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|--------------------------------------|--|---------------------|----|---------------|
| <b>Part A. PERSONAL INFORMATION</b>  |  | <b>CV date</b>      |    | Dec. 11, 2020 |
| First and Family name                | Ángel de la Torre Vega                       |                     |    |               |
| Social Security, Passport, ID number | 24256286A                                    | Age                 | 49 |               |
| Researcher codes                     | Open Researcher and Contributor ID (ORCID**) | 0000-0002-9736-5190 |    |               |
|                                      | SCOPUS Author ID (*)                         | 57191444895         |    |               |
|                                      | WoS Researcher ID (*)                        | C-6618-2012         |    |               |

### A.1. Current position

|                                |   |        |  |
|--------------------------------|---|--------|--|
| Name of University/Institution | University of Granada   |        |  |
| Department                     | Department of Signal Theory, Telematics and Communications  |        |  |
| Address and Country            | Periodista Daniel Saucedo Aranda S/N 18071-Granada  |        |  |
| Phone number                   | 958-240842  | E-mail | <a href="mailto:atv@ugr.es">atv@ugr.es</a> |
| Current position               | Profesor Titular de Universidad   | From   | 05/03/2003                                 |
| Key words                      | Electrophysiological responses of the auditory system, high rate stimulation, automatic evaluation of evoked responses, artifact rejection, adaptation of the auditory system, cochlear implant, voice recognition; seismic signal processing, photoluminescent sensors, mass spectrometry. |        |  |

### A.2. Education

| PhD                      | University | Year |
|--------------------------|------------|------|
| BS in Physical Sciences  | Granada    | 1994 |
| PhD in Physical Sciences | Granada    | 1999 |

### A.3. General indicators of quality of scientific production

Number of total citations: WOS 1121; (Scopus 1776)

Average number of citations per year (in the last 5 years): WOS 108.2; (Scopus 133)

Number of publications in Q1: 20; (and 24 in Q2)

h-index: WOS 16; (Scopus 20)

PhD. Theses supervised: 7

Number of "sexenios de investigación": 4 (last evaluated period: 2013-2018)

### Part B. CV SUMMARY (max. 3500 characters, including spaces)

The main research lines are related to signal processing and communications and their applications:

\* **Robust automatic voice recognition systems:** he has developed techniques that address the problem of noise in speech recognition at different levels: voice activity detection; statistical characterization of noise; reduction of the effect of noise on the representation; model adaptation. He completed a 4-month research stay at the "Laboratoire RFIA du Loria" in Nancy.

\* **Application of signal processing in audiology:** since 1999 he collaborates with the ENT Service of the San Cecilio University Hospital of Granada to apply signal processing in the field of audiology. Relevant results related to cochlear implant systems have been obtained (noise reduction; improvement in the fitting of speech processors). Innovative techniques have also been developed to record electrophysiological measurements (measurement of compound action potential, brainstem potentials and medium latency potentials at high stimulation rate). He completed a 3-month research stay at the Institut für Angewandte Physik in Innsbruck. There is currently a research collaboration with the National Acoustic Laboratories of Sydney (Australia).

\* **Seismic signal processing:** this line includes the classification of seismic-volcanic signals, the detection of signals in the presence of noise, the precise determination of the arrival time



of seismic phases and their application for volcanic tomography. It is part of a research collaboration with the Andalusian Institute of Geophysics.

\* **Indoor location systems:** this line includes indoor location procedures using audio and radio technologies. Among the main achievements, precise synchronization techniques of wireless sensor networks have been developed and ultrasonic location systems have been developed with sub-centimeter accuracy, and also positioning systems based on RSSI level of audio and radio signal. In this line, research transfer contracts have been signed with Telefónica I+D and with Asistencias Digitales TDA S.L.

\* **Applications of signal processing in Analytical Chemistry:** through a collaboration with the Department of Analytical Chemistry of the University of Granada, he investigates the processing of mass spectrometry data (automatic detection and identification of compounds, improved sensitivity of mass spectrometers, identification of bioactive compounds) and the development of chemical sensors based on photoluminescence (detection in low lighting conditions, multiparametric sensors, characterization of sensor phases, improved accuracy in the determination of analytes, etc.). In 2012 he made a 3 month stay with the company Bruker Daltonik in Bremen, to investigate advanced signal processing techniques in mass spectrometry.

\* **Development of electrophoretic displays:** applying graphene and nanomaterial technologies in collaboration with laboratories specialized in these technologies, he participates in the development of flexible/foldable electrophoretic displays. Within this framework, research transfer contracts have been signed and a research project is being carried out.

