

Curriculum vitae of Tonelli Roberto

Personal Data:

Name: Roberto Tonelli

Address: Via delle Tortore 1, 09126 Cagliari -Italy

e-mail roberto.tonelli@dsf.unica.it

Date of birth 02/02/1968

Current position: temporary researcher and professor at University of Cagliari – Italy

Titles:

I obtained the **Abilitazione Scientifica Nazionale** Universitaria of MIUR as **Professore Associato** for the scientific sector 09/H1, “sistemi di elaborazione delle informazioni”, with the following judgement by the external committee member Prof. James Miller:

“World-class researchers are assumed to regularly publish in the premier locations (journals and conferences) within their field. Within any field, the list of premier locations is very short. Further, world-class research is recognised by the committee as contributions which “drive a field forward”; they resonate in terms of their impact and influence in articles in the future. When, the above is considered, I am delighted to say that the candidate’s research (Tonelli Roberto) can be viewed as world-class.”

I hold the IELTS certificate for English, level C1.

Dottorato di ricerca in Ingegneria Informatica:

Universita' degli studi di Cagliari, Marzo 2012, con tesi dal titolo: “Power Laws in Software Systems”.

Dottorato di Ricerca in Fisica:

presso l’Università degli studi di Cagliari, Gennaio 2000. Titolo della Tesi: “Phase Space Analysis and Applications for Different Nonlinear Systems”.

Researcher at “Porto Conte Ricerche” as expert of Statistics and Informatics applied to Biological Systems, 2008-2010.

Post-doc at EECS (**Electrical Engineering and Computer Science**) of University of California Berkeley, California,U.S.A dal 02/2000 al 01/2001.

Visiting Scientist from 04/01/2001 to 31/01/2002 at EECS of University of California Berkeley, California,U.S.A.

Master at University of California – Berkeley, by the N.O.E.L. Lab.: “Studiare la transizione del caos con il formalismo della termodinamica non estensiva applicata al circuito di Chua” finalced by the “programma Master&Back della Regione Sardegna 2006/07”.

Visiting Scientist at “Institute of Plasma Research (IPR)” University of Maryland - Maryland, (1999)

Education

-Laurea degree in Physics (Magna cum Laude - With honor mention), July 1995, University of Cagliari Italy . Thesis title: “A nonlinear mechanical model for the fracture of composite materials” Advisor Prof. F. Meloni

-Ph. D. In Software Engineering at University of Cagliari – Italy, 2009-2012 . Thesis title: “Power Laws in Software Systems” , Advisor Prof. M. Marchesi

-Ph. D. in Physics at University of Cagliari – Italy, in collaboration with University of Maryland, Washington DC – USA, 1997-1999

Thesis title: “Phase Space Analysis and Applications for Different Nonlinear Systems” . Advisors Prof. F. Meloni and Prof. C. Grebogi

-Master at University of California – Berkeley, N.O.E.L. Lab.: “The transition to chaos through extensive thermodynamics and applications to Chua's circuit”, Master&Back Sardinia Region 2006/07.

-Master of Sardinia Region on “Virtual Reality Markup Language”, June1996/June1997, AILUN, Nuoro Italy

Language skills

English: C1 level.

French: good scholastics oral and written

University Research and Teaching

-Professorship, academic years 2004 - 2010, Fundamental of Informatics, SSD INF/01, course degree in Physics, University of Cagliari.

-Professorship (academic year 07/08), Informatics, SSD INF/01, course degree in Industrial Biotechnologies, University of Cagliari.

-Professorship, academic year 2005/06, Assembly programming and Microprocessor Systems, at University of Cagliari, ITP- SSIS.

-Professorship, academic year 2012/13, Mathematics and Statistics, SSD MAT/03, course degree in Biology, University of Cagliari.

-Professorship, academic year 2011/12, Physics, SSD FIS/01, course degree in Industrial Biotechnologies , University of Cagliari.

-Professorship, academic year 2010/11 Physics – Riallineamento, Faculty of Engineering, University of Cagliari.

-Professorship, year 2008, at University of Cagliari, SSIS: “Corso integrato di Didattica della Fisica”

-Professorship, year 2007, at University of Cagliari, SSIS: “Corso integrato di Laboratorio di Didattica della Fisica”

-Post-doc at EECS (Electrical Engineering and Computer Science) of University of California Berkeley, California,U.S.A from 02/2000 to 01/2001.

-Visiting Scientist from 04/01/2001 to 31/01/2002 at EECS (Electrical Engineering and Computer Science) of University of California Berkeley, California, U.S.A.

-Visiting Scientist at “Institute of Plasma Research (IPR)” University of Maryland - Maryland, (March -May 1999).

-Post Doc at Physics Department of University of Cagliari, 07/01/2000 al 06/30/02, working on computer simulations of complex systems.

-Temporary researcher/Assistant Professor at Physics Department of University of Cagliari, August 2003 - August 2007, working on computer simulations of complex systems.

-Visiting Scientist at Dept. of Electronic Engineering and Computer Science, University of California, Berkeley CA - US , 07/2006 07/2007.

-Temporary researcher/Assistant Professor at Electrical and Electronic Engineering Department of University of Cagliari, November 2007 – November 2008, working on the analysis of software metrics in Open Source systems.

