Research Statement

My main research interest is the study of mathematically rigorous and applicable approaches for the understanding and developing of robust dynamic computational systems, particularly using a reactive systems approach. More general, I am interested in applications of logic to computer science, and formal methods for the design, analysis and verification of systems. I advocate for powerful and scalable technologies, and that require human intervention only in the most creative parts of the process. Some particular topics that I am interested on nowadays are:

1. Stream runtime verification.
2. Formal approaches to Blockchain and Smart Contracts, using logics, programming languages and formal methods.
3. Temporal hyperproperties, including specification languages, algorithms and dynamic monitoring.
4. Reactive synthesis and its application to the analysis of temporal requirements for critical systems.
5. Logic, games and automata theory (both foundations and applications).

Research Experience

Nov 2013–present   Associate Research Professor (tenured), Madrid Institute for Advanced Studies in Software Development Technologies (IMDEA Software Institute), Spain.


Jan 2008–Nov 2013   Assistant Research Professor (tenure-track), IMDEA Software Institute.

May 2007–Dec 2007   Postdoctoral Scholar, University of California at Santa Cruz, working with Prof. Luca de Alfaro. Focusing on real-time testing for embedded systems.


Summer 2005   Research Intern, Intel Research, Hillsboro, OR. As part of the PlanetLab group, developed new algorithms for large-scale distributed event-based systems.

1998–1999   Research Assistant, School of Computer Science (UPM). Implemented new transactional models using design-patterns for distributed systems.
Education


2001 Master of Science degree in Computer Science, Stanford University. Specializations: Software Theory and Theoretical Computer Science. Avg. GPA: 4.120.

1998 “Ingeniero de Telecomunicación” (BS+MS in EE, six years degree), Universidad Politecnica de Madrid (UPM) (Spain), graduation with Honors. Specialization: telematics.

Dissertation

“Deadlock Avoidance for Distributed Real-time and Embedded Systems.” Adviser: Zohar Manna. Coadviser: Henny B. Sipma. My thesis presents a novel method for deadlock avoidance in distributed real-time and embedded systems, using the combination of static analysis and run-time protocols. Program analysis allows the extraction of the call dependencies between remote components. Run-time protocols then ensure that the interleavings of executions cannot reach to deadlocks, while maximizing concurrency. This solution out-performs existing techniques to deal with deadlocks in distributed systems.

Funding and projects


− ElasTest: An elastic platform for testing complex distributed large software systems. H2020-ICT ICT-10-2016 Ref: 731535. Start-End date: 01/01/2017 to 31/12/2019. Duration: 3 years. IMDEA PI. Total amount: 5,031,187€. (IMDEA’s budget: 288,875€).

− EU COST Action IC1402: ArVi: Runtime Verification Beyond Monitoring. EU COST. Start-End date: 01/01/2016 to 31/12/2019. Duration: 4 years. WG Leader, MC Member. Total amount: 360,000€.


– Strongsoft. Spanish National Project. MINECO TIN2012-39391-C04-03. Start-End date: 01/01/2013 to 31/12/2015. Duration: 3 years. Researcher. Total amount: 113.000€.

– EU COST Action IC0901: RichModel Toolkit. EU COST. Start-End date: 01/10/2009 to 15/10/2013. Duration: 4 years. MC Chair (PI). Total amount: 360.000€.

Publications

**Journal Publications**


**Conference Publications**


**Chapters in Books**


**Volumes and Special Issues edited**


**Doctoral Students and Student Supervision**

**Doctoral Thesis**

- Luis Miguel Danielsson Villegas (in progress, expected 2023)
- Margarita Capretto (in progress)
- Andoni Rodriguez-Herrera (in progress)
- Matias Brizzio (in progress)

**Masters Thesis**

Alejandro Sanchez, Decision Procedures for the Temporal Verification of Concurrent Data Structures, UCM, 2011.


