering special issue on Maintenance and Metrics (2006).  
Journal Computers and Operations Research Focussed Issue on Search Based Software Engineering (2006).  
Journal of Software Testing, Verification and Reliability special issue of Extended Papers from the TAIC PART 2006  
Journal of Software Maintenance and Evolution special issue on Search Based Software Maintenance and Evolution (2008)  
Journal of Systems and Software special issue of Extended Papers from the TAIC PART 2007 and Mutation 2007  
IEEE Transactions on Software Engineering special issue on Search Based Software Engineering (SBSE) 2010  
Journal of Software Testing, Verification and Reliability special issue of best papers from ICST 2011 (2013)  
Journal of Software Testing, Verification and Reliability special issue on Mutation testing (to appear)  
Journal of Systems and Software special issue on Search Based Software Engineering (SBSE) (to appear)  
ACM Transactions on Software Engineering and Methodology special issue of best papers from ISSA 2013 (to appear)

## Management and Leadership of Research Networks

I am head of Software Systems Engineering at UCL since March 2012. I am also the director of the UCL CREST - the Centre for Research in Evolution Search and Testing, since its foundation in 2006. CREST is the world leader in Search Based Software Engineering. It is also internationally leading in Software Testing and internationally competitive in Source Code Analysis.

I was the head of the King's Software Engineering Section, one of three sections in the department (2004-2010).

I led the ASTRENET, an EPSRC-funded network, working on slicing, analysis and transformation (2004-2007). I also led the EPSRC Software Engineering using Metaheuristic INnovative ALgorithms (SEMINAL) research Network which established the research area of Search Based Software Engineering (1999-2002). I was a member of the steering committee for the FORTEST Network (2003-2006).

I co-founded (with Malcolm Munro) the IEEE International Working Conference on Source Code Analysis and Manipulation (SCAM) in 2001. Since then it has grown steadily in submissions and attendance. I co-founded (with Phil McMinn) the IEEE Testing Academia and Industry Conference - Practice and research Techniques (TAIC PART) in 2006. I founded the International Symposium on Search based Software Engineering in 2009.

I co-founded the Special Interest Group in Teaching Software Engineering (SIGToSE), 1996-1998 and was on the steering committee for the Software Engineering Association (SEA), 1997-1998.

## Consultancy

I have provided consultancy services to

Daimler Chrysler (several times)  
University of Durham  
Bradford and Bingley  
Hertfordshire University  
Huawei, China  
Keele university  
University of Leicester  
MicroLimit Ltd.  
The University of Westminster  
Islington Chamber of Commerce  
Visa Europe

The topics on which I have been consulted include

Slicing  
Transformation  
Testing  
E-commerce  
Viruses  
Research activity  
Software Project Cost Estimation

I was the London Technology Network business fellow for the Department of Information Systems and Computing at Brunel (2002-2004).

## **UK Grant Reviewing**

I have been a member of the EPSRC college since January 1st 2003. I served as a member of the EPSRC ICT Strategic Advisory Team (SAT) 2008-2013. I have served on EPSRC responsive mode panels in January 2003, May 2003, July 2005, December 2007, July 2008, January 2010, DREAM fellows panel (January 2010). I chaired the EPSRC responsive mode panel in December 2007 and the EPSRC large grants panel in July 2008.

I have reviewed proposals for the Leverhulme and Nuffield trusts.

## **International Grant Reviewing**

I have acted as referee for funding proposals from the following international research funding bodies:

NSERC (the Canadian research council)

Research Council of Norway

Qatar National Research Fund

Vienna Science and Technology Fund: Wiener Wissenschafts-, Forschungs- und Technologiefonds

Austrian Research Council: Der Wissenschaftsfonds (FWF)

Swedish Research Council: Vetenskapsrådet

Swiss National Science Foundation (FNSNF)

Athens University of Economics and Business Basic Research Funding Program

The Italian Assessment of Quality in Scientific Research 2004-2010

ETH Zurich

University of Luxembourg

## External Examining (updated February 2015)

I examined doctoral theses for the following UK Universities (24 examinations in total):

Brunel (1)  
Cambridge (1)  
DeMontfort (1)  
Derby (1)  
Durham (4)  
King's London (2)  
Oxford (1)  
QMW (2)  
Imperial (1)  
Sheffield (1)  
Strathclyde (1)  
UCL (6)  
York (2)

I examined doctoral theses for the following International Universities (10 examinations in total):