-Researcher at “Porto Conte Ricerche”, Tramariglio – Alghero, Sardinia, Italy, October 2008/ December 2010, working as expert of informatics and statistics for the analysis of data from biological systems.

-Present: researcher at the Electrical and Electronic Engineering Department of University of Cagliari, working on empirical software engineering.

Conferences Organized, Reviewer activity, Achievements and Awards

Reviewer for: International Journal of Bifurcations and Chaos, Material Research Society (symposium Proceedings), Physica A, European Physics Journal B. Transactions on Software Engineering, Journal of Software Maintenance and Evolution, Int. J. of Software Engineering and Knowledge Engineering, WETSOM proceedings, XP2013, XP2014, XP2015, Springer Lectures Notes for XP, Wetsom, Agile and RefTest series, Advances in Software Engineering-Indawi, Journal of Software Evolution and Process, and others

Organizer of WETSOM 2015, workshop of ICSE, Florence – Italy 2015.

Organizer and Chair of RefTest 2015 Workshop, co-located with XP2015, Helsinki, May 2015.

Principal Organizer and Chair of RefTest 2014 Workshop, co-located with XP2014, Rome, May 2014.

Principal Organizer and Chair of RefTest 2013 Workshop, co-located with XP2013, Wien, June 2013

Organizer for XP2012 Scientific Workshop, Malmo May 2012.

Track-Chair for XP2013 Scientific Workshop, Wien, May 2013.

Track-Chair for XP2014 Scientific Workshop, Rome, May 2014.

Track-Chair for XP2015 Scientific Workshop, Helsinki, May 2015.

PC member of WETSOM 2011, workshop of ICSE, Honolulu, Hawaii, USA 2011.

PC member of WETSOM 2012, workshop of ICSE, Zurich, May 2012.

PC member of WETSOM 2013, workshop of ICSE, Sanfrancisco, May 2013.

PC member of AGILE 2015, Washington DC, USA, August 2015.

Awarded for the best Ph.D. Thesis in Software Engineering: “Power Laws in Software Systems”, DIEE Electrical and Electronics Eng. Dept., University of Cagliari, Italy.

Discoverer of integer number sequences “Fibonacci-like”, accepted and published by The On-Line Encyclopedia of Integer Sequences, AT&T, numbers A131600 e A131601 for the computation of topological entropies in shift spaces and in cellular automata.

Award for Young Researchers project of University of Cagliari, 5 Million Italian Lire, 2000/01.

Award for Young Researchers project of Regione Sardegna (RAS): "Analisi di sistemi dinamici non-lineari con simulazioni numeriche al calcolatore", 8 Million Italian Lire, 1999.

Grants and Projects participation

-RAS Integrated Facilitation Program (PIA) for Industry, Artisanhip and Services, call 14/10/2008, project No. 265, Advanced Technologies for Software Measuring and Integrated Management, TAMIGIS.

-L.R. 7/2007: LEAN 2.0: Un Approccio Lean per Abilitare l'Internet del Futuro - Eur 250.000, participant (2012-2015).

-EURACE: studio di modelli economici e di un simulatore ad agenti dell'economia europea: Progetto U.E. STREP - Eur 2.200.000 (260.000 to Cagliari Unit) participant (2006-2009).

-tOSSad - towards Open Source Software adoption and dissemination , Progetto Europeo IST-3, participant.

- Complex Markets: studio dei mercati finanziari dal punto di vista della teoria della complessità 2008, participant
- Visiting Professor project, University of Cagliari, “Control of nonlinear dynamic systems, impulsive control theory and its applications to chaotic communication systems” 14.000 Eur, 2007.
- Project Master&Back of Regione Sardegna: ”Studiare la transizione del caos con il formalismo della termodinamica non estensiva applicata al circuito di Chua”, 28.800 Eur 2006/07-2007/08.
- Young Researchers project of University of Cagliari, 5 Million Italian Lire, 2000/01.
- Young Researchers project of Regione Sardegna: "Analisi di sistemi dinamici non-lineari con simulazioni numeriche al calcolatore”, 8 Million Italian Lire, 1999.
- Regione Autonoma della Sardegna (RAS), Regional Law No. 7, 2007 on Promoting Scientific Research and Technological Innovation in Sardinia, call 14/2/2009.

Thesis Supervised

Degree thesis:

