

# **Metric-Driven Design Verification**

An Engineer's and Executive's Guide  
to First Pass Success

Hamilton B. Carter  
Shankar Hemmady

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 Springer

Hamilton B. Carter  
Cadence Design Systems, Inc.  
San Jose, CA  
USA

Shankar Hemmady  
Cadence Design Systems, Inc.  
San Jose, CA  
USA

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# Table of Contents

<b>The Authors</b>	<b>xi</b>
<b>Dedications</b>	<b>xiii</b>
<b>Preface</b>	<b>xv</b>
<b>Introduction</b>	<b>xix</b>
<b>Contributing Authors in Order of Appearance</b>	<b>xxi</b>
<b>PART I ANALYZING AND DRIVING VERIFICATION: AN EXECUTIVE'S GUIDE</b>	<b>1</b>
<b>Chapter 1 The Verification Crisis</b>	<b>3</b>
<b>Chapter 2 Automated Metric-Driven Processes</b>	<b>13</b>
Introduction	13
The Process Model	15
The Automated Metric-Driven Process Model	16
Project Management Using Metric-Driven Data	28
What Are Metrics For?	29
Tactical and Strategic Metrics	29
Summary	30
<b>Chapter 3 Roles in a Verification Project</b>	<b>31</b>
Introduction	31
The Executive	31
Marketing	33
Design Manager	34
Verification Manager	34
Verification Architect/Methodologist	35
Design/System Architect	36
Verification Engineer	37
Design Engineer	38
Regressions Coordinator	39
Debug Coordinator	39
Summary	40
<b>Chapter 4 Overview of a Verification Project</b>	<b>41</b>
Introduction	41
Summary	49

<b>Chapter 5 Verification Technologies</b>	<b>51</b>
Introduction	51
Metric-Driven Process Automation Tools	52
Modeling and Architectural Exploration	58
Assertion-Based Verification	63
Simulation-Based Verification	70
Mixed-Signal Verification	73
Acceleration/Emulation-Based Verification	75
Summary	78
<b>PART II MANAGING THE VERIFICATION PROCESS</b>	<b>79</b>
<b>Chapter 6 Verification Planning</b>	<b>81</b>
Introduction	81
Chapter Overview	83
Verification Planning	86
Summary	105
<b>Chapter 7 Capturing Metrics</b>	<b>107</b>
Introduction	107
The Universal Metrics Methodology	109
<b>Chapter 8 Regression Management</b>	<b>113</b>
Introduction	113
Early Regression Management Tasks	114
Regression Management	114
Linking the Regression and Revision Management Systems	115
Bring-Up Regressions	116
Integration Regressions	119
Design Quality Regressions	121
Managing Regression Resources and Engineering Effectiveness	122
Regression-Centric Metrics	123
How Many Metrics Are Too Many?	125
Summary	127
<b>Chapter 9 Revision Control and Change Integration</b>	<b>129</b>
Introduction	129
The Benefits of Revision Control	131
Metric-Driven Revision Control	132
Summary	139
<b>Chapter 10 Debug</b>	<b>141</b>
Introduction	141

Debug Metrics	144
Summary	153

## **PART III EXECUTING THE VERIFICATION PROCESS 155**

<b>Chapter 11 Coverage Metrics</b>	<b>157</b>
Introduction	157
<b>Chapter 12 Modeling and Architectural Verification</b>	<b>163</b>
Introduction	163
How to Plan	164
Tracking to Closure	165
Reusing Architectural Verification Environments	165
Summary	166
<b>Chapter 13 Assertion-Based Verification</b>	<b>167</b>
Introduction	167
How to Plan	170
Tracking to Closure	175
Opportunities for Reuse	177
Summary	179
<b>Chapter 14 Dynamic Simulation-Based Verification</b>	<b>181</b>
Introduction	181
How to Plan	183
Taxonomy of Simulation-Based Verification	187
Tracking to Closure	191
Summary	196
<b>Chapter 15 System Verification</b>	<b>197</b>
Introduction	197
Coverification Defined	199
Advancing SoC Verification	201
List of Challenges	202
ARM926 PrimeXsys Platform Design	205
Closing the Gap	207
DMA Diagnostic Program	208
Connecting the DMA Diagnostic to the Verification Environment	212
Connecting the Main() Function in C	215
Writing Stubs	216
Creating Sequences and Coverage	217
Conclusion	219
References	220

