

Marie Skłodowska-Curie - Innovative Training Networks - European Joint Doctorate
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12 PhD positions in the EU Horizon 2020 Marie Skłodowska-Curie Project ETOPIA

Applications are invited for 12 PhD positions (“Early Stage Researchers”) to be funded by the Marie-Skłodowska-Curie Innovative Training Network “ETOPIA - European Training network Of PhD researchers on Innovative EMI analysis and power Applications” within the Horizon 2020 Programme of the European Commission. ETOPIA is a consortium of six universities, supported by 12 industrial entities, in the Netherlands, United Kingdom, Germany, Poland, Italy and Romania. Each of the 12 ESRs will be working towards a unique **joint** PhD degree awarded by all six universities, supported by a carefully chosen supervisory team that maximizes both scientific excellence as well as interdisciplinary and inter-sectoral collaboration. The 12 ETOPIA ESRs will not only receive state-of-the-art science/technology training but will also benefit from a unique soft-skills training programme.

Research Fields

Electromagnetic Compatibility

Participating universities

At every university 2 ESRs will be employed. However, ALL ESRs have to visit several other universities, attend summer schools, and receive training from all universities. The universities are:

UT: University of Twente, the Netherlands

UC: University of Craiova, Romania

PM: Politecnico di Milano, Italy

LUH: Leibniz University Hannover, Germany

UZ: University of Zielona Gora, Poland

UN: The University of Nottingham, United Kingdom

Career Stage: ESR

Early Stage Researcher (ESR) are those who are, at the time of recruitment by the host, in the first four years (full-time equivalent) of their research careers. This is measured from the date when they obtained the degree which formally entitles them to embark on a doctorate, either in the country in which the degree was obtained or in the country in which the research training is provided, irrespective of whether or not a doctorate was envisaged. Persons who performed part-time research, for instance 50%, over a period of for instance 6 years, are eligible, as the criterion is ‘four years full-time equivalent’. Please do NOT apply if you are not eligible! Please also do NOT apply if you do not have an electrical engineering background!

Key dates:

7 January 2019: Launch of 12 ESR Positions

31 March 2019: Deadline for on-line application for the Recruitment Event

1 April 2019: Circulation list “ETOPIA preselected candidates”

30 April 2019: Invitation for Recruitment event

30 April 2019: deadline for on-line application, waiting list

17-18 May 2019: ETOPIA Recruitment Event

18 May 2019: Circulation list “recruited ETOPIA ESRs”

1 September 2019: Targeted starting date for ESR contracts

Recruitment Procedure

All applications proceed via the on-line channels (see www.ETOPIA-itn.org, etopia-vacancies@utwente.nl). Candidates apply electronically for one to maximum three positions and indicate their preference. Candidates provide all requested information including a detailed CV - Europass format obligatory - and motivation letter. During the registration, applicants will need to prove that they are eligible (cf. ESR definition, mobility criteria, and English language proficiency). The ETOPIA Recruitment Committee selects up to 20 candidates for the Recruitment Event which will take place in Amsterdam on 17 and 18 May 2019. The selected candidates provide a sharp-15-minute presentation and are interviewed by the Recruitment Committee. Only in exceptional cases the interview is done via Skype. The final decision on who to recruit is communicated on 18 May.

Benefits and salary

The successful candidates will receive an attractive salary in accordance with the MSCA regulations for Early Stage Researchers. The exact (net) salary will be confirmed upon appointment and is dependent on local tax regulations and on the country correction factor (to allow for the difference in cost of living in different EU Member States). The salary includes a living allowance, a mobility allowance and a family allowance (if married). The guaranteed PhD funding is for 36 months (i.e. EC funding, additional funding is possible, depending on the local Supervisor, and in accordance with the regular PhD time in the country of origin). In addition to their individual scientific projects, all fellows will benefit from further continuing education, which includes internships and secondments, a variety of training modules as well as transferable skills courses and active participation in workshops and conferences.