1. Matteo Orru', supervisors: Prof. M. Marchesi, Dott. R. Tonelli,: “Algoritmi per lo studio di reti software complesse” Aprile 2012”, Università degli Studi di Cagliari, Dipartimento DIEE.
2. Nicola Murgia, supervisors: Prof. Franco Meloni, Dott. R. Tonelli,: “Dinamica non lineare in sistemi bidimensionali: i composite fermions” Marzo 1999”, Università degli Studi di Cagliari, Dipartimento di Fisica.
3. Ramon Pilia, supervisors: Prof. Franco Meloni, Dott. R. Tonelli, “Analisi di Elettroencefalogrammi (ECG) come serie temporale di dati non lineari”, Università degli Studi di Cagliari, Dipartimento di Fisica. a.a. 2000/01.
4. Silvia Dessi, supervisors: Prof. Franco Meloni, Dott. R. Tonelli,“ Sincronizzazione di sistemi non lineari tramite Pole-Placement”, Università degli Studi di Cagliari, Dipartimento di Fisica. a.a. 2001/02.
5. Luisa Cossu, supervisors: Prof. Franco Meloni, Dott. R. Tonelli,“ Analisi Nonlineare di Elettrocardiogrammi”, Università degli Studi di Cagliari, Dipartimento di Fisica. a.a. 2002/03
6. Francesco Ricci, supervisors: Prof. Franco Meloni, Dott. R. Tonelli, “Dinamica nonlineare e dinamica simbolica applicate allo studio di mercati finanziari simulati”, Università degli Studi di Cagliari, Dipartimento di Fisica. Ottobre 2005.
7. Maria Ilenia Saba, supervisors: Prof. Franco Meloni, Dott. R. Tonelli, “Analisi di sistemi simulati in econofisica mediante dinamica non lineare e dinamica simbolica”, Università degli Studi di Cagliari, Dipartimento di Fisica.
8. Ferruccio Lai, supervisors: Prof. Franco Meloni, Dott. R. Tonelli: “Dinamica simbolica di mappe caotiche”, Università degli Studi di Cagliari, Dipartimento di Fisica, Ottobre 2006
9. Massimo Pibiri, supervisors: Prof. Franco Meloni, Dott. R. Tonelli: “Studio analitico delle mappe logistiche”, Università degli Studi di Cagliari, Dipartimento di Fisica, Febbraio 2007.
10. Francesco Ricci, supervisors: Prof. Franco Meloni, Dott. R. Tonelli: “Sincronizzazione di reti di sistemi caotici accoppiati”, Aprile 2008.

Ph. D. Thesis coordinated:

Dott. Murgia Alessandro “Time evolution and distribution analysis of software bugs from a complex network perspective” DIEE, Department of Electrical and Electronic Engineering, Cagliari (Italy), University of Cagliari 2011.

Dott. Destefanis Giuseppe “Assessing Software Quality by Micro Patterns Detection” DIEE, Department of Electrical and Electronic Engineering, Cagliari (Italy), University of Cagliari 2013.

Dott. Marco Ortu “Mining software repositories: measuring effectiveness and affectiveness in software

systems". University of Cagliari 2015.

Presently I am coordinating three Ph.D. students DIEEE, Department of Electrical and Electronic Engineering, Cagliari (Italy).

Memberships:

- 1996 member of INFN (Istituto Nazionale di Fisica della Materia)
- 1998-1999 and 2002-2003 member of Material Research Society (MRS)
- 1999 member of IRP (Institute of Plasma Research) at University of Maryland in College Park, (USA).
- 2000 staff member of NOEL LAB and ERL - University of California , Berkeley
- Member of SLACS/INFN/CNR - Dip. Di Fisica, Cagliari (IT)
- Member of INFN, sezione di Cagliari, dal 2004.
- Member of S.I.F. (Societa' Italiana di Fisica).
- From 1987 member of ANPDI (Associazione Nazionale Paracadutisti D'Italia).

Conferences and Talks

"Two Case Studies on Clusterization of Refactored Classes " RefTest 2013, Wien.

ETSM 2009 "Statistical distributions and Modeling of Software Networks ", Pula, Italy – May 2009.

XP2009, "An analysis of bug distribution in object oriented systems", Pula, Italy – May 2009.

"Complex Market Meeting", Cagliari, 21st Feb. 2006.

Congresso "AFRICAN MRS2003", Johannesburg (South-Africa) 2003.

International Conference on Waves and Stability in Continuous Media "WASCOM 2003", Villasimius (CA) Italy 2003

"MRS 2002 Spring Meeting", Sanfrancisco (USA), 2002

"ISCAS 2002", Scottsdale-Phoenix, AZ (USA) 2002

International Workshop on synchronization, pattern formation and spatio-temporal chaos in coupled chaotic oscillators, CHAOS' 98, Santiago di Compostela, Spain, 1998;

"Dynamics Days 1999" Como Italy (1999).

"MRS 1998 Fall Meeting", Boston (USA), 1998.

"MRS 2002 Spring Meeting", Sanfrancisco (USA), 2002

"Plasticity of Materials, Granada, Spagna 1998.

"8th Granada Seminar on Computational and Statistical Physics", 7-10 Febbraio 2005, Granada, Spain.

"NextSigmaPhi" (Nonextensive Thermodynamics), Colymbari, Crete, Greece, 12-18 Aug. 2005.

"Dynamics Days 2003" Scottsdale-Phoenix, AZ (USA) 2003

Other

I did attend the following courses and seminars at the Electrical and Electronic Engineering Department, University of Cagliari:

- Software Engineering- Prof. Michele Marchesi (16 hours) may 2009.
- 27/07/2010: Emerging Trends in Agile and Lean Software Development, Prof. Pekka Abrahamsson, (18 hours)
- 05/05/2009: The evaluation of the maturity of software solutions for productive sectors, Prof. Michele Marchesi, (16 hours)
- 06/05/2011: Challenges in Empirical Studies of Code – Prof. Ewan Tempero, (20 hours)
- 08/07/2011: Software Quality Engineering – Prof. Hongyu Zhang, (16 hours)
- 21/09/2010: Smalltalk: a language for modeling e simulation – Prof. Michele Marchesi, (24 hours)
- 23/04/2009: Software evaluation for Public Administrations – Prof. Giulio Concas, (16 hours)

