



# UC3M R&D FOR TRANSPORT, particularly railway

IDENTIFICATION OF THE RESEARCH ACTIVITY,  
TECHNOLOGIES, PATENTS, INFRASTRUCTURES, AND OTHER  
UC3M CAPABILITIES FOR RAIL TRANSPORT

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Universidad **Carlos III** de Madrid

Vicerrectorado de Política Científica

Servicio de Apoyo al Emprendimiento y la Innovación



The Entrepreneurship and Innovation Service Support - SEI of the Universidad Carlos III de Madrid wants to present the potential of the university in this "knowledge map" through the research areas developed in the frame of R&D projects, both national and international, patents and other results of UC3M investigators, in the Railway Transport Area.

The global knowledge obtained, the experience of collaborating with the industry, the existence of infrastructures and proper laboratories and, above all, the multidisciplinary nature of UC3M are characteristics that provide an added value so that our support towards the innovation of institutions, big companies and SMEs has an integral quality.

We invite you to deepen the knowledge of the UC3M and to collaborate in new R&D and innovation projects.

**Entrepreneurship and Innovation Service Support**  
**Universidad Carlos III de Madrid**

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R&D GROUP	LINES OF RESEARCH	RESEARCH PROJECTS	TECHNOLOGICAL OFFER / OTHERS
<b>COMPUTER SCIENCE</b>			
<p><b>Computer, Communications, and Systems Architecture (ARCOS)</b></p> <hr/> <p><b>PI: Jesús Carretero</b></p>	<ul style="list-style-type: none"> <li>Real-time systems:               <ul style="list-style-type: none"> <li>Real-time system simulation in planes and trains</li> <li>Wireless sensor networks</li> <li>Remote system monitoring</li> </ul> </li> <li>High-performance computing:               <ul style="list-style-type: none"> <li>Scalable massive data management</li> <li>Cloud and Grid Computing</li> <li>Parallel file systems</li> </ul> </li> <li>Distributed and parallel systems:               <ul style="list-style-type: none"> <li>High-performance data retrieval and transmission system</li> <li>Social network data analysis</li> <li>Peer to peer systems</li> </ul> </li> </ul>	<p><b>Railway overhead line support infrastructure design and calculation by means of using high-throughput computing tools</b></p> <p>This project provides a valid solution for each structure, satisfying design and structural limitations in accordance with existing railway regulations.</p> <p>It includes expertise in different fields, such as structure design and calculation, technical safety, legal regulations, topography, etc.</p> <p><b>Simulation of power supply systems for trains</b></p> <p>Assessment of electrical variables for rail lines using real operating condition simulation.</p> <p>Aid for designers to make decisions concerning the location of sub-stations, electrical infrastructure, wiring, etc.</p> <p>Automatic report generation.</p> <p>Results validated with respect to other EU simulators, but a quicker calculation as a result of parallelism.</p> <p><b>Real-time vehicle data monitoring and management</b></p> <p>Real-time data monitoring for moving vehicles with built-in, multiplatform software.</p> <p>The data is sent to the control station for analysing and modeling vehicle behaviour and state.</p> <p>Conventional communication technologies: web and DDS services.</p> <p>Applicable to train engines, railway inspection trolleys, and grinders.</p>	<p><b>Experience and Capabilities</b></p> <p>The main objective of the ARCOS group is to perform research relating to hardware and software systems and to develop said systems in the fields of real-time and built-in systems, high-performance computing, high-throughput computing (Cloud and Grid), storage systems, and systems and reliable systems.</p> <p>ARCOS research focuses on tools and methods for software development, high-performance computing, and data utilisation and management.</p> <p><b>Technological Offer</b></p> <ul style="list-style-type: none"> <li>Development of parallel applications for the management and storage of large volumes of data</li> <li>Energy efficient data management mechanisms</li> <li>Semi-automatic parallelisation of computer applications</li> <li>Traffic and power consumption simulation in transportation systems</li> </ul>

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COMPUTER SCIENCE			
<p><u>Computer, Communications, and Systems Architecture (ARCOS)</u></p> <hr/> <p>PI: Jesús Carretero</p>		<p><b>Reliability centered maintenance for large-scale transportation systems</b></p> <p>Computing tool to reduce software maintenance cost by means of using reliability centered maintenance (RCM) and expertise.</p> <p>Optimisation based on multiple logistic variable and preventive maintenance criteria for increasing productivity and reducing organisation costs.</p>	