Applicants need to fully respect all three eligibility criteria (to demonstrated in the Europass cv):

Early-stage researchers (ESR) are those who are, at the time of recruitment by the host, in the first four years (full-time equivalent) of their research careers. This is measured from the date when they obtained the degree which formally entitles them to embark on a doctorate, either in the country in which the degree was obtained or in the country in which the research training is provided, irrespective of whether or not a doctorate was envisaged.

Conditions of international mobility of researchers: Researchers are required to undertake transnational mobility (i.e. move from one country to another) when taking up the appointment. At the time of selection by the host organisation, researchers must not have resided or carried out their main activity (work, studies, etc.) in the country of their host organisation for more than 12 months in the 3 years immediately prior to their recruitment. Short stays, such as holidays, are not taken into account.

English language: Network fellows (ESRs) must demonstrate that their ability to understand and express themselves in both written and spoken English is sufficiently high for them to derive the full benefit from the network training.

ETOPIA project abstract and key project information

Our modern society becomes highly interconnected where power supply is not only providing energy between many distributed sources and loads but are also a main path of interference, especially in large complex systems, platforms and facilities, where interoperability of the electronic systems has to be achieved. There is an urgent need to train new researchers with a closer interaction of electrical power and power electronics with information technology and communications equipment. The ETOPIA consortium of key academic partners, supported by industry, has been brought together not only to train a sufficient number of qualified researchers but also to provide the fundamental research that underpins future technological developments. The detailed coordinated multidisciplinary multinational doctoral training program will provide the trainee researchers with a complete broad experience and at the same time allow them to develop and eventually lead their focused area of research. The program will focus on the development of novel methods to model, simulate, design, evaluate, measure and monitor. ETOPIA will also develop corrective economical measures for a safe, reliable, efficient and greener electrical power distribution system in and between buildings and vehicles. Specific innovations expected to be achieved through ETOPIA are methodologies to optimize the design of complex electrical/ electronic

installations with respect to compatibility and efficiency. Dissemination methods to realize optimal impact will include scientific publications, workshops, training of engineers in industry, and dissemination through newsletters, interviews, social media.

Intersectoral and multi-disciplinary training

To help the ESRs put what they have learned during their research and S/T training into practice in their future careers, they will also receive soft-skills training to help them communicate effectively at all levels and become sought-after recruits. ETOPIA is closely aligned with the high-priority areas of the EU, addressing many Horizon 2020 thematics. But the most important output of ETOPIA will be 12 well qualified people who have been trained to tackle many of the problems now being faced by European industry.

Workpackages

ETOPIA is organized also along three research lines which are organised in work packages (WP):

WP5 Non-conventional modelling and measurements,

WP6 Multi-domain optimization, and

WP7 EM-Coexistence.

(WP1-4 are for management, training, dissemination and outreach)

Each Early Stage Researcher (ESR) will be scientifically trained through doing research on his/her well-defined individual project within a certain WP, continuously interacting with the other ESRs within and between the WPs to broaden outlook and realise the inter/multi-disciplinary aspects of the doctoral programme. Together with his/her supervisor each ESR will draw up a detailed work plan for their individual sub-project. An important aspect is the secondment to the other universities as this is also required by the universities for the Joint doctorate. But also secondments to industry, as the ESRs will be exposed to different environment, and will be requested to collaborate with researchers and engineers in industry. Also validation of the modelling and simulation methodology will be done in very close collaboration with industry.

Workpackage 5: Non-conventional modelling and measurements

Modern electronic systems draw current during a very short period of time, causing transients (microsecond timescales), sags and surges (milliseconds) and compensating currents in the power distribution system. In this WP non-linear models (parametric macro-models) to be used in the time domain (so not only line-commutated), is investigated, developed and applied. With this approach, non-linear and dynamic effects of electronic devices will be taken into account. Such device models will then be integrated in a typical "topological" approach for the simulation of a whole system, which will be carried out in WP7, resulting in models for components and devices to be used within the power distribution design environment. Individual ESRs' projects within this WP are:

ESR2 Large-system EMI (interaction) analysis using EM topology implementing non-linear non-causal behavioural models