<b>Chapter 16 Mixed Analog and Digital Verification</b>	<b>221</b>
Abstract	222
Introduction	222
Traditional Mixed-Signal Verification	223
Verification Planning	225
Analog Mixed-Signal Verification Kit	229
Conclusion	233
Reference	234
<b>Chapter 17 Design for Test</b>	<b>235</b>
Introduction	236
Motivation	238
A Unified DFT Verification Methodology	239
Planning	240
Executing	241
Automating	243
Test Case	245
Benefits	248
Future Work	249
Conclusions	249
References	250
<b>PART IV CASE STUDIES AND COMMENTARIES</b>	<b>253</b>
<b>Metric-Driven Design Verification: Why Is My Customer a Better Verification Engineer Than Me?</b>	<b>255</b>
Abstract	255
Introduction	256
Section 1: The Elusive Intended Functionality	257
Section 2: The Ever-Shrinking Schedule	265
Section 3: Writing a Metric-Driven Verification Plan	270
Section 4: Implementing the Metric-Driven Verification Plan	274
Conclusion	277
<b>Metric-Driven Methodology Speeds the Verification of a Complex Network Processor</b>	<b>279</b>
The Task Looked to be Complex	280
Discovering Project Predictability	281
A Coverage-Driven Approach, a Metric-Driven Environment	282
A New Level of Confidence	283
<b>Developing a Coverage-Driven SoC Methodology</b>	<b>285</b>
Introduction	285
Verification Background	286
Current Verification Methodology	289

Table of Contents	ix
Coverage and Checking	292
Results and Futures	293
<b>From Panic-Driven to Plan-Driven Verification Managing the Transition</b>	<b>297</b>
<b>Verification of a Next-Generation Single-Chip Analog TV and Digital TV ASIC</b>	<b>303</b>
Abstract	303
Introduction	304
The Design	305
Verification Challenges	306
Addition of New Internal Buses	307
Module-Level Verification	309
Data Paths and Integration Verification	309
Management of Verification Process and Data	309
Key Enablers of the Solution	310
Results	320
Conclusions	322
Future Work	322
<b>Management IP: New Frontier Providing Value Enterprise-Wide</b>	<b>325</b>
<b>Adelante VD3204x Core, SubSystem, and SoC Verification</b>	<b>329</b>
Abstract	330
Introduction	330
Project Background	331
Verification Decisions	333
DSP Core Verification	335
DSP Subsystem Verification	338
SoC-Level Verification	341
Results and Future Work	342
<b>SystemC-based Virtual SoC: An Integrated System-Level and Block-Level Verification Approach from Simulation to Coemulation</b>	<b>345</b>
Abstract	346
Introduction: Verification and Validation Challenges	347
Virtual SoC TLM Platform	348
Functional Verification: Cosimulation TLM and RTL	350
Validation: Coemulation TLM-Palladium	352
Conclusion and Future Developments	353
<b>Is Your System-Level Project Benefiting from Collaboration or Headed to Chaos?</b>	<b>355</b>
<b>Index</b>	<b>359</b>



## The Authors



### **Hamilton Carter**

Hamilton Carter has been awarded 14 patents in the field of functional verification. The patents address efficient sequencers for verification simulators, MESI cache coherency verification and component-based reusable verification systems. Carter worked on verification of the K5, K6, and K7 processors and their chipsets at AMD. He staffed and managed the first functional verification team at Cirrus Logic and has served as a manager, engineer, or consultant on over 20 commercial chips and EDA projects.