R&D GROUP	LINES OF RESEARCH	RESEARCH PROJECTS	TECHNOLOGICAL OFFER / OTHERS
<b>COMPUTER SCIENCE</b>			
<p><b><u>Planning and Learning (PLG)</u></b></p> <p><b>PI: Daniel Borrajo</b></p>	<ul style="list-style-type: none"> <li>• Artificial intelligence</li> <li>• Task planning</li> <li>• Machine learning</li> <li>• Problem solving</li> <li>• Heuristic optimisation</li> <li>• Decision support systems</li> </ul>	<p><b>R&amp;D National Plan Projects</b></p> <ul style="list-style-type: none"> <li>• GoalHUB: Optimised automatic planning software which assures the efficient utilisation of train traffic capacity in heavily congested stations</li> <li>• TIMI: Intelligent intermodal transport of goods. Automatic intermodal transport logistic planning, combining means of land transport, rail transport, and sea transport</li> <li>• PLICOGOR: Intelligent collective transport planning system with optimised route generation</li> <li>• ARPIA: Activity recognition and automatic planning for the design of intelligent assistants</li> <li>• ONDROAD: Tourism service and digital content management platform</li> <li>• Planinteraction: Multi-agent interaction for planning</li> </ul> <p><b>Private Funding</b></p> <ul style="list-style-type: none"> <li>• Optimising the assignation of people to tasks, taking into account restrictions and costs</li> <li>• Pricing strategy optimisation</li> </ul>	<p><b>Experience and Capabilities</b></p> <p>The PLG is a group specialising in task planning, scheduling, and machine learning technologies. It is formed by a team of experts in developing effective and innovative software solutions for the automation of planning tasks and data analysis by means of advanced artificial intelligence technologies.</p> <p><b>Technological Offer</b></p> <ul style="list-style-type: none"> <li>• Software for planning long- and short-distance goods transport logistics</li> <li>• Optimising the assignation of vehicles/people to tasks</li> <li>• Automatic optimisation of the data analysis process (data mining)</li> <li>• Automation of dynamic planning and decision making processes</li> <li>• Process optimisation based on intelligent data analysis and trend or risk prediction</li> <li>• Design of intelligent data retrieval - data mining systems based on state-of-the-art technologies</li> <li>• Improvement of on-line services by means of using intelligent agents in the Internet</li> </ul>

R&D GROUP	LINES OF RESEARCH	RESEARCH PROJECTS	TECHNOLOGICAL OFFER / OTHERS
<b>COMPUTER SCIENCE</b>			
<p><b><u>Control, Learning and System Optimisation Laboratory (CAOS)</u></b></p> <p><b>PI: M<sup>a</sup> Araceli Sanchis</b></p>	<ul style="list-style-type: none"> <li>• Artificial intelligence</li> <li>• Machine learning</li> <li>• Data analysis</li> <li>• Predictive control</li> <li>• Optimisation</li> <li>• Artificial neural networks</li> <li>• Patter recognition</li> <li>• Evolutionary computation</li> <li>• Agent modeling</li> </ul>	<p><b>R&amp;D National Plan Projects</b></p> <ul style="list-style-type: none"> <li>• Autonomous air-ground system for the collaborative inspection and digitalisation of rail network</li> <li>• Unmanned ultralight vehicle that can travel on rails to perform automatic track and railway infrastructure inspection, maintenance, and monitoring jobs with intelligent positioning and behaviour by means of computers and sensors</li> <li>• High performance and precision intelligent robotic system to provide automatic guiding when laying down ballast and to optimise railway track construction and maintenance, based on machine vision and fusion of AVATTRACK sensors</li> </ul>	<p><b>Experience and Capabilities</b></p> <p>The Control Learning and System Optimisation (CAOS) Laboratory is formed by a team of professionals whose expertise lies in the prediction, optimisation, control, and automatic planning of processes and business services based on data analysis using advanced artificial intelligence technologies and other systems which have proven effective in solving complex business- or industry-related problems.</p> <p><b>Technological Offer</b></p> <ul style="list-style-type: none"> <li>• Trend prediction and process optimisation based on intelligent data analysis</li> <li>• Design of intelligent data retrieval – data mining systems based on state-of-the-art technology</li> <li>• Time series prediction by means of machine learning techniques</li> <li>• Representation of an explicit mode of key processes and knowledge of complex organisations</li> <li>• Application of artificial intelligence techniques for solving business problems</li> </ul>