ESR4 Using Wavelet transform for highly distorted currents in an environment with variable levels of noise

ESR7 Reproducible in-situ magnetic field measurements for power electronic application

ESR11 Conducted and radiated EMI in T and F domain

Workpackage 6: Multi-domain optimization

The complex relationships between the non-stationary currents on a distribution system with many different non-linear loads will be investigated through comparisons between laboratory measurements and behavioural modelling. The effects of load and power system impedance variability will be explored and stochastic techniques for accurately assessing their impact on the system voltages and currents will be developed. This WP shall provide a complete toolbox of analysis techniques and indices for distortions that fully represents their stochastic and time varying nature (variability, deterioration in service etc). Individual ESRs' projects within this WP are:

ESR3 Multi-domain design (EMI, Power Quality, Functional) of electric drive systems, including power converters

ESR6 Optimized design of passive & active EMI filters

ESR8 Transient radiated fields from power systems

ESR10 Interoperability of converter based (IFBT, SiC, GaN) power system devices

Workpackage 7: EM-Coexistence

A conventional distribution system, in a cabinet, or series of cabinets, a platform or building, or a large production plant, or (part of) a Smart City, is designed based on assumed power consumption at the fundamental (50 or 60 Hz) frequency. Nowadays we have to consider a multitude of energy suppliers and users with fast variations, for instance during switching, while at the same time more power line communication systems are being used for communication, control and monitoring. Many cases of electromagnetic interferences have been reported, including those with many other (non-communication) equipment. A high-level design approach is needed with proper levels of immunity and signalling, for complete, complex installations, to predict the risk of interference and deterioration of the energy quality of the power supplied. A topological approach, such as that developed by dr. Carl Baum for electromagnetic fields, will be researched for power networks, in association with network simulation as well as mathematical approaches, for instance Hypersim . ESRs' projects in this WP are:

- ESR1 EM coexistence power electronic devices & communication systems
- ESR5 EM coexistence
- ESR9 EMC of electric vehicles and charging infrastructures
- ESR12 Propagation and aggregation of interference including statistical properties

