








## Gustavo Carvalho

### Lecturer

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## About me

I am Lecturer at *Centro de Informática (CIn)* of the *Universidade Federal de Pernambuco (UFPE)*, Brazil. My main research interest is on Software Engineering, with emphasis on tests and formal methods.

## Research

- Formal specification (CNL, CSP, Z, B)
- Formal verification (theorem proving, model checking)
- Tools development (C/C++, Java)

## Education

2016	D.Phil. in Computer Science	Universidade Federal de Pernambuco (BR)
2010	M.Sc. in Computer Science	Universidade Federal de Pernambuco (BR)
2006	B.Sc. in Computer Science	Universidade Federal de Pernambuco (BR)

## Appointments

2017 – present	Lecturer in Computer Science	Universidade Federal de Pernambuco (BR)
2010 – 2017	Lecturer in Computer Science	Universidade de Pernambuco (BR)
2009 – 2010	System analyst	Tribunal da Justiça de Pernambuco (BR)
2008 – 2010	Lecturer in Computer Science	FATEC-PE (BR)
2007 – 2008	Game developer	Jynx Playware (BR)
2005 – 2005	Game developer	Preloud (BR)

## Awards

2019	Keynote speaker – XXII Brazilian Symposium on Formal Methods
2016	Honoured lecturer – Computer Engineering (2016.1) at UPE
2016	Honoured lecturer – Computer Engineering (2015.2) at UPE
2015	Honoured lecturer – Computer Engineering (2014.2) at UPE
2009	Honoured lecturer – Computer Science (2009.2) at FATEC-PE
2007	Best student – Test Analysis Course at UFPE and Motorola
2004	Bronze medal – Brazilian selection for the ACM ICPC

## Teaching

2018 – present	Algorithms and data structures
2018 – present	Introduction to proof assistants
2018 – 2018	Discrete mathematics
2015 – 2017	Software analysis and design
2013 – present	Introduction to formal methods
2010 – 2014	Experimental software engineering
2010 – 2013	Introduction to the scientific method
2008 – 2017	Compilers

## Projects

2020 – present	A CNL for supporting robotic testing of mobile devices In this project, we are developing a CNL for supporting the specification of test cases of mobile devices, which are performed with the aid of robotic arms.
2019 – present	A CNL for describing assumptions of robotic environments RoboWorld is a controlled natural language (CNL) for the specification of environment and platform assumptions with a precise semantics in the context of the RoboStar technology.
2011 – present	NAT2TEST: test cases from natural-language requirements The NAT2TEST strategy supports automatic generation of test cases for timed reactive systems from controlled natural-language requirements. Test generation is supported by different formalisms, techniques and tools, such as: CSP (model checking + FDR), Coq (property-based testing + QuickChick), CPN (simulation + CPN Tools), among others.



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## Service

### Guest editor

1. [To appear] Gustavo Carvalho and Volker Stolz  
Science of Computer Programming – Special Issue  
Selected papers from the 23rd Brazilian Symposium on Formal Methods
2. [2020] Gustavo Carvalho and Volker Stolz  
Formal Methods: Foundations and Applications (LNCS, volume 12475)  
Proceedings of the 23rd Brazilian Symposium on Formal Methods

### PC chair

1. [2020] Gustavo Carvalho and Volker Stolz  
XXIII Brazilian Symposium on Formal Methods

### General chair

1. [2017] XX Brazilian Symposium on Formal Methods

### Reviewer (journals)

1. IEEE Transactions on Software Engineering
2. Information and Software Technology
3. Journal of Computer Science and Technology
4. Science of Computer Programming
5. Software: Practice and Experience
6. Software and Systems Modeling

### Reviewer (conferences)

1. [2020] Brazilian Symposium on Formal Methods (PC member)
2. [2020] IEEE International Conference on Consumer Electronics (External reviewer)
3. [2019] Brazilian Symposium on Formal Methods (PC member)
4. [2019] International Symposium on Formal Methods (External reviewer)
5. [2019] Int. Symposium on Theoretical Aspects of Software Engineering (External reviewer)
6. [2018] International Symposium on Formal Methods (External reviewer)
7. [2017] Int. Conference on Software Engineering and Formal Methods (External reviewer)
8. [2016] International Symposium on Formal Methods (External reviewer)
9. [2015] Brazilian Symposium on Software Engineering (External reviewer)
10. [2014] International Colloquium on Theoretical Aspects of Computing (External reviewer)
11. [2014] International Symposium on Formal Methods (External reviewer)
12. [2013] Int. Conference on Software Engineering and Formal Methods (External reviewer)
13. [2011] Brazilian Symposium on Software Engineering (External reviewer)



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- Tools development (C/C++, Java)

14. [2011] International Colloquium on Theoretical Aspects of Computing (External reviewer)