ETH Zurich (1)  
Malaga, Spain (1)  
University of Michigan (1)  
University of Pisa (1)  
Polytechnic of Montreal (1)  
Queen's University, Canada (1)  
Trinity College Dublin, Ireland (1)  
TU Delft, Netherlands (1)  
Trento, Italy (1)  
University of Tampere (1)

I am external examiner at Bristol University (for BSc courses), 2014-. I was External Examiner (2005-2010) for the M.Sc. at the University of Nottingham. I was External Examiner (2008-2010) for BSc and MSc at University College London (UCL). I was External Examiner (2004-2007) for the M.Sc. at the University of Kent. I was the external examiner for the Southampton Institute B.Sc. in Computer Studies (1997-2001) and the University of Westminster Conversion and Advanced M.Sc. courses in Software Engineering and Parallel and Distributed Computing (1998-2001).

## Administrative Roles and Leadership

**At PNL** (which became UNL in 1992) I had a wide variety of administrative roles, culminating in my appointment as Head of Department. I wrote the 1996 RAE submission for the department (achieving a 2 grade improvement).

**At Goldsmiths** I was Director of Post-Graduate Study.

**At Brunel** I was the co-ordinator for level one and represented the department at the Faculty Undergraduate Module Review Committee. I also mentored and guided junior staff in the development of their grant proposals (with some considerable success) and ran staff development sessions for the department and the university on grant writing and on criterion-based assessment. I was promoted to personal chair with effect from October 2004, but moved to King's College, London in August 2004 (before this took effect).

**At King's College, London** I was head of the Software Engineering Section, the largest group within the department. I wrote that part of the 2008 RAE submission relevant to the Software Engineering section. I was also the Chair of the Industrial Advisory Board, in which role I oversaw a significant increase in industrial involvement. I was the chair of the departmental recruitment committee, in which role I overhauled and led the development of recruitment activities, with significant success. I was the department funding opportunities co-ordinator, in which role I ran workshops and training days for staff on proposal writing and processes. In this role I provided advice and guidance on the following successfully funded EPSRC grants (in addition to those for which I am PI or CI):

EP/C545605: Quantitative Information Flow, PI: David Clark, £87,141,

EP/D059372: Scale-Free Structures: Models and Algorithms, PI: Colin Cooper, £10,065,

EP/D036852: SOSoRNet: Service-Oriented Software Research Network, PI: Nicolas Gold, £63,253,

EP/D062012: Stochastic Local Search Algorithms for Structural Proteomics, PI: Kathleen Steinhöfel, £219,751,

EP/G03012X: Higher-order Refinement Techniques for Model Driven Architecture, PI: Iman Poernomo, £315,590 (ranked number 1).

In 2006 I established the CREST centre (the Centre for Research on Evolution Search and Testing). Initially the centre had 2 lecturing staff (including myself), 3 RAs, 6 PhD students and one full time administrative post. In 2009 I secured an EPSRC platform grant to support the centre. By 2010 the centre had grown to 4 lecturing staff, 8 RAs, 12 PhD students and one full time admin post as well as several long term visiting academics. In August 2010 University College London Department of Computer Science recruited the entire centre from King's College London, occasioning my move to take up a chair at UCL. In 2012 we recruited two new lecturing faculty, bringing the staffing total in 2014 to 6 lecturing staff, 10 RAs, 10 PhD students and one full time admin post. In 2016 CREST celebrated its 10th anniversary with a workshop culminating in a cruise along the Thames, funded by generous sponsorship from Huawei and Zuhlke Engineering.

**At UCL** I was/am the departmental lead for the Research Excellence Framework (REF 2014), the head of Software Systems Engineering (SSE) and the director of the CREST centre. I am also the Departmental Funding Co-ordinator.

## Publications (last updated Nov 27th 2016)

### Journal Papers Published (93)

Fan Wu, Jay Nanavati, Mark Harman, Yue Jia, and Jens Krinke. Memory mutation testing. *Information & Software Technology*, 81:97–111, 2017.

William B. Langdon, José Javier Dolado, Federica Sarro, and Mark Harman. Exact mean absolute error of baseline predictor, MARP0. *Information & Software Technology*, 73:16–18, 2016.

Nadarajen Veerapen, Gabriela Ochoa, Mark Harman, and Edmund K. Burke. An integer linear programming approach to the single and bi-objective next release problem. *Information & Software Technology*, 65:1–13, 2015.