Individual Research Projects

ESR1	Host: UT	PhD enrolment: Y	Start date: M6	Duration: 36M	Del.: 7.1, 7.3
Supervisor / co-supervisors: Prof. Leferink (UT), Prof. Smolenski (UZ), mentor: Kees Post (LE)					
Doctoral School: Twente Graduate School (NL) (Joint Degree with UC, PM, LUH, UZ and UN)					
Project Title and related WP: EM coexistence between power electronic devices and communication systems (smart meters), evaluation techniques for in-situ measurement and monitoring (WP7)					
Objectives: Multi-channel time-domain measurements using direct sampling and large over-sampling to achieve a high dynamic range will be developed with the objective to create proper models which include the non-linear and non-stationary behaviour of modern devices. The effect of PLC signal propagation and interference potential will be evaluated using advanced numerical methods with particular reference to interference evaluation in power systems, and the models developed in WP6 shall be embedded in the topological design methodology.					
Expected Results: Integration of the WP5 results. Validated set of tools and expert systems using statistical techniques for complex systems for PQ and EMC and determination of risk of interference. ESR1 trained in large system EMI analysis.					
Planned secondments: @UN: courses on statistical modelling, exchange on research results (M10); @LE: practical experience, learn about the long-term and short-term (transient) statistics in rail systems (M17); @PM: follow courses, exchange of data, and collaborate with ESR5 (M24); @JLR: validation by measurements in large complex installations (M30), @UZ: follow courses (M31); @THALES: validation by measurements (M36)					
ESR2	Host: UT	PhD enrolment: Y	Start date: M6	Duration: 36M	Del.: 5.1, 5.2, 5.4
Supervisor / co-supervisors: Prof. Leferink (UT), Prof. Garbe (LUH), mentor: JK van der Ven (RHM)					
Doctoral School: Twente Graduate School (NL) (Joint Degree with UC, PM, LUH, UZ and UN)					
Project Title and related WP: Large-system EMI (interaction) analysis using EM topology implementing non-linear non-causal behavioural models (WP5)					
Objectives: Black-box and behavioural models will be developed, but in real life these are dependant of variabilities. To overcome this limitation, parameterisation in behaviour models of active components will be investigated and implemented. Via parameterised behavioural models it becomes possible to simulate the actual behaviour of complex platforms with respect to abnormal and interfering conditions due to other equipment. This shall be investigate taking either functional signals like power line communication, or non-functional into account. The non-functional interference is the classical EMI. In the most extreme sense, the (im)possibilities of cognitive communication of strongly-interfering signals using the time-frequency diversity concept will be investigated.					
Expected Results: Methodology for embedding of models in time (active, non-linear) domain simulators. Characterization and validation of the achieved benefits in terms of simulation performance. Communication performance in BER for heavily polluted power lines. ESR2 trained in interaction analysis in complex platforms.					
Planned secondments: @UN: follow courses, perform stage in power lab (M10-11); @NR: apply techniques and knowledge exchange with engineers in transport (M14); @LUH: Learn about field measurements (M20); @TAURON: evaluate measurement techniques in large networks (M25); @UC: Learn about Wavelet transforms (M31); @RHM: Implement and evaluate techniques in large complex installations (M32)					
ESR3	Host: UC	PhD enrolment: Y	Start date: M6	Duration: 36M	Del.: 6.2
Supervisor / co-supervisors: Prof. Petre-Marian Nicolae (UC), Prof. Leferink (UT), mentor: Eng. Zlatian R. (SFT)					
Doctoral School: Electrical Engineering and Energetic / University of Craiova (RO) (Joint Degree with UT, PM, LUH, UZ, UN)					
Project Title and related WP: Efficiency of an electric traction system concerning the improvement of electric energy quality and the reducing of EMI through multi-domain design of electric drive systems, including power converters (WP 6)					
Objectives: Develop a procedure for the optimal design of electric traction system used for electric trains, including optimization of the design procedure. In this task interconnect and black-box models will be developed, including power converters as components, focusing on appropriate models for frequencies above 2 kHz where data is scarce but interference with power line communication is more problematical. Energy/power quality will be considered in the optimization design process. Another optimization criterion will be the reducing of EMI, especially at low frequency.					