### **Shankar Hemmady**

Shankar Hemmady is a senior manager at Cadence responsible for verification planning, methodology, and management solutions. Mr. Hemmady has verified and tested, or managed the functional closure of over 25 commercial chips over the past 18 years during his tenure in the industry as an engineer, manager, and consultant at 12 companies, including AMD, Cirrus Logic, Fujitsu, Hewlett Packard, Intel, S3, Sun, and Xerox.

## **Dedications**

*To my Parents who removed the word “cannot” from my vocabulary!*

*Hamilton Carter*

*To Seema, Shona, & Anand who make each and every moment a special one!*

*Shankar Hemmady*

## Preface

With the alarming number of first pass silicon functional failures, it has become necessary for all levels of engineering companies to understand the verification process. This book is organized to address all verification stakeholders at all levels of the engineering organization. The book is targeted at three somewhat distinct audiences:

- *Executives*. The people with their jobs on the line for increasing shareholder value.
- *Project, design, and verification managers*. The people responsible for making sure each design goes out on time and perfect!
- *Verification and design engineers*. The innovators responsible for making sure that the project actually succeeds.

The book is divided into three parts corresponding to its three audiences. The level of technical depth increases as the book proceeds.

*Part I* gives an overview of the functional verification process. It also includes descriptions of the tools that are used in this flow and the people that enable it all. After outlining functional verification, Part I describes how the proper application of metric-driven techniques can enable more productive, more predictable and higher quality verification projects. Part I is targeted at the executive. It is designed to enable executives to ask appropriate educated questions to accurately measure and control the flow of a project.

*Part I* also holds value for project managers and verification engineers. It provides an overall view of the entire chip design process from a verification perspective. The chapters on a typical verification project and the overview of verification technologies will be of use to entry level verification engineers as well. This part of the book also provides a unique viewpoint on why management is asking for process data and how that data might be used.

*Part II* describes the various process flows used in verification. It delves into how these flows can be automated, and what metrics can be measured to accurately gauge the progress of each process. Part II is targeted at design and verification project managers. The emphasis is on how to use metrics within the context of standardized processes to react effectively to bumps in the project's execution.

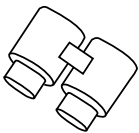
*Part III's* audience is the design and verification engineering team. It focuses on the actual verification processes to be implemented and executed. This section of the book is divided with respect to the various verification technologies. Each chapter on a given technology is further subdivided into sections on how to plan effectively, and how to track metrics to closure.

Entire books have been written on implementing verification using the technologies discussed in Part III. We will not reiterate what those excellent volumes have already stated, nor do we intend to reinvent the wheel (yet, we are engineers after all). Implementation details will be discussed when they will make the metric-driven techniques discussed more effective.

*Part IV* contains various case studies and commentaries from experts in the metric-driven verification field.

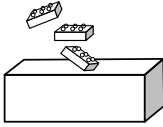
The various parts of the book can also be described as a progression of process abstractions. The layers of abstractions are “Observational Processes,” “Container Processes,” and “Implementation Processes.”

### **Observational Processes**



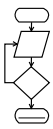
*Part I* looks at the verification process from an observational point of view. The various aspects of a project that should be observed are described to the reader along with informal suggestions about how to strategically manage a verification project based on these observations.

### Container Processes



*Part II* looks at processes that are necessary regardless of the verification technology you are using; processes such as regression management, revision control, and debug. *Part II* describes how to implement these processes using metric-driven methodologies. It also discusses the inter-relations of these processes.