R&D GROUP	LINES OF RESEARCH	RESEARCH PROJECTS	TECHNOLOGICAL OFFER / OTHERS
<b>ELECTRICAL ENGINEERING</b>			
<p><b><u>Diagnosis of Electric Machines and Insulating Materials (DIAMAT)</u></b></p> <p><b>PI: Juan Carlos Burgos, Juan Manuel Martínez, Guillermo Robles</b></p>	<ul style="list-style-type: none"> <li>• Analysis of aging and characteristics of insulating materials in electric machines and devices</li> <li>• Diagnosis by partial discharges with high frequency sensors</li> <li>• Monitoring and diagnosis of electrical machines and transformers for "Smart Grids"</li> <li>• Review of transformer design</li> </ul>	<p><b>R&amp;D National Plan Projects</b></p> <ul style="list-style-type: none"> <li>• Intelligent sensor for the localisation and identification of partial discharges in electricity asset maintenance</li> </ul> <p><b>Private Funding</b></p> <ul style="list-style-type: none"> <li>• ELECTREN Chair: Studies on the Technological Innovation and Development in Electric Traction</li> </ul>	<p><b>Experience and Capabilities</b></p> <p>The Diagnosis of Electric Machines and Insulating Materials (DIAMAT) Group is involved in the development of novel techniques for the monitoring and diagnosis of electric machine insulations (particularly power transformers), the analysis of the behaviour of insulating materials in electric machines and devices, and the performance of high-voltage tests and measurements, as well as the analysis of dielectric response (in the frequency domain).</p> <p>These tests can be completed and compared with the finite element simulation results.</p> <p><b>Patents</b></p> <ul style="list-style-type: none"> <li>• <i>Método y dispositivo para la diferenciación de descargas parciales y ruido eléctrico</i> (Method and device for the differentiation of partial discharges and electrical noise) (ES2512040)</li> <li>• <i>Sensor inductivo con aislamiento galvánico para la detección y medida de pulsos de corriente de alta frecuencia</i> (Inductive sensor with galvanic insulation for the detection and measurement of high-frequency current pulses) (ES2340750)</li> </ul>

R&D GROUP	LINES OF RESEARCH	RESEARCH PROJECTS	TECHNOLOGICAL OFFER / OTHERS
<b>MECHANICAL ENGINEERING</b>			
<p><b>Machine Laboratory (MAQLAB)</b></p> <p><b>PI: Cristina Castejón</b></p>	<ul style="list-style-type: none"> <li>Railroads</li> <li>Machine and mechanism analysis and synthesis</li> <li>Kinematic and dynamic modeling and simulation of machines and mechanisms</li> <li>Superconductivity: mechanical applications</li> <li>Maintenance in industry 4.0</li> </ul>	<p><b>European Projects</b></p> <ul style="list-style-type: none"> <li>EURAXLES: Minimizing the risk of fatigue failure of railway axles</li> </ul> <p><b>R&amp;D National Plan Projects</b></p> <ul style="list-style-type: none"> <li>MAQSTATUS: Integral critical mechanical assembly monitoring system for improving transport maintenance</li> </ul> <p><b>Private Funding</b></p> <ul style="list-style-type: none"> <li>Design, optimisation, and analysis of roller sensitivity. Improvement of underground wheel lathe</li> <li>Rail Competence Center: Laboratory of advanced techniques for the analysis of the state of mechanical systems</li> <li>Laboratory for the advanced processing of vibration signals for operating railway axles</li> <li>Laboratory of advanced techniques for the analysis of the state of rotating mechanical systems applicable to railways by vibrations</li> <li>Development of new techniques and methodologies for improving railway axle maintenance in the event of failure due to fatigue - RANKINE 21 (Project CDTI in collaboration with Danorail, Alstom, SKF, and Integria-Renfe)</li> <li>Reduced bogie dynamic behaviour simulation PR1 4600086180</li> <li>Study for the improvement of behaviour in the presence of vibrations of ASFA antenna installation in S-100</li> </ul>	<p><b>Experience and Capabilities</b></p> <p>The R&amp;D&amp;I activities of the Machine Laboratory (MAQLAB) group are centred in the field of mechanical engineering and include research projects applied to the industry, vehicles, transportation, safety, and defence relating to advanced mechanisms, special mechanisms, magnetomechanics, applied tribology, and monitoring and measuring techniques.</p> <p><b>Railway-related activities of the Maqlab Group</b></p> <ul style="list-style-type: none"> <li>"Technical notes" concerning the application of European standards used in the design of railway axles (UNE-EN 13103, UNE-EN 13104, UNE-EN 13260, UNE-EN 13261).</li> <li>Continuously updated database containing more than 100 articles on the subject (fatigue, fracture, corrosion, non-destructive testing)</li> <li>Design of a test bench for true-to-scale railway axles, applying the "dimensional analysis" technique for the calibration of the mechanical magnitudes to be detected</li> <li>Characterisation of defects in true-to-scale axles by means of vibration analysis (a TD under development)</li> </ul> <p><b>Patents</b></p> <ul style="list-style-type: none"> <li><i>Método para la detección de defectos de ejes ferroviarios en ensayos a fatiga</i> (Method for detecting defects in railway axles during fatigue tests)</li> <li><i>Método y sistema para detectar automáticamente fallos en un eje rotatorio</i> (Method and system for automatically detecting defects in a rotating axle)</li> </ul> <p><b>Software</b></p> <ul style="list-style-type: none"> <li>Teaching program for cam calculation and design: MAQCAM</li> </ul>