Expected Results: Validated on stand and in situ the optimal/multi-domain design of electric traction system considering energy/power quality and the reducing of EMI (electromagnetic interference) as criterion for optimization processes. ESR3 trained in energy quality and EMI reduction					
Planned secondments: @UZ: learn about macro modelling, follow courses (M12); @SFT: practical experience for smart metering and PLC (M14); @PM: experimental techniques, exchange on data (M21); @EKO: measurements for verification in networks (M26); @ABB: model validation and verification in complex systems (M30-31); @LUH: learn field measurements (M37)					
ESR4	Host: UC	PhD enrolment: Y	Start date: M6	Duration: 36M	Del.: 5.7
Supervisor / co-supervisors: Prof.Ph.D. Nicolae PM(UC), Prof. Garbe (LUH), mentor: Eng. Ciolofan T. (INAS)					
Doctoral School: Electrical Engineering and Energetic / University of Craiova (RO) (Joint Degree with UT, PM, LUH, UZ, UN)LLUH					
Project Title and related WP: Using Wavelet transforms for highly distorted currents in an environment with variable levels of noise at power sources, smart grids and loads levels (WP5)					
Objectives: Develop wavelet-based tools for complex evaluation of PQ indices and modeling of transient regimes in the presence of variable electromagnetic noise. Various wavelet based methods will be used depending on the addressed problem and operational context: Discrete Wavelet Transform (working with frequency ranges and providing fast time-frequency localization of non-stationarities), Wavelet Packet Transform (providing more specific time-frequency localization of non-stationarities) and Stationary Wavelet transform (preserving time resolution at lower frequencies and thus allowing the accurate extraction of the fundamental and distortions). Macro models of the non-linear properties for input/output of active circuits will be developed and embedded in power system models, focusing on appropriate models for frequencies above 2 kHz where data is scarce but interference with power line communication is more problematical. In this case the commonly terminal equipment, i.e. power consumers, will be analysed.					
Expected Results: Validated EM tools regarding embedding black-box models for supra-harmonic frequencies (above 2kHz), taking into account the power lines, stray reactance and the non-linear effects; black-box models for active devices and distributed unbalanced recourses. ESR4 trained in Wavelet transforms for power and EMI.					
Planned secondments: @UT: learn about macro modelling, follow courses (M9); @RSE: practical experience for smart metering and PLC (M13); @LLUH: experimental techniques, exchange on data (M20); @THALES: comparison of conventional techniques with the develop Wavelet transforms (M25); @UN: statistical techniques (M31); @INAS: application in complex systems (M34)					
ESR5	Host: PM	PhD enrolment: Y	Start date: M6	Duration: 36M	Del.: 7.2, 7.6
Supervisor / co-supervisors: Prof. Grassi (PM), Prof. Smolenski (UZ), mentor: Dr. Chiumento (RSE)					
Doctoral School: Politecnico di Milano (IT) (Joint Degree with UT, UC, LUH, UZ and UN)					
Project Title and related WP: EM coexistence: Advanced communication and modulation techniques to assure coexistence of power and data (WP7)					
Objectives: Experimental characterization and modelling of the EMI environment in applications characterized by the presence of power converters, such as smart sub-stations, islanded micro-grids, ships, electric and hybrid vehicles. Coexistence of ac and dc lines. Characterization by simulation and measurement of the interference induced on data lines. Identification of hardware and software (communication techniques) solution to assure coexistence with control lines and communication systems. Investigation on the feasibility to apply the powerline communications technology in these contexts. Identification and/or development of suitable modulation schemes, based on random and/or spread spectrum techniques, to mitigate conducted, and therefore radiated, emissions generated by power converters					
Expected Results: Modeling tools to predict EMI between power and data lines in applications characterized by a massive presence of power converters. Guidelines to reduce interference, with particular emphasis on possible application of the Powerline Communications technology. Identification and development of advance modulations schemes assuring EMI reduction. ESR5 trained in advanced communication and modulation techniques for smart applications.					
Planned secondments: @UN: courses on statistical modelling, exchange on research results (M10); @ RSE: learn about powerline communications & modulation techniques, (M17); @UT: follow courses, exchange of data, and collaborate with ESR1 (M23); @ENEA: measurements in large complex installations (M30), @UZ: follow courses (M31); @ATKINS: validation by measurements (M37)					
ESR6	Host: PM	PhD enrolment: Y	Start date: M6	Duration: 36M	Del.: 6.1, 6.5
Supervisor / co-supervisors: Prof. Grassi (PM), Prof. Nicolae (UC), mentor: Prof. Enrico Ragaini (ABB)					
Doctoral School: Politecnico di Milano (IT) (Joint Degree with UT, UC, LLUH, UZ and UN)					
Project Title and related WP: Optimized design of passive & active EMI filters (WP6)					
Objectives: Experimental characterization and modelling of switching converters in the frequency interval from 2 kHz up to 30-100 MHz. Model implementation in circuit simulators such SPICE or Simulink. The proposed models should represent not only the functional behaviour of the device but also the EMC behaviour. To this end, ad hoc measurement strategies will be identified in order to extract model parameters from the measurements carried out with the device switched on. Such models will be then used as key-ingredients for optimized design of passive/active EMI filters aimed at mitigating the conducted emissions exiting power converters.					
Expected Results: Development of measurement setups and procedures for the characterization and modelling (through equivalent circuits and/or behavioural models to be implemented in SPICE/Simulink) of the conducted emissions exiting power electronics devices. Recommendations for the monitoring of harmonics and conducted emissions (above 2 kHz). Guidelines for optimal design of passive or active filtering strategies. ESR6 trained in measurement and modelling of power electronics devices and filter design.					
Planned secondments: @UZ: learn about macro modelling, follow courses (M12); @ABB: practical experience on power-electronics components and filtering (M14); @UC: Wavelets (M18); @TAURON: measurements for verification in networks (M21); @LLUH: learn field measurements (M37); @URSUS: model validation and verification in buses (M26)					
ESR7	Host: LLUH	PhD enrolment: Y	Start date: M6	Duration: 36M	Del.: 5.5
Supervisor / co-supervisors: Prof. Garbe (LLUH), Prof. Thomas (UN), Dariusz Michalak (SOLARIS)(mentor)					
Doctoral School: Leibniz University Hannover (GE) (Joint Degree with UT, UC, PM, UZ, UN)					
Project Title and related WP: Reproducible in-situ magnetic field measurements (incl. Calibration on transient magnetic field sensors)for power electronic application (WP5)					