- 29/04/2009: Software quality – Prof. Michele Marchesi, (16 hours)

Congresso Nazionale di Fisica della Materia 1997;

Convegno Nazionale di Fisica Statistica 1997;

Scuola e al Workshop: “ Field Theories for Low Dimensional Condensed Matter Systems: Spin Systems and Strongly Correlated Electrons” 1997 (Lecturer: R. B. Laughlin, Premio Nobel);

Meeting: Common Trends in Condensed Matter Physics and High Energy Physics” 1997;

“International Conference on Disorder and Chaos (ICDC)”, Roma (Italy), 1997

Convegno "VII Italian-Swiss Workshop on Computation Materials Science", S. Margherita di Pula (Italy), 1997.

Convegno "VIII Italian-Swiss Workshop on Computation Materials Science" S. Margherita di Pula (Italy), 1998.

Convegni “IX X XI XII XIII Italian-Swiss Workshop on Computation Materials Science”, Villasimius, (Italy), 1999 - 2000 - 2001 - 2002 - 2003.

Conferenza Water in the Mediterranean Area della Società Chimica Italiana (1998);

Convegno “Fifth biennial conference on Low Energy Antiproton Physics (LEAP98)”, Villasimius (Italy), 1998.

“Next2003”(Nonextensive Thermodynamics, settembre 2003), Villasimius, (Italy)

“SPT 2004 Symmetry and Perturbation Theory “ 30 May - 6 June 2004, Cala Gonone (Sardinia, Italy)

“1 Seminario Nazionale sul Software della Fisica Nucleare, Subnucleare ed Applicata” 7-11 Giugno 2004, Alghero – Italy.

FEMLAB SEMINAR, 14 Marzo 2005, Roma

“Constrained dynamics and quantum gravity IV (QG05)”, Settembre 2005, Cala Gonone (NU) Italy.

Books

Editor of:

“Agile Methods: Large-scale development, Refactoring, Testing and Estimation”,

Springer Lecture Notes in Business Information Processing 2014

Authors: Dingsøyr, T, Moe N.B., Tonelli R., Counsell S., Gencel C., Petersen K.

“6th Workshop on Emerging Trends in Software Metrics (WETSoM 2015)”

ACM-Proceedings of the 37th International Conference on Software Engineering 2015.

Authors: Counsell S., Tempero E., Tonelli R., Visaggio A. ISBN 978-1-4673-7103-2

Publication List

[Would You Mind Fixing This Issue?](#)

M Marchesi, R Tonelli - 2015
Agile Processes, in Software Engineering, and Extreme Programming: 16th ...

[The evolution of knowledge in the refactoring research field](#)

M Orrú, S Porru, M Marchesi, R Tonelli - 2015
Scientific Workshop Proceedings of the XP2015, 10

[Would you mind fixing this issue?](#)

M Ortu, G Destefanis, M Kassab, S Counsell, M Marchesi, R Tonelli 1 2015
Agile Processes, in Software Engineering, and Extreme Programming, 129-140

[Could micro patterns be used as software stability indicator?](#) - 2015

M Ortu, G Destefanis, M Orru, R Tonelli, M Marchesi
Patterns Promotion and Anti-patterns Prevention (PPAP), 2015 IEEE 2nd ...
[Agile Methods. Large-Scale Development, Refactoring, Testing, and Estimation: XP 2014 International Workshops, Rome, Italy, May 26-30, 2014, Revised Selected Papers](#) - 2014
Springer

[On the influence of maintenance activity types on the issue resolution time](#)
A Murgia, G Concas, R Tonelli, M Ortu, S Demeyer, M Marchesi 4 2014
Proceedings of the 10th International Conference on Predictive Models in ...
[Research Report](#)
R Tonelli - 2014
<http://www.dsf.unica.it/~roberto/report3.pdf>

[Clustering of defects in Java software systems](#)
G Concas, C Monni, M Orru, R Tonelli - 2014
Proceedings of the 5th International Workshop on Emerging Trends in Software ...

[System performance analyses through object-oriented fault and coupling prisms](#)
A Murgia, R Tonelli, M Marchesi, G Concas, S Counsell, S Swift - 2014
Proceedings of the 5th ACM/SPEC international conference on Performance ...

[Are Some Refactorings Attached to Fault-Prone Classes and Others to Fault-Free Classes?](#)
S Counsell, S Swift, A Murgia, R Tonelli, M Marchesi, G Concas - 2014
Agile Methods. Large-Scale Development, Refactoring, Testing, and Estimation ...

[Refactoring Clustering in Java Software Networks](#)
G Concas, C Monni, M Orru, M Ortu, R Tonelli - 2014
Agile Methods. Large-Scale Development, Refactoring, Testing, and Estimation ...

[Are Refactoring Practices Related to Clusters in Java Software?](#)
G Concas, C Monni, M Orru, R Tonelli 2 2014
Agile Processes in Software Engineering and Extreme Programming, 269-276

[Software Metrics in Agile Software: An Empirical Study](#)
G Destefanis, S Counsell, G Concas, R Tonelli 4 2014
Agile Processes in Software Engineering and Extreme Programming, 157-170

[The fractal dimension of software networks as a global quality metric](#)
I Turnu, G Concas, M Marchesi, R Tonelli 5 2013
Information Sciences 245, 290-303

[A study of the community structure of a complex software network](#)
G Concas, C Monni, M Orru, R Tonelli 2 2013
Emerging Trends in Software Metrics (WETSOM), 2013 4th International ...