### Implementation Processes

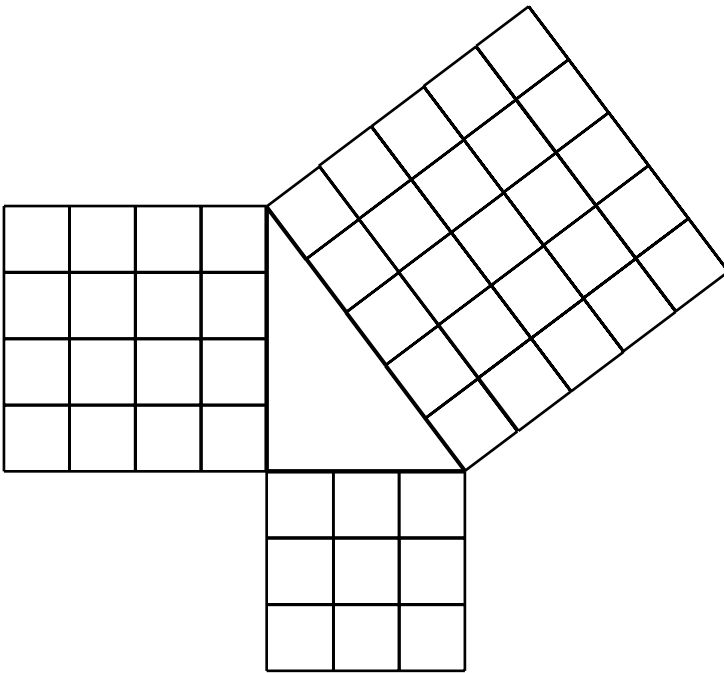


*Part III* describes each of the verification technologies and explores how a metric-driven methodology can be used to enhance the productivity, predictability, and quality offered by each of these technologies.

Finally, *Part IV* leaves the world of abstraction altogether and presents several concrete case studies that illustrate metric-driven processes in action. In addition to these case studies are several commentaries offered by industry experts in metric-driven methodologies.

## Introduction

Legend has it that 2300 years ago, Euclid walked the beaches of Egypt with his students. They were exploring the fundamentals of a new field: geometry. Each day, Euclid would draw a new problem in the sandy shores of the Mediterranean Sea. He'd ask his students to reflect on each problem and discover what they could. One day he sketched a diagram that would come to be known as Euclid's 42nd Problem.



One of his particularly bright students worked on the diagram and came back with a simple formula:

$$a^2 + b^2 = c^2$$

This formula became so famous that it is now known simply by its discoverer's name: the Pythagorean Formula.

Pythagoras thirsted for knowledge and spent most of his life traveling the various countries of the ancient Hellenic world searching for it. In his travels, he encountered many cultures and gleaned valuable knowledge from each of them applying it to the burgeoning new field of geometry.

Today we're witnessing the birth of another new field, Metric-Driven Verification. Like Euclid, we hope to layout templates that not only illustrate the basics of this promising new field, but also inspire the reader to make even greater discoveries. Like Pythagoras, we have traveled the world searching for the best applications of this knowledge.

This book contains more than our basic understanding of the principles of metric-driven verification. The book also contains examples and experiences gleaned from many industry experts in verification and design. All of these are presented in their entirety in Part IV.

The last three chapters of Part III are about emerging technologies in the field of metric-driven verification:

- System verification
- Mixed-signal verification
- Verification of DFT hardware

These chapters use a different format. Each chapter contains a complete case study from one of the industry leaders in each of these three emerging areas.

## Contributing Authors in Order of Appearance



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### Jason Andrews

Jason Andrews is a project leader at Cadence Design Systems, where he is responsible for hardware/software coverification and methodology for system-on-chip (SoC) verification. He is the author of the book “Co-Verification of Hardware and Software for ARM SoC Design” and holds a bachelor’s degree in electrical engineering from The Citadel (Charleston, SC) and a master’s degree in electrical engineering from the University of Minnesota (Minneapolis).

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### Monia Chiavacci

Ms. Chiavacci cofounded Yogitech in 2000. She is responsible for the mixed signal division. She worked as an analog designer from 1998 to 2000 after receiving her degree cum laude in electronic engineering at the Pisa University. Her work experiences include high-reliability systems in critical environments such as biomedical, space, and high-voltage automotive applications.

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### Gabriele Zarri

Mr. Zarri is a verification engineer at Yogitech. He is responsible for the development of verification IPs, verification environments for many international customers, and trainings on verification methodologies. His experience includes automotive protocols such as LIN, CAN, and Flexray. He is expert in OCP protocol, a universal complete socket standard for SoC design, and has recently acquired experience in the verification of mixed signal circuits. Gabriele specialized in Microelectronics and Telecommunications with an MS from Nice Sophia-Antipolis University.