## **Part C. RELEVANT MERITS** (from 2010 to present, the 10 most relevant contributions)

### **C.1. Publications**

1. **Ángel de la Torre**, Joaquín Valderrama, Isaac Álvarez, José Carlos Segura. **2020**. Latency-dependent filtering and compact representation of the complete auditory pathway response. *Journal of the Acoustical Society of America*, 148(2): 599-613, (Q2, impact factor: 1.780). doi: 10.1121/10.0001673.
2. **Ángel de la Torre**, Joaquín Valderrama, José Carlos Segura, Isaac Álvarez. **2019**. Matrix-based formulation of the iterative randomized stimulation and averaging method for recording evoked potentials. *Journal of the Acoustical Society of America*, 146(6): 4545. (Q2, impact factor: 1.819). doi: 10.1121/1.5139639.
3. Joaquín Valderrama, **Ángel de la Torre**, Bram Van Dun. **2018**. An automatic algorithm for blink-artifact suppression based on iterative template matching: application to single channel recording of cortical auditory evoked potentials. *Journal of Neural Engineering*, 15(1): 016008 (15pp). (Q1, impact factor: 4.551). doi:10.1088/1741-2552/aa8d95.
4. Joaquín Valderrama, **Ángel de la Torre**, Carlos Medina, Jose Carlos Segura, A. Roger Thornton. **2016**. Selective processing of auditory evoked responses with iterative-randomized stimulation and averaging: A strategy for evaluating the time-invariant assumption. *Hearing Research*, 333:66-76. (Q1, impact factor: 2.824). doi:10.1016/j.heares.2015.12.009.
5. Joaquín Valderrama, **Ángel de la Torre**, Isaac Álvarez, José Carlos Segura, A. Roger D. Thornton, Manuel Sainz, José Luis Vargas. **2014**. A study of adaptation mechanisms based on ABR recorded at high stimulation rate. *Clinical Neurophysiology*, 125: 805-813. (Q2, impact factor: 3.097). doi: 10.1016/j.clinph.2013.06.190
6. Joaquín Valderrama, **Ángel de la Torre**, Isaac Álvarez, José Carlos Segura, A. Roger D. Thornton, Manuel Sainz, José Luis Vargas. **2014**. Automatic quality assessment and peak identification of auditory brainstem responses with fitted parametric peaks. *Computer Methods and Programs in Biomedicine*, 114: 262-275. (Q2, impact factor: 1.897). doi: 10.1016/j.cmpb.2014.02.015
7. Joaquín Valderrama, **Ángel de la Torre**, Isaac Álvarez, José Carlos Segura, A. Roger D. Thornton, Manuel Sainz, José Luis Vargas. **2014**. Auditory brainstem and middle latency responses recorded at fast rates with randomized stimulation. *Journal of the Acoustical Society of America*, 136(6): 3233-3248. (Q2, impact factor: 1.503). doi:10.1121/1.4900832



8. Joaquín Valderrama, Isaac Álvarez, **Ángel de la Torre**, Jose Carlos Segura, Manuel Sainz, José Luis Vargas. **2012**. Recording of auditory brainstem response at high stimulation rates using randomized stimulation and averaging. *Journal of the Acoustical Society of America*, 132(6): 3856-3865. (Q2, impact factor: 1.646). doi:10.1121/1.4764511
9. Isaac Álvarez, **Ángel de la Torre**, Manuel Sainz, Cristina Roldán. **2010**. Reducing blanking artifact in electrically evoked compound action potentials. *Computer Methods and Programs in Biomedicine*, 97(3):257-263. (Q2, impact factor: 1.238). doi:10.1016/j.cmpb.2009.09.006
10. Isaac Álvarez, **Ángel de la Torre**, Manuel Sainz, Cristina Roldán; Hansjoerg Schoesser, Philipp Spitzer. **2010**. Using evoked compound action potentials to assess activation of electrodes and predict C-Levels in the Tempo+ cochlear implant speech processor. *Ear and Hearing*, 31(1):134-145. (Q1, impact factor: 2.257). doi:10.1097/AUD.0b013e3181bdb88f

## C.2. Research projects and grants

1. "Etiquetado colaborativo de eventos volcano-sísmicos basado en la compartición de conocimiento experto y técnicas avanzadas de machine learning" (CROWDLABELLING, A-TIC-215-UGR18)  
Founding entity: Programa Operativo Feder Andalucía 2014-2020. Primera Convocatoria.  
PI: Luz García Martínez. (Ene 2020 - Dic 2021). Grant: 14.900 €
2. "Electrophoretic display (electronic ink) in textile support combining nanostructured tissues and graphene technologies" (AT17-6094 (J.A.) - PSE/16/002 (UGR))  
Founding entity: Consejería de Economía, Conocimiento, Empresas y Universidad, Junta de Andalucía / University of Granada  
**PI: Ángel de la Torre**. (Jan 2017 - Oct 2020). Grant: 35.200 € (J.A.) / 25.000,00 € (UGR)
3. "Molecular Reclassification to find clinically useful biomarkers for systemic autoimmune diseases" (IMI-2013-115565)  
Founding entity: Innovative Medicines Initiative (IMI), Unión Europea – EFPIA  
PI: Antonio Segura Carretero. (Feb 2014 - Feb 2019). Grant: 571.080,00 € (UGR)
4. "Knowledge extraction of the state of active volcanoes and its application to the modelling of eruption forecast by advanced seismic signal analysis" (KNOWAVES, TEC2015-68752)  
Founding entity: Economy and Competitiveness Spanish Ministry  
PI: María del Carmen Benítez Ortúzar and Jesús M. Ibáñez Godoy  
(Jan 2016 - Dic 2019). Grant: 201.900,00 €
5. "Multi-sensor platform for precise detection of fixed and mobile obstacles and measurement of air parameters coupled to the D-KISS system (CEMIX-10/16)  
Founding entity: Mixed Center University of Granada-MADOC  
**PI: Ángel de la Torre**. (Mar 2016 - Sep 2017). Grant: 8.000,00 €
6. "Advanced signal processing algorithms for recognition and characterization of seismic signal from volcanoes" (APASVO, TEC2012-31551)  
Founding entity: Science and Innovation Spanish Ministry.  
PI: María del Carmen Benítez Ortúzar. (Jan 2013 - Dic 2015). Grant: 59.000,00 €
7. "Front-end signal processing for robust speech recognition and speaker adaptation/normalization" (ACI2009-0892).  
Founding entity: National R&D Internationalization Program. Joint Indo-Spanish Program for Cooperation in Science and Technology. Science and Innovation Spanish Ministry.  
PI: María del Carmen Benítez Ortúzar. (Jan 2010 - Dic 2013). Grant: 78.000€.
8. "Thematic network on speech technologies" (RTTH, TEC2011-13308-e).  
Founding entity: Science and Innovation Spanish Ministry.  
PI: Alfonso Ortega Giménez. (Jan 2012 - Dic 2013). Grant: 44.000€.
9. "Design, implementation and evaluation of an advanced system for recording auditory brainstem response (ABR) based on encoded signaling" (ADV-ABR, TEC2009-14245).