[Conditional-based refactorings and fault-proneness: an empirical study](#)
S Counsell, M Gatrell, R Hierons, A Murgia, R Tonelli, M Marchesi, ... - 2013
Software Testing, Verification and Validation Workshops (ICSTW), 2013 IEEE ...

[Entropy of some CK metrics to assess object-oriented software quality](#)
I Turnu, G Concas, M Marchesi, R Tonelli 2 2013
International Journal of Software Engineering and Knowledge Engineering 23 ...

[Micro Patterns in Agile Software](#)
G Concas, G Destefanis, M Marchesi, M Ortu, R Tonelli 2 2013
Agile Processes in Software Engineering and Extreme Programming, 210-222

[Effects of the fermentation process on gas-cell size two-dimensional distribution and](#) 4 2012

- [rheological characteristics of durum-wheat-based doughs](#)
S Fois, C Fadda, R Tonelli, M Sanna, PP Urgeghe, T Roggio, P Catzeddu
Food Research International 49 (1), 193-200
- [A case study of the use of Open Source CMS in Public Administrations](#)
G Destefanis, R Tonelli, L Cocco, G Concas, M Marchesi - 2012
Web Systems Evolution (WSE), 2012 14th IEEE International Symposium on, 31-34
- [Micro Pattern Fault-Proneness](#)
G Destefanis, R Tonelli, E Tempero, G Concas, M Marchesi 5 2012
Software Engineering and Advanced Applications (SEAA), 2012 38th EUROMICRO ...
- [Onset of chaotic phase synchronization in complex networks of coupled heterogeneous oscillators](#)
F Ricci, R Tonelli, L Huang, YC Lai 8 2012
Physical Review E 86 (2), 027201
- [Entropy of the degree distribution and object-oriented software quality](#)
I Turnu, M Marchesi, R Tonelli 10 2012
Proceedings of the 3rd International Workshop on Emerging Trends in Software ...
- [An empirical study of software metrics for assessing the phases of an agile project](#)
G Concas, M Marchesi, G Destefanis, R Tonelli 15 2012
International Journal of Software Engineering and Knowledge Engineering 22 ...
- [Refactoring and its relationship with fan-in and fan-out: An empirical study](#)
A Murgia, R Tonelli, M Marchesi, G Concas, S Counsell, J McFall, S Swift 9 2012
Software Maintenance and Reengineering (CSMR), 2012 16th European Conference ...
- [An analysis of anti-micro-patterns effects on fault-proneness in large Java systems](#)
G Destefanis, R Tonelli, G Concas, M Marchesi 8 2012
Proceedings of the 27th Annual ACM Symposium on Applied Computing, 1251-1253
- [Power laws in software systems](#)
R Tonelli - 2012
Universita'degli Studi di Cagliari
- [Mixing SNA and classical software metrics for sub-projects analysis](#)
R Tonelli, G Destefanis 1 2012
Proceedings of 11th WSEAS International conference on Software Engineering ...
- [On the distribution of bugs in the eclipse system](#)
G Concas, M Marchesi, A Murgia, R Tonelli, I Turnu 25 2011
Software Engineering, IEEE Transactions on 37 (6), 872-877
- [An empirical study of refactoring in the context of FanIn and FanOut coupling](#)
A Murgia, R Tonelli, S Counsell, G Concas, M Marchesi 5 2011
Reverse Engineering (WCRE), 2011 18th Working Conference on, 372-376
- [The fractal dimension metric and its use to assess object-oriented software quality](#)
I Turnu, G Concas, M Marchesi, R Tonelli 4 2011
Proceedings of the 2nd International Workshop on Emerging Trends in Software ...
- [Effect of modified atmosphere packaging on Quality Index Method \(QIM\) scores of farmed gilthead seabream \(Sparus aurata L.\) at low and abused temperatures](#)
M Campus, E Bonaglini, R Cappuccinelli, MC Porcu, R Tonelli, T Roggio 8 2011
Journal of food science 76 (3), S185-S191
- [Parameter-based refactoring and the relationship with fan-in/fan-out coupling](#)
A Murgia, M Marchesi, G Concas, R Tonelli, S Counsell 4 2011