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### **Egidio Pescari**

Egidio is a senior design and verification engineer at Yogitech. Prior to Yogitech, Mr. Pescari developed systems in critical environments such as automotive and space applications. He acquired experience in many automotive protocols such as LIN and CAN. He graduated from the University of Perugia in 1998.

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### **Stylianos Diamantidis**

Stylianos Diamantidis is the Managing Director of Globetech Solutions. Mr. Diamantidis is responsible for driving IP product strategy, engineering and consulting services. Prior to cofounding Globetech Solutions, he managed SGI's systems diagnostics group, spanning across servers, super-computers, and high-end graphics product lines. His current areas of interest include advanced design verification methodologies, embedded systems, silicon test, debug, and diagnosis. Stylianos holds a B.Eng. from the University of Kent at Canterbury, UK and a MS in electrical engineering from Stanford University, USA. He is a member of the IET, IEEE, and IEEE-DASC.

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### **Iraklis Diamantidis**

Iraklis Diamantidis is a founder and senior verification engineer at Globetech Solutions. His current areas of interest include Electronic System-Level Design, Advanced Design Verification Methodologies, Silicon Test, Debug and Diagnosis, and System Software. Iraklis holds a B.Eng. from the University of Kent at Canterbury, UK, and a MS in electrical engineering from Stanford University. He is a member of the IET and the IEEE.

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**Thanasis Oikonomou**

Thanasis Oikonomou is a senior digital systems designer and verification engineer at Globetech Solutions. His interests include computer architecture, high-speed networks, digital design, verification, and testing. He received BSc and MSc in computer science from the University

of Crete, Greece.

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**Jean-Paul Lambrechts**

Jean-Paul Lambrechts has over 20 years experience in leading hardware design in the networking and computer areas. His experience covers board-level hardware design, FPGA, and verification. Jean-Paul has now been with

Cisco for 9 years where he has been responsible for line cards, packet forwarding engines, and layer 4–7 processor card. Jean-Paul holds a MSEE degree from the Louvain University in Belgium.

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**Alfonso Íñiguez**

Alfonso Íñiguez is a principal staff verification engineer with the Security Technology Center at Freescale Semiconductor, where he is the verification lead responsible for developing, improving and applying functional verification tools, and methodologies. His work includes cryptographic hardware accelerator design. He holds a B.S. in computer engineering from the Universidad Autónoma de Guadalajara, México, and an MS in electrical engineering from the University of Arizona.

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**Dr. Andreas Dieckmann**

In 1995, after obtaining his MA at the University of Erlangen and his Ph.D. in electronic engineering at Technical University of Munich, Dr. Dieckmann began working at Siemens AG. He was initially responsible for board and fault simulation. From 1997, Dr. Dieckmann gained expertise in system simulation and verification of ASICs. Since 2001, he has been in charge of coordinating and leading several verification projects employing simulation with VHDL and Specman “e,” formal property and equivalence checking, emulation, and prototyping.

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**Susan Peterson**

Susan Peterson has been trying to escape from the EDA industry for the past 20 years, where she has spent her time listening to customers and trying to help them to solve their critical problems in various sales and marketing roles. Prior to that, she was a practicing engineer, and earned her MBA from the University of Denver.

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**Paul Carzola**

Paul Carzola is a senior consulting engineer for verification at Cadence. He received a Bachelor of Science Degree in computer engineering at Florida Atlantic University in 1995. Since then, Paul has spent the last 10 years in functional verification and the pursuit to finding effective and powerful methods to verification while making it easier and enjoyable to apply. For the past 5 years, he has served in a consulting role in the area of functional verification methodology and has seen first hand the power of a Coverage-Driven approach.

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**YJ Patil**

YJ Patil is a senior verification engineer at Genesis Microchip, where he is responsible for managing the verification of digital television (DTV) controller ASICs. Prior to Genesis, Mr. Patil was a verification engineer at several technology leaders including ATI, Silicon Access Networks, and Philips Semiconductors. He was a board designer at Tektronix. Mr. Patil holds an MS in software systems from BITS Pilani, India and BE in electronics and communication from Gulbarga University, India.