R&D GROUP	LINES OF RESEARCH	RESEARCH PROJECTS	TECHNOLOGICAL OFFER / OTHERS
<b>MECHANICAL ENGINEERING</b>			
<p><u>Experimental Mechanics, Calculation, and Transport (MECATRAN)</u></p> <p><b>PI: Beatriz López Boada, María Jesús López Boada</b></p>	<ul style="list-style-type: none"> <li>• Railways and automobiles</li> <li>• Transport</li> <li>• Intelligent transport systems</li> <li>• Graphical engineering, simulation, and virtual reality</li> <li>• Acoustics and vibrations</li> </ul>	<p><b>Private Funding</b></p> <ul style="list-style-type: none"> <li>• R&amp;D design of railway material</li> <li>• Technical study for optimising, assessing the holding capacity, and verifying the resistance of a rolling stock holding system in a track platform</li> <li>• External engineering, assistance service for ERTMS L1 in the MOROCCO project</li> <li>• External engineering, assistance for signalling subsystem management in the Lima Metro project</li> <li>• External engineering, assistance for signalling system management in the Quito Metro project</li> <li>• External engineering, Assistance service for ERTMS L1-L2 MOROCCO project</li> <li>• Assistance for the railway traffic control and monitoring system in the Oporto Metro Project</li> <li>• Assistance in ERTMS engineering in the Corredor del Mediterráneo project</li> <li>• Assistance for designing an interface for the application of the CBTC system in the Mahmutbey project</li> <li>• Assistance for drawing up a script for the automatic generation of AutoCad wiring diagrams in the Morocco Project</li> </ul>	<p><b>Experience and Capabilities</b></p> <p>The MECATRAN Group is formed by a team of specialists with vast experience in a wide range of disciplines relating to mechanical engineering.</p> <p>- <b>Master in Railway Systems Engineering UC3M-BOMBARDIER</b>  <a href="https://www.uc3m.es/master/ingenieria-sistemas-ferroviarios">https://www.uc3m.es/master/ingenieria-sistemas-ferroviarios</a></p> <p><b>Technological Offer</b></p> <p>The MECATRAN Group masters the main commercial Software and Hardware tools related with dynamic simulation and virtual reality applied to the technological fields of mechanical engineering.</p> <p>The following stand out among the applications available from the group:</p> <ul style="list-style-type: none"> <li>• Computer Aided Design (CAD) Software</li> <li>• Data Acquisition and Treatment Software</li> <li>• Mechanical Systems Dynamic Simulation Software</li> <li>• Finite Elements Analysis Software</li> <li>• Experimental Modal Analysis Software</li> <li>• Traffic Simulation Software</li> </ul>