Founding entity: Science and Innovation Spanish Ministry.

PI: José Carlos Segura Luna. (Jan 2010 - Dic 2013). Grant: 40.535,00 €

10. " Location technologies in environmental intelligence applications for dependant people" (TELIAMADE, P08-TIC-03886)

Founding entity: Andalusian Regional Government, Spain

PI: José Carlos Segura Luna. (Jan 2009 - Dic 2013). Grant: 121.724,00 €

### C.3. Contracts

1. "The development a signal-processing algorithm that evaluates the brainstem neural response evoked by a basilar membrane resonance induced by the repetitive presentation of a frequency-specific stimulus"

Founding entity: Macquarie University.(Jul 2019-Mar 2020). Funding: 6.275,00€

Principal Investigator: **Ángel de la Torre**

2. "Prospective study of electrophoretic displays"

Founding entity: Asistencias Digitales TDA S.L.(Jul 2015-Mar 2016). Funding: 6.050,00€

Principal Investigator: **Ángel de la Torre**

3. "Feasibility study of positioning solutions in large interior spaces combining WIFI and Audio technologies. Phase 2"

Founding entity Asistencias Digitales TDA S.L.(Nov 2014-Nov 2015).Funding: 3.993,00€

Principal Investigator: **Ángel de la Torre**

4. "Validation study of the technological development progress of the company "Universal Diagnostics S.L. in the study -Metabolomics-based prediction of different healthy states-"

Founding entity UNIVERSAL DIAGNOSTICS S.L.(Jul 2014-Jul 2015).Funding: 3.712,00€

Principal Investigator: **Ángel de la Torre**

5. "Feasibility study of positioning solutions in large interior spaces combining WIFI and Audio technologies. Phase 1"

Founding entity Asistencias Digitales TDA S.L.(Mar 2014-Sep 2014) Funding: 3.227,00€

Principal Investigator: **Ángel de la Torre**

### C.4. Patents

1. "Systems and methods for obtaining auditory evoked potentials", Macquarie University and University of Granada,WO 2020/000028 A1; (intern. filing date: 24/06/2019).

2. "Method for flexible deconvolution of auditory evoked potentials", National Acoustic Laboratories and University of Granada, Australian Provisional patent 2019901078; Apr/2019.

### C.5. Doctoral thesis supervised since 2010

1. Joaquín Tomas Valderrama Valenzuela. "Development and implementation of an advanced system for recording auditory evoked potentials. New high-rate stimulation strategies". Supervisors: **Ángel de la Torre** and José Carlos Segura. University of Granada. Oct/2014.

2. Santiago Medina Rodríguez. "Study of methods for estimating the luminescence life time in optical sensor phases: Development, implementation and evaluation of a laboratory test bench for the characterization of sensor phases of different types". Supervisors: Alberto Fernandez Gutiérrez, **Ángel de la Torre**, Jorge Fernández Sánchez and Alberto Fernández Gutiérrez. University of Granada. Mar/2014.

3. Carlos Medina Rodríguez. "Wireless sensor networks oriented to indoor location using ultrasound". Supervisors: José Carlos Segura and **Ángel de la Torre**. University of Granada. Nov/2013.

### C.6. Scientific activity management

Head of the research group "Signal Processing and Communications" (TIC-123), from April 2014 to the present. In addition to the reported projects, Angel de la Torre was principal investigator of a project related to audiology in the period 2004-2005 (national competitive call for projects supported by the Fondo de Investigación sanitaria - I.S. Carlos III). He is also principal investigator of a project focused on binaural perception, currently under evaluation, for the period 2021-2023 (autonomic competitive call for projects).