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**Dean D'Mello**

Dean D'Mello is a solutions architect at Cadence Design Systems. He works closely with key customers worldwide to deploy advanced verification technologies, and with R&D to plan, develop, and introduce new methodologies and products. Prior to Cadence, Mr. D'Mello held ASIC design and verification roles at LSI Logic, Cogency Semiconductor, and Celestica, and product and test engineering roles at IBM. Dean holds a Masters of Applied Science (MASc) in electrical and computer engineering, from the University of Toronto, Canada.

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**Steve Brown**

Steve Brown is Director of Marketing for Enterprise Verification Process Automation at Cadence Design Systems. He is a 20-year veteran of the EDA verification industry and has held various engineering and marketing positions at Cadence, Verisity, Synopsys, and Mentor Graphics. He specializes in solving engineering, management, and marketing challenges that arise when new technology and products enter the market. He earned BSEE and MSEE degrees from Oregon State University and has studied marketing strategy at Harvard, Stanford, Kellogg, and Wharton.

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**Roger Witlox**

Roger Witlox joined Philips Research Laboratories in Eindhoven, The Netherlands in 1992, where he has been working on optical coherent communications systems and access networks. Mr. Witlox was earlier involved in the development of analog laser temperature and current control system. In 2000, he joined the CTO organization at Philips Semiconductors, where he was responsible for development and support of an in-house verification tool. He has been responsible for functional verification methodologies for hardware IP and was a member of the Verification Technical Work Group of the SPIRIT consortium. In 2004, he joined the DSP Innovation Center and is currently focusing on DSP subsystems, both specification and verification.

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**Ronald Heijmans**

Ronald Heijmans studied at the Hogeschool Eindhoven and graduated in 1992 in the field of “Technical Computer Science.” He started his career as a PCB designer at the Philips Research Laboratories. Later, Mr. Heijmans focused on DSP algorithm design and applications for multichannel audio and speech coding. In 1999, he became a verification engineer at ESTC Philips Semiconductors, where he focused on DSP core and subsystems. Currently, as a verification architect, Ronald is defining a new environment including new verification methodologies.

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**Chris Wieckardt**

Chris Wieckardt has been a verification engineer at Philips Semiconductors, Adelante Technologies and NXP Semiconductors in Eindhoven, The Netherlands since 2000. Prior to Philips, Mr. Wieckardt was a digital design engineer at Océ Research and Development, Venlo, The Netherlands.

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---

**Dr. Laurent Ducouso**

Laurent Ducouso has over 20 years of experience in digital design and verification. In 1994, Dr. Ducouso joined STMicroelectronics as the verification expert on CPU, microcontroller and DSP projects. Since 2000, he has managed the Home Entertainment Group verification team. Prior to STMicroelectronics, he was engaged in mainframe CPU development at Bull S.A for 8 years. Laurent holds a Ph.D. in computer sciences from Paris, France.

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**Frank Ghenassia**

Frank Ghenassia is Director of the System Platforms Group in the HPC (Home, Portable, and Communication) sector at STMicroelectronics. Mr. Ghenassia focuses on IP/SOC verification, architecture definition, platform automation, and embedded software development based on high-level modeling approaches. He joined STMicroelectronics in 1995 and has worked on OS development, software debuggers, and system-to-RTL design flow activity. Mr. Ghenassia received his MS in electrical engineering in Israel.

---



---

**Dr. Joseph Bulone**

Joseph Bulone manages a team that provides central services in hardware emulation to STMicroelectronics divisions. Joseph defines and provides hardware-accelerated platforms for IP/SoC verification and software development. He joined the Central R&D division of STMicroelectronics in 1989, and was initially involved in the design of ATM chips. He began working on hardware emulation in 1993. He has been in charge of video chip validation, and hardware software co-design. He holds a Ph.D. in microelectronics from the Institut National Polytechnique de Grenoble, France.

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