

Part A. PERSONAL INFORMATION

First name	José Antonio		
Family name	Belloch Rodríguez		
Open Researcher and Contributor ID (ORCID) (*)	0000-0002-2595-1828		

(*) Mandatory

A.1. Current position

Position	Prof. Titular de Universidad		
Initial date	11/04/2025		
Institution	Universidad Carlos III de Madrid (UC3M)		
Department/Center	Electronic Technology	Microelectronic Design and applications group	
Country	Spain	Teleph. number	
Key words	Parallel Computing, Heterogeneous SoC, GPUs, FPGAs		

Part B. CV SUMMARY (max. 5000 characters, including spaces)

Jose A. Belloch received his degree in Telecommunications Engineering (2007), his Master's degree in Parallel and Distributed Computing (2010) and his Ph.D. in Computer Science (2014), all from Universitat Politècnica de València (UPV). In 2010 he obtained a competitive Ph.D. fellowship from the Spanish Ministry of Science and Innovation (BES-2010-037793). His Ph.D. focused on GPU acceleration of digital audio signal-processing applications (convolution, FFT, spatial audio, etc.) and was recognised with UPV's Extraordinary Ph.D. Thesis Award.

After completing his Ph.D., Dr. Belloch joined the High Performance Computing and Architectures (HPC&A) group at Universitat Jaume I (UJI) as a postdoctoral researcher, where he participated in the European projects EXA2GREEN (FP7) and INTERTWinE (H2020) in the field of energy-aware high-performance and heterogeneous computing. In 2016 he obtained a postdoctoral fellowship from the Regional Government of Valencia (APOSTD/2016/069), which included a research stay at Universidad Complutense de Madrid. During this period, his research focused on exploiting heterogeneous embedded systems (CPUs, GPUs and FPGAs) to minimise energy consumption while supporting demanding multichannel audio tasks such as sound reproduction and acoustic source localisation.

Since 2017, Dr. Belloch has been with the Department of Electronic Technology at Universidad Carlos III de Madrid (UC3M), where he is now Associate Professor. His work centres on the efficient and reliable deployment of signal-processing and deep-learning workloads on heterogeneous embedded and edge-AI platforms, combining GPU/FPGA acceleration, multi-core CPUs and SoC-based architectures. This includes performance- and energy-aware implementations, as well as the design of fault-tolerant algorithms and runtime mechanisms, with particular emphasis on radiation-induced soft errors and industrial deployment conditions. He maintains long-standing collaborations with Prof. Vesa Välimäki (Aalto University) and Dr. Balázs Bank (Budapest University of Technology and Economics), with whom he has co-authored several works on efficient audio signal processing on heterogeneous many-core systems.

Dr. Belloch is Principal Investigator of several competitive projects, including TEC-2024/COM-360 (sensors and communications for advanced 6G services) and PID2022-137048OA-C43 (spatial audio and array processing for industrial applications via parallel and approximate computing). He has previously led TED2021-131401A-C22 (digital transformation of the psychology sector through efficient sensing of physiological signals) and the interdisciplinary project MIMACUHSACE-CM (microwave material characterisation using heterogeneous SoCs for space environments), and has obtained funding for two predoctoral positions (PEJD-2019-PRE/TIC-16327 and PIPF-IA-UC3M). His technology-transfer activity includes industrial contracts with Arquimea (microwave sensing on heterogeneous embedded platforms for space) and INTA (autonomous acoustic processor based on a spherical microphone array), as well as the registration of the GPU Microbench software tool for GPU performance analysis.

His publication record (7 Q1 and 24 Q2 JCR papers) reflects a coherent trajectory at the intersection of acoustic signal processing, heterogeneous computing, energy efficiency and reliability. Recent works cover enhanced U-Net architectures for room impulse-response generation, evaluation and acceleration of Vision Transformers on embedded edge-AI GPUs, and quantitative studies of radiation reliability, performance and energy consumption of low-power SoCs and ARM-based processors. Earlier contributions on GPU-based dynamic wave-field synthesis, multi-GPU acoustic localisation with

massive microphone arrays, and energy-minimised core signal-processing kernels on mobile/IoT devices provide a long-term background in edge-oriented, audio-centric computing. These achievements have led to his appointment to the Editorial Board of the Elsevier journal *Digital Signal Processing* and regular reviewer duties for several IEEE Transactions.