Undergrad Thesis

Victor de Juan: Pruebas de Primer Orden de Programas Concurrentes, Universidad Austral de Madrid, 2016.

Doctoral Committee Member


Interns and Visitors

Martin Ceresa (visiting PhD student from Rosario, Argentina)

Aldana Ramirez (intern)

Andoni Rodriguez (intern)

Margarita Capreto (intern)

Alexander Schramm (intern)

Amir Goharshadi (intern)

Markus Rabe (visiting from Saarland University, Germany)

Antonio Artes (intern)

Santiago Romero (intern)

Juan Manuel Crespo (intern)

Alejandro Sánchez (intern)

Victor de Juan (intern)

Elena Gutierrez (intern)

Program Committees and Journal Editing

Editor

Guest editor of the special issue of Formal Methods in Systems Design for selected papers of RV’16.

Guest editor of the special issue of Acta Informatica for selected papers of TIME’13.
– Guest editor of the special issue Acta Informatica for selected papers of EU COST Action RichModel Toolkit IC0901.

PC Chair
– PhD Symposium at iFM (PhD@iFM'19)
– 16th International Conference on Runtime Verification (RV’16)
– 20th International Symposium on Temporal Representation and Reasoning (TIME’2013)

PC Member
TACAS’23, RV’22, PROLE’22, FMBC’22, DAPSS’22, VORTEX’22, ATVA’22, TACAS’22, RV’21, PROLE’21, FMBC’21, DAPSS’21, VMCAI’22, RV’21, RV’20, ICTAC’20, FORMATS’19,FMBC’20, RV’19, iFM’19, GAUSS’19, SEFM’19, FORTE’19, SEFM’18, FORMATS’18, PROLE’18, RV’18, VORTEX’18, PROLE’17, PrePost’17, RV’17, FSEN’17, IFM’16, FORMATS’16, VeriComp’16, FORMATS’15, FSEN’15, SOAP’15, SOA’15, SAC’15, RV’15, ACM Transaction on Embedded Computing Systems’15, GandALF’14, MOD*14, TTSS’14, FSEN’14, TASE’14, FMCAD’13, FSEN’13, TIME’12, PROLE’12, PROLE’11, TIME’11, SVARM’10, VLSI-SoC’10, PDMC’09, ICTAC’09.

Awards and Recognitions
2021

2012
Two “quinquenios” (5 years) of research excellence (2000–2005 and 2005–2010) awarded by CSIC.

2007
Juan de la Cierva Fellowship, supporting an early career researcher position at IMDEA-Software; provided by the Spanish Ministry of Education and Science.

2006
ACM SIGBED/SIGSOFT Frank Anger Memorial Student Award.

2005

2000
A check by Don Knuth for $2.56 for finding an error in Graham, Knuth, Patashnik “Concrete Mathematics”, Addison Wesley, 1994.

2000
Champion team of the 24th ACM International programming contest (Southwest Europe). 15th place in the world finals.

1999
La Caixa Graduate Fellowship, from 1999 to 2001. This prestigious Spanish Fellowship provides full funding for the Fellows during two years of graduate studies.

1998

1997
IEEE Award for Outstanding Leaderships and Service.

Teaching Experience

Winter 2018
― Formal Methods for Concurrent and Reactive Systems‖. Masters MUSS (Master Universitario Software y Sistemas), Universidad Politecnica de Madrid (UPM).

Winter 2017
― Formal Methods for Concurrent and Reactive Systems‖. Masters MUSS, Universidad Politecnica de Madrid (UPM).

Winter 2016
― Formal Methods for Concurrent and Reactive Systems‖. Masters MUSS, Universidad Politecnica de Madrid (UPM).

Spring 2015
― Concurrent Programming‖. Undergraduate Degree in Computer Science, Universidad Politecnica de Madrid (UPM).

Winter 2003
Teaching fellow, Stanford University, CS department. Independently taught CS156: “Logic and automated reasoning”.