Justyna Petke, Myra B. Cohen, Mark Harman, and Shin Yoo. Practical combinatorial interaction testing: Empirical findings on efficiency and early fault detection. *IEEE Transactions on Software Engineering*, 41(9):901–924, 2015.

Earl T. Barr, Mark Harman, Phil McMinn, Muzammil Shahbaz, and Shin Yoo. The oracle problem in software testing: A survey. *IEEE Transactions on Software Engineering*, 41(5):507–525, May 2015.

William B. Langdon and Mark Harman. Optimising existing software with genetic programming. *IEEE Transactions on Evolutionary Computation (TEVC)*, 19(1):118–135, Feb 2015.

Mark Harman, Jens Krinke, Inmaculada Medina-Bulo, Francisco Palomo-Lozano, Jian Ren, and Shin Yoo. Exact scalable sensitivity analysis for the next release problem. *ACM Transactions on Software Engineering and Methodology (TOSEM)*, 23(2):19:1–19:31, April 2014.

Nadarajen Veerapen, Gabriela Ochoa, Mark Harman, and Edmund K. Burke. An integer linear programming approach to the single and bi-objective next release problem. *Information & Software Technology*, 65:1–13, 2015.

José Javier Dolado, Mark Harman, and Mari Carmen. Equivalence hypothesis testing in experimental software engineering. *Software Quality Journal*, 22(2):215–238, 2014.

Syed Islam, Jens Krinke, David Binkley, and Mark Harman. Coherent clusters in source code. *Journal of Systems and Software (JSS)*, 88:1–24, February 2014.

Kelly Androutsopoulos, David Clark, Mark Harman, Jens Krinke, and Laurie Tratt. State-based model slicing: A survey. *ACM Computing Surveys*, 45(4):53:1–53:36, August 2013.

Mustafa Bozkurt, Mark Harman, and Youssef Hassoun. Testing and verification in service-oriented architecture: a survey. *Journal of Software Testing, Verification and Reliability (STVR)*, 23(4):261313, June 2013.

David Binkley, Nicolas Gold, Mark Harman, Syed S. Islam, Jens Krinke, and Zheng Li. Efficient identification of linchpin vertices in dependence clusters. *ACM Transactions on Programming Languages and Systems (TOPLAS)*, 35(2 (Article 7)):7, 2013.

Saswat Anand, Antonia Bertolino, Edmund Burke, Tsong Yueh Chen, John Clark, Myra B.



Cohen, Wolfgang Grieskamp, Mark Harman, Mary Jean Harrold, Jenny Li, Phil McMinn, and Hong Zhu. An orchestrated survey on automated software test case generation. *Journal of Systems and Software*, 86(8):1978–2001, August 2013.

Mark Harman, Kiran Lakhotia, Jeremy Singer, David White, and Shin Yoo. Cloud engineering is search based software engineering too. *Journal of Systems and Software*, 86(9):2225–2241, 2013.

Shin Yoo, Mark Harman, and David Clark. Fault localization prioritization: Comparing information theoretic and coverage based approaches. *ACM Transactions on Software Engineering and Methodology*, 22(3 (Article 19)), July 2013.

Kelly Androutsopoulos, David J. Clark, Mark Harman, Robert M. Hierons, Zheng Li, and Laurence Tratt. Amorphous slicing of extended finite state machines. *IEEE Transactions on Software Engineering*, 39(7):892–909, July 2013.

Shin Yoo, Mark Harman, and Shmuel Ur. GPGPU test suite minimisation: search based software engineering performance improvement using graphics cards. *Journal of Empirical Software Engineering*, 18(3):550–593, June 2013.

Kiran Lakhotia, Mark Harman, and Hamilton Gross. AUSTIN: An open source tool for search based software testing of C programs. *Journal of Information and Software Technology*, 55(1):112–125, January 2013.

Yuanyuan Zhang, Mark Harman, and Soo Ling Lim. Empirical evaluation of search based requirements interaction management. *Journal of Information and Software Technology*, 55(1):126–152, January 2013.

Mark Harman, Afshin Mansouri, and Yuanyuan Zhang. Search based software engineering: Trends, techniques and applications. *ACM Computing Surveys*, 45(1):Article 11, November 2012.

Luay H. Tahat, Bogdan Korel, Mark Harman, and Hasan Ural. Regression test suite prioritization using system models. *Journal of Software Testing, Verification and Reliability*, 22(7):481–506, 2012.

Shin Yoo and Mark Harman. Test data regeneration: Generating new test data from existing test data. *Journal of Software Testing, Verification and Reliability*, 22(3):171–201, May 2012.