- Software Testing, Verification and Validation Workshops (ICSTW), 2011 IEEE ...
- [Application of 2-D DIGE to formalin-fixed, paraffin-embedded tissues](#) 23 2011
A Tanca, D Pagnozzi, G Falchi, R Tonelli, S Rocca, T Roggio, S Uzzau, ...
Proteomics 11 (5), 1005-1011
- [Proteomic analysis of formalin-fixed, paraffin-embedded lung neuroendocrine tumor samples from hospital archives](#) 32 2011
A Tanca, MF Addis, D Pagnozzi, P Cossu-Rocca, R Tonelli, G Falchi, ...
Journal of proteomics 74 (3), 359-370
- [An analysis of SNA metrics on the Java Qualitas Corpus](#) 5 2011
R Tonelli, G Concas, M Marchesi, A Murgia
Proceedings of the 4th India Software Engineering Conference, 205-213
- [A modified Yule process to model the evolution of some object-oriented system properties](#) 27 2011
I Turnu, G Concas, M Marchesi, S Pinna, R Tonelli
Information Sciences 181 (4), 883-902
- [NMR analysis of seven selections of vermentino grape berry: metabolites composition and development](#) 13 2011
G Mulas, MG Galaffu, L Pretti, G Nieddu, L Mercenaro, R Tonelli, ...
Journal of agricultural and food chemistry 59 (3), 793-802
- [Computing the fractal dimension-a global metrics for large software systems](#) 3 2010
G Concas, M Locci, M Marchesi, R Tonelli, I Turnu
Computational Intelligence and Software Engineering (CiSE), 2010 ...
- [A machine learning approach for text categorization of fixing-issue commits on CVS](#) 12 2010
A Murgia, G Concas, M Marchesi, R Tonelli
Proceedings of the 2010 ACM-IEEE International Symposium on Empirical ...
- [Assessing traditional and new metrics for object-oriented systems](#) 23 2010
G Concas, M Marchesi, A Murgia, S Pinna, R Tonelli
Proceedings of the 2010 ICSE Workshop on Emerging Trends in Software Metrics ...
- [Three algorithms for analyzing fractal software networks](#) 10 2010
M Locci, G Concas, R Tonelli, I Turnu
WSEAS Transactions on Information Science and Applications 7 (3), 371-380
- [Three efficient algorithms for implementing the preferential attachment mechanism in Yule-Simon Stochastic Process](#) 8 2010
R Tonelli, G Concas, M Locci
WSEAS Transactions on Information Science and Applications 7 (2), 176-185
- [An empirical study of social networks metrics in object-oriented software](#) 20 2010
G Concas, M Marchesi, A Murgia, R Tonelli
Advances in Software Engineering 2010, 4
- [Efficient implementation of the Yule-Simon stochastic process for modeling internet and software development activities](#) - 2009
R Tonelli, G Concas, M Locci
Proceedings of the 9th WSEAS international conference on Applied computer ...
- [Empirical study on software metrics and issues in object oriented systems](#) - 2009
A Murgia, G Concas, M Marchesi, S Pinna, R Tonelli
Emerging Trends in Software Metrics, 33
- [Empirical study of software quality evolution in open source projects using agile practices](#) 9 2009
A Murgia, G Concas, R Tonelli, I Turnu

- Proc. of the 1st International Symposium on Emerging Trends in Software ...
- [An analysis of bug distribution in object oriented systems](#) 3 2009
A Murgia, G Concas, M Marchesi, R Tonelli, I Turnu
arXiv preprint arXiv:0905.3296
- [A dynamic model of software product generative process](#) 1 2008
G Concas, M Marchesi, S Pinna, R Tone, I Turnu
Software Engineering Conference, 2008. APSEC'08. 15th Asia-Pacific, 43-50
- [Controlling Chua's circuits using computational verb controllers](#) 11 2008
R Tonelli, T Yang
International Journal of Robust and Nonlinear Control 18 (17), 1622-1636
- [Fibonacci-like sequences and shift spaces in symbolic dynamics](#) - 2007
R Tonelli
arXiv:0708.4370v1, 8
- [Convergence to the critical attractor at infinite and tangent bifurcation points](#) - 2006
R Tonelli
International Journal of Bifurcation and Chaos 16 (08), 2369-2375
- [Statistical descriptions of nonlinear systems at the onset of chaos](#) 11 2006
M Coraddu, M Lissia, R Tonelli
Physica A: Statistical Mechanics and its Applications 365 (1), 252-257
- [Numerical study of the oscillatory convergence to the attractor at the edge of chaos](#) 9 2006
R Tonelli, M Coraddu
The European Physical Journal B-Condensed Matter and Complex Systems 50 (1-2 ...
- [Entropy production and Pesin-like identity at the onset of chaos](#) 13 2006
R Tonelli, G Mezzorani, F Meloni, M Lissia, M Coraddu
Progress of theoretical physics 115 (1), 23-29
- [Non-extensive entropies and weak sensitivity at the edge of chaos](#) - 2005
R Tonelli, M Lissia, M Coraddu
Modeling Cooperative Behavior in the Social Sciences 779 (1), 208-209
- [What entropy at the edge of chaos?](#) 2 2005
M Lissia, M Coraddu, R Tonelli
arXiv preprint cond-mat/0501299
- [Weak insensitivity to initial conditions at the edge of chaos in the logistic map](#) 12 2004
M Coraddu, F Meloni, G Mezzorani, R Tonelli
Physica A: Statistical Mechanics and its Applications 340 (1), 234-239
- [Fracture in materials investigated by chaos theory](#) - 2003
F Meloni, R Tonelli, F Aymerich, F Ginesu
CONFERENCE PROCEEDINGS-ITALIAN PHYSICAL SOCIETY 84, 377-388
- [Chua's Periodic Table](#) 7 2002
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Research Statement/Resume