## Publications

### Journal papers

1. Gustavo Carvalho, Igor Meira. Validating, verifying and testing timed data-flow reactive systems in Coq from controlled natural-language requirements. *Sci. Comput. Program.* 201 (2020).
2. Bruno Cesar F. Silva, Gustavo Carvalho, Augusto Sampaio: CPN simulation-based test case generation from controlled natural-language requirements. *Sci. Comput. Program.* 181: 111-139 (2019)
3. Hugo L. S. Araujo, Gustavo Carvalho, Morteza Mohaqeqi, Mohammad Reza Mousavi, Augusto Sampaio: Sound conformance testing for cyber-physical systems: Theory and implementation. *Sci. Comput. Program.* 162: 35-54 (2018)
4. Gustavo Carvalho, Ana Cavalcanti, Augusto Sampaio: Modelling timed reactive systems from natural-language requirements. *Formal Aspects Comput.* 28(5): 725-765 (2016)
5. Gustavo Carvalho, Diogo Falcão, Flávia de Almeida Barros, Augusto Sampaio, Alexandre Mota, Leonardo Motta, Mark R. Blackburn: NAT2TEST<sub>SCR</sub>: Test case generation from natural language requirements based on SCR specifications. *Sci. Comput. Program.* 95: 275-297 (2014)

### Conference papers

1. Hugo L. S. Araujo, Gustavo Carvalho, Mohammad Reza Mousavi, Augusto Sampaio: Multi-objective Search for Effective Testing of Cyber-Physical Systems. *SEFM 2019*: 183-20.
2. Tainã Santos, Gustavo Carvalho, Augusto Sampaio: Formal Modelling of Environment Restrictions from Natural-Language Requirements. *SBMF 2018*: 252-270.
3. Thomas Gibson-Robinson, Guy H. Broadfoot, Gustavo Carvalho, Philippa J. Hopcroft, Gavin Lowe, Sidney Nogueira, Colin O'Halloran, Augusto Sampaio: FDR: From Theory to Industrial Application. *Concurrency, Security, and Puzzles 2017*: 65-87
4. Bruno Oliveira, Gustavo Carvalho, Mohammad Reza Mousavi, Augusto Sampaio: Simulation of hybrid systems from natural-language requirements. *CASE 2017*: 1320-1325
5. Hugo L. S. Araujo, Gustavo Carvalho, Augusto Sampaio, Mohammad Reza Mousavi, Masoumeh Taromirad: A Process for Sound Conformance Testing of Cyber-Physical Systems. *ICST Workshops 2017*: 46-50
6. Sérgio Barza, Gustavo Carvalho, Juliano Iyoda, Augusto Sampaio, Alexandre Mota, Flávia de Almeida Barros: Model Checking Requirements. *SBMF 2016*: 217-234
7. Bruno Cesar F. Silva, Gustavo Carvalho, Augusto Sampaio: Test Case Generation from Natural Language Requirements Using CPN Simulation. *SBMF 2015*: 178-193
8. Gustavo Carvalho, Flávia A. Barros, Ana Carvalho, Ana Cavalcanti, Alexandre Mota, Augusto Sampaio: NAT2TEST Tool: From Natural Language Requirements to Test Cases Based on CSP. *SEFM 2015*: 283-290
9. Gustavo Carvalho, Ana Carvalho, Eduardo Rocha, Ana Cavalcanti, Augusto Sampaio: A Formal Model for Natural-Language Timed Requirements of Reactive Systems. *ICFEM 2014*: 43-58
10. Gustavo Carvalho, Flávia de Almeida Barros, Florian Lapschies, Uwe Schulze, Jan Peleska: Model-Based Testing from Controlled Natural Language Requirements. *FTSCS 2013*: 19-35



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11. Gustavo Carvalho, Augusto Sampaio, Alexandre Mota: A CSP Timed Input-Output Relation and a Strategy for Mechanised Conformance Verification. ICFEM 2013: 148-164
12. Gustavo Carvalho, Diogo Falcão, Flávia A. Barros, Augusto Sampaio, Alexandre Mota, Leonardo Motta, Mark R. Blackburn: Test case generation from natural language requirements based on SCR specifications. SAC 2013: 1217-1222
13. Ling Shi, Yang Liu, Jun Sun, Jin Song Dong, Gustavo Carvalho: An Analytical and Experimental Comparison of CSP Extensions and Tools. ICFEM 2012: 381-397
14. Gustavo Carvalho, Diogo Falcão, Alexandre Mota, Augusto Sampaio: A Process Algebra Based Strategy for Generating Test Vectors from SCR Specifications. SBMF 2012: 67-82
15. Gustavo Carvalho, Rafael Cabral, Alexandre Mota. A Formal Analysis of Concurrent Assembly Code based on CSP. SBMF 2012
16. Gustavo Carvalho, Tarciana Dias, Alexandre Mota, Augusto Sampaio. Analytical Comparison of Refinement Checkers. SBMF 2011: 61-66

## Supervision

### Graduate students (D.Phil. – co-supervisor)

1. [present] Hugo Leonardo da Silva Araujo  
A framework for testing Cyber-Physical Systems: Input generation and causality analysis