Phil McMinn, Mark Harman, Youssef Hassoun, Kiran Lakhotia, and Joachim Wegener. Input domain reduction through irrelevant variable removal and its effect on local, global and hybrid search-based structural test data generation. *IEEE Transactions on Software Engineering*, 38(2):453 – 477, March&April 2012.

Cu Nguyen, Simon Miles, Anna Perini, Paolo Tonella, Mark Harman, and Michael Luck. Evolutionary testing of autonomous software agents. *Journal of Autonomous Agents and Multi-Agent Systems*, 25(2):260–283, 2012.

Shin Yoo and Mark Harman. Regression testing minimisation, selection and prioritisation: A survey. *Journal of Software Testing, Verification and Reliability*, 22(2):67–120, 2012.

Juan José Durillo, Yuanyuan Zhang, Enrique Alba, Mark Harman, and Antonio J. Nebro. A study of the bi-objective next release problem. *Empirical Software Engineering*, 16(1):29–

60, 2011.

Yuanyuan Zhang, Mark Harman, Anthony Finkelstein, and Afshin Mansouri. Comparing the performance of metaheuristics for the analysis of multi-stakeholder tradeoffs in requirements optimisation. *Journal of Information and Software Technology*, 53(7):761–773, 2011.

Alessandro Marchetto, Roberto Tiella, Paolo Tonella, Nadia Alshahwan, and Mark Harman. Crawlability metrics for automated web testing. *Journal on Software Tools for Technology Transfer*, 13(2):131–149, 2011.

Sebastian Danicic, Richard W. Barraclough, Mark Harman, John Howroyd, Ákos Kiss, and Michael Rupen Laurence. A unifying theory of control dependence and its application to arbitrary program structures. *Theoretical Computer Science*, 412(49):6809–6842, 2011.

Mark Harman. Software engineering meets evolutionary computation. *IEEE Computer*, 44(10):31–39, October 2011.

Yue Jia and Mark Harman. An analysis and survey of the development of mutation testing. *IEEE Transactions on Software Engineering*, 37(5):649 – 678, September–October 2011.

David Binkley, Mark Harman, and Kiran Lakhotia. FlagRemover: A testability transformation for transforming loop assigned flags. *ACM Transactions on Software Engineering and Methodology*, 20(3), 2011.

Giulio Antoniol, Massimiliano Di Penta, and Mark Harman. The use of search-based optimization techniques to schedule and staff software projects: An approach and an empirical study. *Software — Practice and Experience*, 41(5):495–519, April 2011.

Kata Praditwong, Mark Harman, and Xin Yao. Software module clustering as a multi-objective search problem. *IEEE Transactions on Software Engineering*, 37(2):264–282, 2011.

Kiran Lakhotia, Phil McMinn, and Mark Harman. An empirical investigation into branch coverage for C programs using CUTE and AUSTIN. *Journal of Systems and Software*, 83(12):2379–2391, 2010.

William B. Langdon, Mark Harman, and Yue Jia. Efficient multi objective higher order mutation testing with genetic programming. *Journal of Systems and Software*, 83(12):2416–2430, 2010.

Torben Amtoft, Kelly Androutsopoulos, David Clark, Mark Harman, and Zheng Li. An alternative characterization of weak order dependence. *Information Processing letters*, 110(21):939–943, 2010.

Mark Harman. Automated patching techniques: The fix is in: technical perspective. *Communications of the ACM*, 53(5):108, 2010. A one page commentary on the paper by Wes Weimer, Stephanie Forrest, Claire Le Goues and ThanhVu Nguyen also in CACM, 53(5), 2010.

Shin Yoo and Mark Harman. Using hybrid algorithm for pareto efficient multi-objective test suite minimisation. *Journal of Systems and Software*, 83(4):689–701, 2010.

Richard Barraclough, David Binkley, Sebastian Danicic, Mark Harman, Rob Hierons, kos Kiss, and Mike Laurence. A trajectory-based strict semantics for program slicing. *Theo-*

*retical Computer Science*, 411(11–13):1372–1386, 2010.

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David Binkley, Mark Harman, Youssef Hassoun, Syed Islam, and Zheng Li. Assessing the impact of global variables on program dependence and dependence clusters. *Journal of Systems and Software*, 83(1):96–107, 2009.

Mark Harman, David Binkley, Keith Gallagher, Nicolas Gold, and Jens Krinke. Dependence clusters in source code. *ACM Transactions on Programming Languages and Systems*, 32(1), October 2009. Article 1.