My research interests are widespread and multidisciplinary, and I always try to keep my stream of research very flexible. The main topic of my research has been the study of power laws in software systems within the perspective of describing software quality. My research contributes to a recent stream of studies in software engineering, where the investigation of power laws in software systems has become widely popular in recent years, since they appear on an incredible variety of different software quantities and properties, like, for example, software metrics, software faults, refactoring, Java byte-code, module dependencies, software fractal dimension, lines of code, software packages and so on. The common presence of power laws suggests that software systems belong to the much larger category of complex systems, where typically self organization, fractality and emerging phenomena occur. Often my work involved the determination of a complex graph associated to the software system, defining the so called "complex software network". For such complex software networks I analyzed different network metrics and I studied their relationships with software quality. I took advantage of the theory of complex systems in order to study, to explain and sometimes to forecast properties and behavior of software systems. Thus my work involved the empirical study of many different statistical properties of software, in particular metrics, faults and refactorings, the construction and the application of statistical models for explaining such statistical properties, the implementation and the optimization of algorithms able to model their behavior, the introduction of metrics borrowed from Social Network Analysis (SNA) for describing relationships and dependencies among software modules. More specifically, my research activity regarded the followings topics: Bugs, power laws and software quality I investigated module faultness and its implications on software quality. I studied data mining from CVS repositories of two large OO projects, Eclipse and Netbeans, focusing on "fixing-issue" commits, and compared static traditional approaches, like Knowledge Engineering, to dynamic approaches based on Machine Learning techniques. In one work I compare for the first time performances of Machine Learning (ML) techniques to automatic classify "fixing-issues" among message commits. Our study calculates precision and recall of different Machine Learning Classifiers for the correct classification of issue-reporting commits. The results show that some ML classifiers can correctly classify up to 99.9% of such commits. I investigated Java software systems as complex graphs, where nodes represent a Java file - called compilation unit (CU) - and an edges represent a relations between them. The distribution of the number of bugs per CU, exhibits a power-law behavior in the tail, as well as the number of CUs influenced by a specific bug. The exam of the evolution of software metrics across different releases allows to understand how relationships among CUs metrics

and CUs faultness change with time. I discussed module faultness from a statistical perspective, using as case studies five versions of Eclipse, to show how log-normal, Double Pareto and Yule-Simon statistical distributions may fit the empirical bug distribution at least as well as the Weibull distribution proposed by Zhang. In particular, I discuss how some of these alternative distributions provide both a superior fit to empirical data and a theoretical motivation to be used for modeling the bug generation process. Further studies present a model based on the Yule process, able to explain the evolution of some properties of large object-oriented software systems. Four system properties related to code production of four large object-oriented software systems – Eclipse, Netbeans, JDK and Ant are analyzed. The properties analyzed, namely the naming of variables and methods, the call to methods and the inheritance hierarchies, show a power-law distribution. A software simulation allows to verify the goodness of the model, finding a very good correspondence between empirical data of subsequent software versions, and the prediction of the model presented. I investigated three algorithms for an efficient implementation of the preferential attachment mechanism lying at the core of the Yule process are developed, and their efficiency in generating power-law distribution for different properties of Object Oriented (OO) software systems. I did also studies on Software metrics and SNA metrics I analysed software metrics related to quality and some metrics borrowed from the Social Network Analysis are applied to OO software graphs. In OO systems the modules are the classes, interconnected with each other by relationships like inheritance and dependency. It is possible to represent OO systems as software networks, where the classes are the network nodes and the relationships among classes are the network edges. Social Networks metrics, as for instance, the EGO metrics, allow to identify the role of each single node in the information flow through the network, being related to software modules and their dependencies. I compared these metrics with other traditional software metrics, like the Chidamber- Kemerer suite, and software graph metrics. The exam of the empirical distributions of all the metrics across the software modules of several releases of two large Java systems systematically shows fat-tails for all the metrics. Moreover, the various metric distributions look very similar and consistent across all system releases and are also very similar in both systems. Analytical distribution functions suitable for describing and studying the observed distributions are also provided. I also present an extensive analysis of software metrics for 111 object-oriented systems written in Java. For each system, I considered 18 traditional metrics such as LOC and Chidamber and Kemerer metrics, as well as metrics derived from complex network theory and social network analysis, computed at class level. Most metrics follow a leptokurtotic distribution. Only a couple of metrics have patent normal behavior while some others are very irregular, and even bimodal. The statistics gathered allow to study and discuss the variability of metrics along different systems. I made a preliminary and exploratory analysis of the Eclipse subprojects, using a joint application of SNA and traditional software metrics. The entire set of metrics has been summarized performing a Principal Component Analysis (PCA) and obtaining a very reduced number of independent principal components, which allow to represent the classes into a space where they show typical patterns. The preliminary results show how the joint application of traditional and network software metrics may be used to identify subprojects developed with similar functionalities and scopes. I analysed the software graphs of 96 systems of the Java Qualitas Corpus, parsing the source code and identifying the dependencies among classes. Twelve software metrics were analyzed, nine borrowed from Social Network Analysis (SNA), and three more traditional software metrics, such as Loc, Fan-in and Fan-out. The results show how the metrics can be partitioned in groups for almost the whole Java Qualitas Corpus, and that such grouping can provide insights on the topology of software networks. For two systems, Eclipse and Netbeans, we computed also the number of bugs, identifying the bugs affecting each class, and finding that some SNA metrics are highly correlated with bugs, while others are strongly anti-correlated. I did also some studies on Software refactoring. I analyse the effect of particular refactorings on class coupling for different releases of four Object Oriented (OO) Open Source (OS) Java software systems: Azureus, Jtopen, Jedit and Tomcat, as representative of general Java OS systems. Specifically, the “add parameter” to a