Fall 2004

Winter 2003
Invited Lectures

February 14, 2019  
University of the Basque Country, Spain. “Temporal Verification of Hyperproperties”

February 14, 2019  
Dagstuhl, Germany. “Overview of Stream Runtime Verification”

January 21, 2019  
COEMS Workshop @ HiPEAC. Valencia, Spain. “Stream Runtime Verification Revisited”

November 10, 2019  
RV Tutorials, Cyprus. “Stream Runtime Verification. A Tutorial”

March 21, 2018  
ArVi Winter School, Praz sur Arly, France. “Stream Runtime Verification”

May 19, 2016  
DRV Workshop, Bertinoro, Italy. “Distributed Deadlock Avoidance”.

September 7, 2016  
6th Iberian Mathematical Meeting. “A Gentle Introduction to Linear-Temporal Logic”.

November 4, 2015  

March 19, 2015  
Shonan Meeting, Japan, “Stream Runtime Verification”.

December 5, 2012  
Saarbruecken, Germany, “A Decision Procedure for Skiplists of Unbounded Height and Length.”

July 12, 2011  
University of Colorado, Boulder, CO, USA. “Deductive Temporal Verification of Parametrized Concurrent Systems.”

February 18, 2011  
Luebeck, Germany, “Temporal Verification of Concurrent Data-Structures.”

January 21, 2011  
Saarbruecken, Germany, “Decision Procedures for the Temporal Verification of Concurrent Lists.”

January 18, 2011  
Saarbruecken, Germany, “Deadlock Avoidance for Distributed Real-Time and Embedded Systems.”

November 8, 2010  
Schloss Dagstuhl, Germany, “Stream Runtime Verification Revisited.”

February 2, 2010  
MIT, “Regular Linear Temporal Logic with Past.”

February 21, 2008  
Universidad Rey Juan Carlos, Spain “Temporal Verification of Concurrent Data-Structures.”

April 5, 2007  
EPFL, Lausanne, Switzerland. “Distributed Deadlock Avoidance”.

February 26, 2007  
NASA, Ames Research Center, Mountain View, CA, USA. “Distributed Deadlock Avoidance”.

December 19, 2006  
VERIMAG, Grenoble, France. “Deadlock Avoidance for Distributed Real-Time and Embedded Systems”.

December 18, 2006  
TU Munich, Germany. “Deadlock Avoidance for Distributed Real-Time and Embedded Systems”.

September 21, 2005  
Facultad Informática, UCM, Madrid, Spain. “Final Semantics of Event-Pattern Reactive Programs”.

September 20, 2005  

September 12, 2005  
Facultad Informática, UPM, Madrid, Spain. “Final Semantics of Event-Pattern Reactive Programs”.

May 8, 2002  
ETSI Telecommunication, UPM, Madrid, Spain. “Introduction to Term-Rewriting Systems”.
Other Publications

2003

July 2000–September 2001
A series of articles regarding the problems and solutions of the 24th ACM International Programming Contest, for “Novatica” (ISSN: 0211-2124).

January 1997–August 1999
A series of articles regarding the Ada programming language and the GNU/Linux Operating System in the magazines “Solo Programadores” (ISSN: 1134-4792), “Programación Actual” (ISSN: 1137-5531) and “Linux Actual”. (ISSN:1138-9443).

Professional Experience

2019–
External consultant, Developair Technologies, Spain.

Summer 2005
Research Intern, Intel Research, Hillsboro, OR.

1997–1998
Lucent Technologies Development Center in Tres Cantos (Spain). Software Engineer position, developed components for Telecommunication equipment, in C.

1994–1996
Telematics Department, UPM, Madrid. Software Developer for the teleconference project ISABEL. Developed video codecs for multimedia infrastructure, in C++.

Service and Membership

1999–
ACM Member.

1995–
IEEE Senior Member.

2002–2005

1994–1996
Vice-president of the IEEE Student Branch, UPM, Madrid.

For more information visit http://software.imdea.org/~cesar