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Phil McMinn, David Binkley, and Mark Harman. Empirical evaluation of a nesting testability transformation for evolutionary testing. *ACM Transactions on Software Engineering and Methodology*, 18(3), May 2009. Article 11.

Rob Hierons, Kirill Bogdanov, Jonathan Bowen, Rance Cleaveland, John Derrick, Jeremy Dick, Marian Gheorghe, Mark Harman, Kalpesh Kapoor, Paul Krause, Gerald Luetzgen, Tony Simons, Sergiy Vilkomir, Martin Woodward, and Hussein Zedan. Using formal methods to support testing. *ACM Computing Surveys*, 41(2), February 2009. Article 9.

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David Wendell Binkley, Mark Harman, and Jens Krinke. Empirical study of optimization techniques for massive slicing. *ACM Transactions on Programming Languages and Systems*, 30:3:1–3:33, 2007.

Sebastian Danicic, Mark Harman, Robert Mark Hierons, John Howroyd, and Mike Laurence. Equivalence of linear, free, liberal, structured program schemas is decidable in polynomial time. *Theoretical Computer Science*, 373:1–18, March 2007.

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David Wendell Binkley, Nicolas Gold, and Mark Harman. An empirical study of static program slice size. *ACM Transactions on Software Engineering and Methodology*, 16(2):1–32, 2007.

Qiang guo, Robert Hierons, Mark Harman, and Karnig Derderian. Heuristics for fault diagnosing when testing from finite state machines. *Software Testing, Verification and Reliability*, 17(1):41–57, 2007.

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David Wendell Binkley, Sebastian Danicic, Mark Harman, John Howroyd, and Lahcen Ouarbya. A formal relationship between program slicing and partial evaluation. *Formal Aspects of Computing*, 18(2):103–119, 2006.

Mark Harman, Arun Lakhotia, and David Wendell Binkley. A framework for static slicers of unstructured programs. *Information and Software Technology*, 48(7):549–565, 2006.

David Binkley, Sebastian Danicic, Tibor Gyimóthy, Mark Harman, Ákos Kiss, and Bogdan Korel. Theoretical foundations of dynamic program slicing. *Theoretical Computer Science*, 360(1):23–41, 2006.

Sebastian Danicic, David Binkley, Tibor Gyimóthy, Mark Harman, Ákos Kiss, and Bogdan Korel. A formalisation of the relationship between forms of program slicing. *Science of Computer Programming*, 62(3):228–252, 2006.

David Binkley, Mariano Ceccato, Mark Harman, Filippo Ricca, and Paolo Tonella. Tool-supported refactoring of existing object-oriented code into aspects. *IEEE Transactions on Software Engineering*, 32(9):698–717, 2006.

Karnig Derderian, Robert Hierons, Mark Harman, and Qiang Guo. Automated Unique Input Output sequence generation for conformance testing of FSMs. *The computer Journal*, 49(3):331–344, 2006.

Sebastian Danicic, Chris Fox, Mark Harman, Robert Mark Hierons, John Howroyd, and Mike Laurence. Slicing algorithms are minimal for programs which can be expressed as linear, free, liberal schemas. *The computer Journal*, 48(6):737–748, 2005.

Qiang Guo, Robert Mark Hierons, Mark Harman, and Karnig Derderian. Constructing multiple unique input/output sequences using evolutionary optimisation techniques. *IEE Proceedings — Software*, 152(3):127–140, 2005.

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Chris Fox, Sebastian Danicic, Mark Harman, and Robert Mark Hierons. ConSIT: a fully automated conditioned program slicer. *Software—Practice and Experience*, 34:15–46, 2004. Published online 26th November 2003.

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Mark Harman, David Wendell Binkley, and Sebastian Danicic. Amorphous program slicing. *Journal of Systems and Software*, 68(1):45–64, October 2003.

Michael R. Laurence, Sebastian Danicic, Mark Harman, Rob Hierons, and John Howroyd. Equivalence of conservative, free, linear program schemas is decidable. *Theoretical Computer Science*, 290:831–862, January 2003.

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Robert Mark Hierons, Mark Harman, Chris Fox, Lahcen Ouarbya, and Mohammed Daoudi. Conditioned slicing supports partition testing. *Software Testing, Verification and Reliability*, 12:23–28, March 2002.

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gineering as a metaheuristic search problem. *Software Engineering Notes*, 26(6):62–66, November 2001.

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