method and “remove parameter” from a method refactorings, as defined according to Fowler’s dictionary, may influence class coupling changing fan-in and fan-out of classes they are applied to. My work investigates, both qualitatively and quantitatively, what is the global effect of the application of such refactorings, providing best fitting statistical distributions able to describe the changes in fan-in and fan-out couplings. A detailed analysis of the best fitting parameters and of their changes when refactoring occurs, has been performed, estimating the effect of refactoring on coupling before it is applied. Such estimates may help in determining refactoring costs and benefits .I did a study of the effect of fan-in and fan-out metrics from the perspective of two refactorings, “add parameter to” and “remove parameter from” a method, collecting these two refactorings from multiple releases of the Tomcat open source system. Results show significant differences in the profiles of statistical distributions of fan-in and fan-out between refactored and not refactored classes. A strong over-arching theme emerged: developers seemed to focus on the refactoring of classes with relatively high fan-in and fan-out values rather than classes with high values in any one. I considered for the first time how a single refactoring modified these metric values, what happened when refactorings had been applied to a single class in unison and finally, what influence a set of refactorings had on the shape of FanIn and FanOut distributions. Results indicated that, on average, refactored classes tended to have larger FanIn and FanOut values when compared with non-refactored classes. Where evidence of multiple (different) refactorings applied to the same class was found, the net effect (in terms of FanIn and FanOut coupling values) was negligible. I shown how highly-coupled classes were more prone to refactoring, particularly through a set of ‘core’ refactorings. However, wide variations were found across systems for our chosen measures of coupling namely, fan-in and fan-out. Specific individual refactorings were also explored to gain an understanding of why these differences may have occurred. An exploration of open questions through the extraction of fifty-two of Fowler’s catalog of refactorings drawn from versions of four open-source systems is accomplished, comparing the coupling characteristics of each set of refactored classes with the corresponding set of non-refactored classes. I did different studies on Software fractal dimension. I analysed the self similar structure of software networks to introduce the fractal dimension as a global software metric associated to software quality, at the system level and at the subproject level. I studied the source code of various releases of two large OO Open Source (OS) Java software systems, Eclipse and Netbeans, investigating the complexity of the whole release and of its subprojects. In all examined cases there exists a scaling region where it is possible to compute a self-similar coefficient, the fractal dimension, using “the box counting method”. Results show that this measure looks fairly related to software quality, acting as a global quality software metric. In particular, we computed the defects of each software system and we found a clear correlation among the number of defects in the system, or in a subproject, and its fractal dimension. This correlation exists across all the subprojects and also along the time evolution of the software systems, as new releases are delivered. Software systems are considered as complex networks which have a self-similar structure under a length-scale transformation. On such complex software networks a self-similar coefficient is computed, also known as fractal dimension, using "the box counting method". Several releases of the publically available Eclipse software system were analyzed, calculating the fractal dimension for twenty sub-projects, randomly chosen, for every release, as well as for each release as a whole. Our results display an overall consistency among the sub- projects and among all the analyzed releases. The study finds a very good correlation between the fractal dimension and the number of bugs for Eclipse and for twenty sub-projects. This result suggests that the fractal dimension could be considered as a global quality metric for large software systems. In some works I propose an algorithm for computing the fractal dimension of a software network, and compare its performances with two other algorithms. Object of study are various large, object-oriented software systems. We built the associated graph for each system, also known as software network, analyzing the binary relationships (dependencies), among classes. We found that the structure of such software networks is self-similar under a length-scale transformation. The fractal dimension of these networks is computed using a Merge algorithm,

first devised by the authors, a Greedy Coloring algorithm, based on the equivalence with the graph coloring problem, and a Simulated Annealing algorithm, largely used for efficiently determining minima in multi-dimensional problems. Our study examines both efficiency and accuracy, showing that the Merge algorithm is the most efficient, while the Simulated Annealing is the most accurate. The Greedy Coloring algorithm lays in between the two, having speed very close to the Merge algorithm, and accuracy comparable to the Simulated Annealing algorithm. I performed some preliminary studies also on the relationships about Micro-patterns, more specifically anti-patterns, and software quality, and I analyzed the role of Agile methodologies in software production and the relationships with software quality and the presence of bugs.

All this research activities have been performed in collaboration with my group in Cagliari University, with Prof. M. Marchesi and Prof. G. Concas, and in collaboration with different professors through international collaborations. In particular I did interact with Professors: Steve Counsell, from Brunel University, UK, Ewan Tempero, from Auckland University, NZ, Honghyu Zhang, from Tsinghua University Beijing, China, Sung Kim, from Hong Kong University of Science and Technology, HK, Francesca Arcelli Fontana, from Milano University, IT, Yossi Jil, Technion - Israel Institute of Technology Technion City, Haifa, ISRAEL. The work with my group in Cagliari and the international collaborations are still ongoing, but I am always looking for new challenges and new interesting topics to work on.

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