In terms of supervision, Dr. Belloch has directed one completed Ph.D. thesis on hardening techniques for mitigating radiation effects in high-end multicores (P. M. Avilés Delgado, 2024, with 8 Q2 papers), and is currently supervising three additional Ph.D.: (i) the design of efficient hardening solutions for neural-network models (L. R. Frías Domínguez, already 1 Q1 and 1 Q2); (ii) efficient embedded implementations of deep-learning algorithms for industrial applications (I. Martín Salinas, 3 Q2); and (iii) the design and optimisation of multichannel audio systems on embedded platforms (J. Ortigoso Narro, 3 Q2). Overall, he has supervised 1 defended Ph.D., 21 Master's theses and 14 Bachelor's theses.

Part C. RELEVANT MERITS (sorted by typology)

C.1. Publications

[1] Jose M. Badía, German León, Mario Garcia-Valderas, Jose A. Belloch, Almudena Lindoso, Luis Entrena. "Analysing the radiation reliability, performance and energy consumption of low-power SoC through heterogeneous parallelism". *Sustainable Computing: Informatics and Systems*, vol. 44, no 101049, pp. 1-11, Dec 2024. DOI: 10.1016/j.suscom.2024.101049, (JCR 2023 – 3.8 Q1).

[2] Ignacio Martin-Salinas, Jose M. Badía, Oscar Valls, Germán León, Rocío del Amor, Jose A. Belloch, Adrian Amor-Martin, Valery Naranjo, "Evaluating and accelerating vision transformers on GPU-based embedded edge AI systems". *Journal of Supercomputing*, vol. 81, no.349, pp. 1 – 21, Dec 2024. (JCR 2023 – 2.5 Q2).

[3] Jose A. Belloch, Jose M. Badía, German León, Vesa Välimäki, "Efficient Velvet-Noise Convolution in Multicore Processors". *AES: Journal of the Audio Engineering Society*, vol. 72, no.6, pp. 383 – 393, June 2024. (JCR 2023 – 1.1 Q3).

[4] Pablo M. Aviles, Almudena Lindoso, Jose A. Belloch, Luis Entrena, "Evaluating reliability through soft error triggered exceptions at ARM Cortex-A9 microprocessor". *Microelectronics Reliability*, Vol. 126, no. 114323. DOI: 10.1109/TNS.2021.3129164 (JCR 2021 – 1.418 Q3).

[5] Jose A. Belloch, German Ramos, Jose M. Badía, Maximo Cobos. "An Efficient Implementation of Parallel Parametric HRTF Models for Binaural Sound Synthesis in Mobile Multimedia". *IEEE Access*, vol. 8, no 1, pp. 49562 – 49573, Dec 2020. (JCR 2020 – 3.367 Q2)

[6] German Fabregat, Jose A. Belloch, Jose M. Badia, Maximo Cobos. "Design and Implementation of Acoustic Source Localization on a Low-Cost IoT Edge Platform". *IEEE Transactions on Circuits and Systems II: Express Briefs*, vol. 67, no 12, pp. 3547 – 3551, Dec 2020. (JCR 2020 – 3.292 Q2)

[7] Jose A. Belloch, Jose M. Badia, Francisco D. Igual, Maximo Cobos. "Practical Considerations for Acoustic Source Localization in the IoT Era: Platforms, Energy Efficiency and Performance". *IEEE Internet of Things Journal*, vol. 6, no 3, pp. 5068 – 5079, Jan 2019. (JCR 2019 – 9.936 Q1)

[8] Jose A. Belloch, Jose M. Badia, Francisco D. Igual, Alberto Gonzalez, Enrique S. Quintana-Ortiz. "Optimized Fundamental Signal Processing Operations for Energy Minimization on Heterogeneous Mobile Devices". *IEEE Transactions on Circuits and Systems I: Regular*, vol. 65, no 5, pp. 1614 - 1627, May. 2018. (JCR 2018 – 3.934 Q1)

[9] Jose A. Belloch, Alberto Gonzalez, Enrique S. Quintana-Ortí, Miguel Ferrer, Vesa Välimäki. "GPU-based Dynamic Wave Field Synthesis using Fractional Delay Filters and Room Compensation". *IEEE Transactions on Audio, Speech and Language Processing*, vol. 25, no. 2, pp. 435 – 447, Feb. 2017. (JCR 2017 – 2.950 Q1)

[10] Jose A. Belloch, Alberto Gonzalez, Antonio M. Vidal, Maximo Cobos. "On the performance of multi-GPU-based expert systems for acoustic localization involving massive microphone arrays". *Expert System With Application*, vol. 42, no. 13, Aug. 2015. (JCR 2015 – 2.981 Q1)

C.2. Research projects

As a principal investigator in competitive calls:

Project Title: Desarrollo e Integración de Sensores y COmunicaciones para servicios avanzados en 6G.
Funding Entity: Proyectos de I+D realizados en colaboración entre grupos de investigación, Comunidad de Madrid. (TEC-2024/COM-360)

Start date: 1-01-2025 End date: 31-12-2028

Principal Investigator: José Antonio Belloch Rodriguez and Adrián Amor Martín.