### Graduate students (M.Sc – supervisor)

1. [present] Francisco Wilson Rodrigues Junior  
Test automation with robotics
2. [2020] Igor de Araújo Meira  
Validating, verifying and testing timed data-flow reactive systems in Coq from controlled natural-language requirements
3. [2017] Tainã Maria dos Santos  
Formal modelling of test environments from natural-language requirements

### Graduate students (M.Sc. – co-supervisor)

1. [2017] Hugo Leonardo da Silva Araujo  
A process for sound conformance testing of Cyber-Physical Systems
2. [2016] Bruno Cesar Ferreira Silva  
CPN simulation-based test case generation from natural language requirements
3. [2016] Bruno Medeiros de Oliveira  
Simulation of hybrid systems from natural language requirements

### Undergraduate students (course conclusion work – supervisor)

1. [present] Carlos Alberto da Silva Carvalho de Freitas  
A Theory of Communicating Sequential Processes in Coq
2. [present] Lucas Vinicius da Costa Santana [in PT-BR]  
Formalização em Coq de uma linguagem de processos para ioco
3. [2019] Fábio Nunes Peixoto Sobral [in PT-BR]  
Uma Formalização em Coq de Testes Baseados em Modelos
4. [2016] Daniel de França Figueroa [in PT-BR]  
MC-Test: Uma Ferramenta para testes de cobertura e testes de mutação
5. [2016] Gemerson Gerardo Feitosa Goncalves [in PT-BR]  
Uma Avaliação do Ensino de Métodos Formais no Brasil
6. [2016] Hartur Barreto Brito [in PT-BR]  
Teaching Logic - Uma Ferramenta para Auxiliar o Ensino de Lógica



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7. [2015] Tainã Maria dos Santos [*in PT-BR*]  
Representação em CSP# de Sistemas Reativos Baseados em Fluxo de Dados
8. [2012] Bruno Fonseca Lins de Oliveira [*in PT-BR*]  
Uso de Constraint Solvers na Geração de Dados de Teste: Um Mapeamento Sistemático da Literatura
9. [2012] Eduardo Augusto de Oliveira Nazaré [*in PT-BR*]  
SeleniumTG: uma Ferramenta WEB para Geração de Scripts de Teste
10. [2012] Rafael Farias Cabral [*in PT-BR*]  
Um Mapeamento entre Assembly e CSP: Analisando Formalmente Programas Concorrentes
11. [2011] Lamartine Veras Sampaio de Souza [*in PT-BR*]  
Geração Automática de Casos de Teste a partir de Casos de Uso: Um Mapeamento Sistemático da Literatura
12. [2011] Hiroshi Nishimura Gonçalves [*in PT-BR*]  
Geração de Testes Automatizados Utilizando o Selenium
13. [2011] Augusta Raiana Marques de Figueredo [*in PT-BR*]  
Um Mapeamento Sistemático da Atividade de Testes no Ambiente de Desenvolvimento Distribuído
14. [2011] Hugo Leonardo C. de O. Lima [*in PT-BR*]  
Análise Formal de Código Java Concorrente
15. [2011] Matheus Levi Pereira Torres [*in PT-BR*]  
CSP<sub>M</sub> x CSP#: Uma Análise Experimental de Problemas Clássicos de Concorrência
16. [2011] Tiago Xavier [*in PT-BR*]  
Geração Automática de Scripts de Teste Utilizando o Selenium

### Undergraduate students (course conclusion work – co-supervisor)

1. [2015] Tomaz de Aquino dos Santos Junior [*in PT-BR*]  
Critérios de Cobertura de Testes Gerados a partir de Linguagem Natural

### Undergraduate students (research student – supervisor)

1. [present] Alice Oliveira de Queiroz Brito [*in PT-BR*]  
Uma linguagem natural controlada para apoiar a geração de testes com robôs
2. [present] Williams Santiago de Souza Filho [*in PT-BR*]  
Geração de testes com robôs a partir de uma linguagem natural controlada
3. [2011] Humberto Beltrão da Cunha Júnior [*in PT-BR*]  
Estudos Empíricos Aplicados ao Management Function Deployment (MFD)
4. [2011] Wagner Melo Nascimento [*in PT-BR*]  
Transformação entre Modelos de Desenvolvimento de Software
5. [2010] Lara Dantas Coutinho [*in PT-BR*]  
Estudos Empíricos Aplicados ao Management Function Deployment (MFD)
6. [2010] Bruna Cavalcanti Galle de Aguiar [*in PT-BR*]  
Estudos Empíricos Aplicados ao Management Function Deployment (MFD)

### Undergraduate students (research student – co-supervisor)

1. [2013] Diogo Filipe Dornelas Falcão [*in PT-BR*]  
Geração de Testes a partir do Processamento de Linguagem Natural

## Software

1. [2016] NAT2TEST tool  
(Test generation tool for timed reactive systems)
2. [2005] Laura's Tierklinik  
(Computer game)





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(theorem proving, model checking)
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(C/C++, Java)

3. [2005] Lissy - Die 3 Freunde von der Reitschule  
(Computer game)