R&D GROUP	LINES OF RESEARCH	RESEARCH PROJECTS	TECHNOLOGICAL OFFER / OTHERS
<b>SYSTEMS AND AUTOMATIC ENGINEERING</b>			
<p><b><u>Intelligent Systems Laboratory (LSI)</u></b></p> <p><b>PI: Arturo de la Escalera, José María Armingol, Francisco José Rodríguez</b></p>	<ul style="list-style-type: none"> <li>• Intelligent transport systems</li> <li>• Driving assistance and surveillance systems</li> <li>• Unmanned aerial vehicles</li> <li>• Computer vision system</li> <li>• Computer-integrated manufacturing</li> <li>• System modeling and simulation</li> <li>• Microrobotics</li> </ul>	<p><b>R&amp;D National Plan Projects</b></p> <ul style="list-style-type: none"> <li>• Development of an integral system for detecting trains, breaks in the rail, and other railway applications based on the intelligent interpretation of rail-transmitted vibrations- Indio project</li> <li>• High performance and precision intelligent robotic system to provide automatic guiding when laying down ballast and to optimise track construction and maintenance, based on machine vision and fusion of AVATRACK sensors</li> <li>• Unmanned ultralight vehicle that can travel on rails to perform automatic track and railway infrastructure inspection, maintenance, and monitoring jobs with intelligent positioning and behaviour by means of computers and sensors</li> </ul> <p><b>Private Funding</b></p> <ul style="list-style-type: none"> <li>• Simulation using Building Information Modeling Methodology of Multimodal, Multipurpose and Multiproduct Freight Railway Terminals Infrastructures</li> <li>• Railway area image analysis</li> <li>• Intelligent aerial platform with complete coverage for the protection and surveillance of installations by means of computer vision</li> </ul>	<p><b>Experience and Capabilities</b></p> <ul style="list-style-type: none"> <li>• Design of perception systems for security and surveillance activities</li> <li>• Design and development of surveillance systems based on autonomous aerial and land vehicles</li> <li>• Railway track maintenance and surveillance systems</li> <li>• Autonomous guiding of unmanned aerial vehicles</li> <li>• Design and development of solutions for automating production processes</li> <li>• Design and development of industrial computer vision applications</li> </ul> <p><b>Patents</b></p> <ul style="list-style-type: none"> <li>• <i>Sistema y método de estimación de aproximación trenes y detección de roturas de carril</i> (System and method for estimating the approach of trains and detecting breaks in the rail) (P201630961)</li> </ul>

R&D GROUP	LINES OF RESEARCH	RESEARCH PROJECTS	TECHNOLOGICAL OFFER / OTHERS
<b>TELEMATIC TECHNOLOGY</b>			
<p><u>Telematic Applications and Systems (GAST)</u></p> <hr/> <p><b>PI: Carlos Delgado Kloos, Carlos García Rubio, Andrés Marín López, Luis Sánchez Fernández</b></p>	<ul style="list-style-type: none"> <li>Ubiquitous computing</li> </ul>	<p><b>European Projects</b></p> <ul style="list-style-type: none"> <li>COST TU1004: Modeling Public Transport Passenger Flows in the Era of Intelligent Transport Systems</li> </ul> <p><b>National R&amp;D Plans</b></p> <ul style="list-style-type: none"> <li>EMRISCO: Safety and mobility</li> <li>Continuity of service and security for transportation systems</li> <li>CONSEQUENCE: Continuity of Service, Security and QoS for Transportation Systems</li> </ul>	<p><b>Experience and Capabilities</b></p> <p>The activity of the GAST (Telematic Applications and Systems) group lies in conducting research in the field of telematic applications and services.</p> <p><b>Technological Offer</b></p> <p>- <b>Ubiquitous computing laboratory:</b></p> <ul style="list-style-type: none"> <li>Solutions for improving public transport planning using mobile devices and wireless technologies</li> <li>Solutions for improving mobile communications inside means of transport</li> <li>Next-generation network identity management. Adding third party profiles or service accounts to the network profile for use thereof in service access</li> <li>Developments focusing on Media Cloud concepts. Use of a shared or private hybrid cloud for managing personal or business digital assets</li> </ul>

