



UNIVERSITÀ DI PISA
DIPARTIMENTO DI INGEGNERIA DELL'INFORMAZIONE
Dottorato di Ricerca in Ingegneria dell'Informazione

Doctoral Course

“Critical Embedded Computing Systems: Introduction and Major Hardware/Software design Trends”

Francisco J. Cazorla, Hamid Tabani

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Short Abstract:

Introduction of basic concepts of critical embedded systems (CES) like those used in cars, planes, and satellites. Analysis of the main requirements put on CES from performance guarantees to safety. Analysis of the main approaches for hardware design to fulfill those requirements with emphasis on the work done as part of the European Processor Initiative. Analysis of the main approaches for software design with emphasis on the software architecture of the Apollo autonomous driving software.

Course Contents in brief:

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| 1. Introduction to CRTES | (2h) |
| 2. Hardware Design for CRTES: A deterministic Approach | (2h) |
| 3. Hardware Design for CRTES: A probabilistic Approach | (2h) |
| 4. Hardware Design for CRTES: A COTS based approach | (2h) |
| 5. Hardware Design for CRTES: The European Processor Initiative | (1h) |
| 6. Software Design for CRTES: Introduction to Deep Learning Software | (2h) |
| 7. Software Design for CRTES: Timing and Safety Related Aspects | (2h) |
| 8. Software Design for CRTES: Apollo Autonomous Driving Software | (2h) |
| 9. H2020 European Processor Initiative global roadmap | (1h) |

The course will have a 1h discussion introduced by Sergio Saponara, University of Pisa, and **Francisco J. Cazorla** and **Hamid Tabani** from BSC, regarding the dissemination to PhD community of the global vision of the H2020 European Processor Initiative, part of the EuroHPC JU roadmap, involving 27 European partners (including BSC and University of Pisa)

Total # of hours: 16

References:

On the convergence of high-performance and mission critical markets. In Design Automation Conference. Austin, Texas (USA). June

WCET Analysis Methods: Pitfalls and Challenges on their Trustworthiness. In 10th IEEE International Symposium on Industrial Embedded Systems (SIES). 2015.

Assessing the Adherence of Industrial Autonomous Driving Software to ISO-26262 Guidelines for Software. In Design Automation Conference. 2019.

Safety-Related Challenges and Opportunities for GPUs in the Automotive Domain. In IEEE Micro. 2018.

Reconciling Time Predictability and Performance in Future Computing Systems. In IEEE Design and Test. 2018.

Generating and Exploiting Deep Learning Variants to Increase Heterogeneous Resource Utilization in the NVIDIA Xavier. In ECRTS. 2019.

CV of the Teachers

Francisco J. Cazorla is the Director of the Computer Architecture / Operating System (CAOS) group at the Barcelona Supercomputing Center. Francisco got his M.Sc. Degree in computer sciences in 2001 and his PhD Degree in 2005 on the area of processor computer architecture. He has coordinated several industry-funded and EU projects in the area of critical embedded systems and currently he is an ERC Consolidator Grant Holder. Find out more about him here: <http://people.ac.upc.edu/fcazorla/>

Hamid Tabani is a postdoctoral researcher at Computer Architecture / Operating System (CAOS) group at the Barcelona Supercomputing Center. Hamid got his PhD in computer architecture from UPC in 2018. He has proposed several solutions for speech recognition systems at software, microarchitecture and hardware level. His contribution resulted in the acquisition of several projects and publication of several top-tier conferences and journals such as HPCA, PACT, DAC, ECRTS, and IEEE Micro. He works on several industrial and European projects such as European Processor Initiative (EPI) and ERC SuPerCom.

Room and Schedule

Room: Aula Riunioni, Dipartimento di Ingegneria dell'Informazione, Largo L. Lazzarino 1, 56122 Pisa, Edificio A, piano 6

For info please contact sergio.saponara@unipi.it

Schedule:

N.	Lesson	Day
1	1.Introduction to Critical Embedded Computing Systems (CRTES) 2.Hardware Design for CRTES: A deterministic Approach	Wednesday 22 January- 9:00-13:00
2	3.Hardware Design for CRTES: A probabilistic Approach 4.Hardware Design for CRTES: A COTS based approach	Thursday 23 January - 9:00-13:00
3	5.Hardware Design for CRTES: The European Processor Initiative 6.Software Design for CRTES: Introduction to Deep Learning Software	Thursday 23 January – 15:00-18:00
4	7.Software Design for CRTES: Timing and Safety Related Aspects 8.Software Design for CRTES: Apollo Autonomous Driving Software 9. H2020 European Processor Initiative global roadmap	Friday 24 January - 9:00-14:00