Grant: **112.750 €**

Project Title: Spatial Audio and Array processing for Industrial Applications and Digital Transformation: Efficient Implementations Through Parallel and Approximate Computing.

Funding Entity: Ministerio de Ciencia e Innovación: Agencia Estatal de Investigación: Proyectos de Generación de Conocimiento 2022. (PID2022-137048OA-C43)

Start date: 1-09-2023 End date: 30-08-2026

Principal Investigator: José Antonio Belloch Rodriguez and Adrián Amor Martín.

Grant: **42000 €**

Project Title: Transformación digital del sector de la Psicología: Sensado y Procesado eficiente de características fisiológicas

Funding Entity: Ministerio de Ciencia e Innovación: Agencia Estatal de Investigación: Proyectos orientados a la transición ecológica y a la transición digital en el marco del plan de Recuperación, Transformación y Resiliencia. (TED2021-131401A-C22)

Start date: 1-12-2022 End date: 30-11-2024

Principal Investigator: José Antonio Belloch Rodriguez and Honorio Martín González.

Grant: **58535 €**

Project Title: Microwave Materials Characterization Using Heterogeneous Systems-on-Chip for the Space Environment.

Funding Entity: Ayudas para la realización de Proyectos Interdisciplinarios de I+D para jóvenes doctores/as de la Universidad Carlos III de Madrid a través de la Consejería de Educación e Investigación de la Comunidad de Madrid (MIMACUHSPEACE-CM-UC3M)

Start date: 1-1-2022 End date: 31-12-2023

Principal Investigator: José Antonio Belloch Rodriguez and Adrián Amor Martín.

Grant: **60000 €**

Project Title: Ayuda para la contratación de un investigador predoctoral (Programa de Empleo Juvenil): a 3-years pre-doctoral contract with the purpose of funding a PhD tesis.

Project ID: PEJD-2019-PRE/TIC-16327.

Funding entity: Comunidad de Madrid: Consejería de Educación e Investigación.

Start date: 1-2-2020 End date: 31-01-2023

Principal Investigator: José Antonio Belloch Rodriguez

Grant: **25000 €** (Rest of the PhD student salary will be paid by UC3M)

As a team investigator:

Project Title: EU H2020-FETHPC-2014 67 1602 "INTERTWinE. Programming Model Interoperability Towards Exascale"

Funding entity: Unión Europea

Start date: 1-10-2015 End date: 30-09-2018

Principal Investigator: M. Bull Grant: 3.861.401 €

Project Title: FP7-ICT-2011-8 EXA2GREEN Energy-Aware Sustainable Computing on Future Technology- Paving the Road to Exascale Computing

Funding entity: Unión Europea

Start date: 1-12-2012 End date: 31-10-2015

Principal Investigator: V. Heuveline Grant: 2.100.000 €

C.3. Contracts, technological or transfer merits

Caracterización de materiales mediante tecnología de microondas usando sistemas embebidos heterogéneos para el entorno espacial. Company: Arquimea. IP: José Antonio Belloch y Adrián Amor Martín (UC3M). **50.000 €**. (01/04/2023-31/12/2023)

C.4. PhD Supervisor

Title: Hardening Techniques for Mitigating Radiation Effects in High-end Multicore.

PhD student: Pablo Miguel Avilés Delgado

Defense: 23-04-2024

Qualification: Excellent Cum Laude with International Distinction.

Supervisors: José Antonio Belloch Rodríguez and Almudena Lindoso

PhD program: Electrical Engineering, Electronics and Automation, Universidad Carlos III de Madrid.

C.5 Research Summary

JCR indexed publications: **37: (7 Q1); (24 Q2); (4 Q3); (2 Q4).**

International Conferences: **27: (8 core A); (4 core B)**

Journal publications no indexed: **3**

Spanish conferences: **10**

According to google scholar: h-Index: **15**; i10-Index: **30**; with **759** citations.

Supervisor of **1** PhD Thesis; **18** TFM (Master); **12** TFG (Grado); **1** PFC (Proyecto Fin Carrera).