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<b>TELEMATIC TECHNOLOGY</b>			
<p><b><u>FIND (Future and mobile Networking)</u></b>  <b><u>(Subgroup of the Communications Networks and Services Group, RYSC)</u></b></p> <hr/> <p><b>PI: María Calderón</b></p>	<ul style="list-style-type: none"> <li>• Vehicular networks</li> <li>• Communication with the Internet from vehicles</li> <li>• Information dissemination services in vehicular networks</li> <li>• 3G - WiFi hybrid networks for connectivity solutions in vehicular networks and fleets</li> <li>• Services for commercial fleets</li> <li>• Integration of sensor networks with Internet connection for providing services to vehicles and commercial fleets</li> </ul>	<p><b>European Projects</b></p> <ul style="list-style-type: none"> <li>• GEONET: Geographical routing and addressing for vehicular communications</li> <li>• DAIDALOS I and II: mobility solutions for networks</li> </ul> <p><b>R&amp;D National Plan Projects</b></p> <ul style="list-style-type: none"> <li>• POSEIDON: Optimum provision of services to vehicular networks in motion</li> <li>• I-MOVING: Vehicular networks and smart phones</li> <li>• ADAS ROAD-EYE: Advance driving assistance system for interurban environments: environment perception and simulation</li> <li>• TEXEO: Technology Enablers for a fleXible Elastic Tb/s Optical Network for 5G Backhaul</li> </ul>	<p><b>Technological Offer</b></p> <ul style="list-style-type: none"> <li>• <i>Procedimiento y dispositivos para provisión de conectividad a Internet vía Wi-Fi a usuarios móviles desde sistemas de transporte (por ejemplo: autobuses y sus paradas)</i> (Method and devices for providing Internet connectivity via Wi-Fi to cell phone users from transport systems (for example, buses and bus stops). Patent ES2360678.</li> <li>• Innovative solutions for controlling goods transport</li> <li>• Development of <i>ad hoc</i> solutions for connectivity-based services in commercial fleets</li> <li>• Development of solutions for providing services based on the dissemination of information to vehicles</li> </ul>

R&D GROUP	LINES OF RESEARCH	RESEARCH PROJECTS	TECHNOLOGICAL OFFER / OTHERS
<b>TELEMATIC TECHNOLOGY</b>			
<p><b><u>ADSCOM</u></b>  <b><u>(Advanced Switching and Communication Systems)</u></b>  <b><u>(Subgroup of the Communications Networks and Services Group, RYSC)</u></b></p> <hr/> <p><b>PI: David Larrabeiti</b></p>	<ul style="list-style-type: none"> <li>• Ultra wideband networks</li> <li>• 5G Networks</li> <li>• Security in communications networks</li> </ul>	<p><b>European Projects</b></p> <ul style="list-style-type: none"> <li>• BlueSPACE: Building on the Use of Spatial Multiplexing 5G Networks Infrastructures and Showcasing Advanced technologies and Networking Capabilities</li> <li>• TEXEO: Technology Enablers for a fleXible Elastic Tb/s Optical Network for 5G Backhaul</li> </ul>	<p><b>Technological Offer</b></p> <ul style="list-style-type: none"> <li>• Internet access on trains and private railway networks</li> <li>• Optical fibre and wireless ultra wideband systems</li> <li>• On-board networks</li> <li>• Critical infrastructure protection (intrusion detection)</li> <li>• Design of real-time accident prediction and warning systems</li> </ul>

R&D GROUP	LINES OF RESEARCH	RESEARCH PROJECTS	TECHNOLOGICAL OFFER / OTHERS
<b>TECHNOLOGY ELECTRONIC</b>			
<p><b>Electronic Power Systems (GSEP)</b></p> <p><b>PI: Andrés Barrado, Emilio Olías</b></p>	<ul style="list-style-type: none"> <li>• Electronic power system analysis, design and optimisation</li> <li>• Magnetic component analysis, design and optimisation</li> <li>• Photovoltaic and hybrid energy system design and optimisation</li> <li>• Electromagnetic interference measurement and correction in equipment and systems. Electromagnetic compatibility</li> </ul>	<p><b>European Projects</b></p> <ul style="list-style-type: none"> <li>• ESSIAL: Electrical Steel Structuring, Insulating and Assembling by means of the Laser technologies</li> </ul> <p><b>R&amp;D National Plan Projects</b></p> <ul style="list-style-type: none"> <li>• Power supply systems for on-board and portable applications based on emergent energy storage devices and sources</li> <li>• Ecological technologies for urban transport (ECOTRANS)</li> </ul> <p><b>In-house Projects (UC3M Funding)</b></p> <ul style="list-style-type: none"> <li>• Strategic action in electronic power system applied to transport</li> </ul> <p><b>Private Funding</b></p> <ul style="list-style-type: none"> <li>• Design, Modeling and Control of High Frequency-High Power Converters for Railway Applications</li> <li>• High frequency- high power DC-DC converter for railway applications</li> <li>• SEPSA Chair</li> </ul>	<p><b>Experience and Capabilities</b></p> <p>The Electronic Power Systems (GSEP) group provides comprehensive services in the consultation, analysis, custom design, and optimisation of electronic power systems and magnetic components, as well as photovoltaic and hybrid energy systems, and electromagnetic compatibility.</p> <ul style="list-style-type: none"> <li>- <b>Energy conversion systems</b> <ul style="list-style-type: none"> <li>• Converter design, modeling, and optimisation</li> <li>• Design of prototypes</li> <li>• Modeling of DC supply systems, including the behavioural model of converters and stability analysis.</li> <li>• CAD tools for electronic power system and equipment design</li> </ul> </li> <li>- <b>Magnetic components</b> <ul style="list-style-type: none"> <li>• Design of magnetic components</li> <li>• Optimisation of magnetic component volume, losses, and temperature</li> <li>• Finite element-based analytical models of high-frequency magnetic components</li> <li>• Contactless power supply systems</li> </ul> </li> <li>- <b>Photovoltaic and hybrid energy systems</b> <ul style="list-style-type: none"> <li>• Optimisation of power electronics in photovoltaic systems</li> <li>• Design of energy control, regulation, and conditioning systems for autonomous and networking systems</li> <li>• Hybrid systems</li> </ul> </li> </ul> <p style="text-align: right;">+</p>

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TECHNOLOGY ELECTRONIC			
<p><u>Electronic Power Systems (GSEP)</u></p> <hr/> <p>PI: Andrés Barrado, Emilio Olías</p>			<ul style="list-style-type: none"> <li>- <b>Equipment electromagnetic compatibility</b> <ul style="list-style-type: none"> <li>• Pre-certification testing of equipment electromagnetic compatibility</li> <li>• Development of EMI filters</li> <li>• Evaluation of environmental radiation level</li> </ul> </li> <li>- <b>Training courses</b></li> </ul> <p><b>Technological Offer</b></p> <ul style="list-style-type: none"> <li>• On-board power supply systems for trains (I) Improvement of design, new model generation, tool development processes           <ul style="list-style-type: none"> <li>· Design of power converters (chargers for batteries, DC-AC systems, etc.)</li> <li>· HV-IGBT models for PSIM simulation</li> <li>· Design of SW: automatic design of three-phase inverters and input filters</li> </ul> </li> <li>• On-board power supply systems for trains (II) Optimised modulation techniques for reducing THD           <ul style="list-style-type: none"> <li>· Predistortion of the inverter three-phase output voltage for cancelling low-frequency harmonic content due to the non-linear loading operation</li> <li>· Inverter modulation techniques for reducing total harmonic distortion</li> </ul> </li> </ul>

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TECHNOLOGY ELECTRONIC			
<p><u>Electronic Power Systems (GSEP)</u></p> <hr/> <p>PI: Andrés Barrado, Emilio Olías</p>			<p><b>Patents</b></p> <ul style="list-style-type: none"> <li>• <i>Método y dispositivo de transformación de corriente continua en corriente alterna</i> (Method and device for transforming direct current into alternating current)</li> <li>• <i>Método y sistema de alimentación de una carga constituida por una pluralidad de cargas elementales, en particular de LED</i> (Method and system for supplying a load consisting of a plurality LED fundamental loads)</li> <li>• Active control procedures for the connection of very capacitive loads using SSPCs</li> </ul>

Performance of the Project "UC3M Plan to boost innovation and transfer of R&D results in the productive sector of the Community of Madrid with priority in the southern metropolitan area"

of Ref .: OI2018 / PC-UC3M-5152, Acronym PC- UC3M, granted in the 2018 Call for aid to promote technological innovation and promote the transfer of technology to the productive sector, included in the priorities of the Regional Research and Innovation Strategy for an intelligent specialization (RIS3) of the Community of Madrid through liaison entities for technological innovation co-financed at 50% by the Community of Madrid and the European Regional Development Fund under the 2014-2020 ERDF operational program of the Community of Madrid.



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