Objectives: Modern power facilities are large installations. Transient signals are dominant. Transient currents are the dominant noise source. Existing normative EMC measurement procedures are considering time harmonic field and measurements done in a fixed distance. Test site is not well defined; measurements have to be done inside the facility. Develop calibration procedure to validate transient magnetic field probes. Identify expected transient waveforms.					
Expected Results: Develop guidelines to measure in large facilities. Application of existing standard in-situ measurements for power energy stations. Assessment of the application of these standards. Does and don'ts for non-conventional tests. Overview of existing test procedures for transient field sensors. Identification of open questions. ESR7 trained in low frequency magnetic field measurements, transient field measurement and its application to the energy sector.					
Planned secondments: @UN: follow courses, perform stage in power lab (M10); @EO: apply techniques and knowledge exchange with engineers in large networks (M13); @UT: multichannel measurements (M16); @LE: evaluate measurement techniques in complex installations (M20); @JLR: Implement and evaluate techniques in automotive (M25); @UC: Learn about Wavelet transforms (M31)					
ESR8	Host: LUH	PhD enrolment: Y	Start date: M6	Duration: 36M	Del.: 6.3
Supervisor / co-supervisors: Prof. Garbe (LUH), Prof. Nicolae (UC), Hans Schipper (THALES)(mentor)					
Doctoral School: Leibniz University Hannover (GE) (Joint Degree with UT, UC, PM, UZ, UN)					
Project Title and related WP: Determine transient radiated field from power lines by measuring the transient CM current (WP6)					
Objectives: CM current in the power installation as the main source of transient magnetic fields. Measuring of transient high power transient CM currents.					
Expected Results: Analytical description to transfer the measured CM current into expected transient fields. Prediction of expected transient field, transient measurement technology. ESR8 trained in high power transient CM currents.					
Planned secondments: @UZ: learn about macro modelling, follow courses (M12); @THALES: apply techniques in large complex platforms (M14); @PM: experimental techniques, exchange on data (M21); @SOLARIS: application of techniques for automotive (M26); @CESi: model comparison (M31); @UC: learn about Wavelet (M37)					
ESR9	Host: UZ	PhD enrolment: Y	Start date: M6	Duration: 36M	Del.: 7.5
Supervisor / co-supervisors: Prof. Smolenski (UZ), Prof. Grassi (PM), Maciej Wojenski (EKO) (mentor)					
Doctoral School: Graduate School University of Zielona Gora (PL) (Joint Degree with UT, UC, PM, LUH and UN)					
Project Title and related WP: EMC of electric vehicles and charging infrastructures (WP7)					
Objectives: Determine possible interference sources in electric vehicles and fast charging infrastructures. Evaluation and experimental tests of the immunity of the currently applied transmission standards enabling interconnection between vehicle and charger (e.g. CAN, PLC). Development and experimental verification of methods assuring reliable operation of electric vehicles and charging infrastructure. Elaboration of generalized recommendation for assurance of EMC of electric vehicle and charging infrastructure.					
Expected Results: Localization of typical EMI "hot spots" in electric vehicles and fast chargers (interference sources and susceptible arrangements). Recommendations concerning assurance of EMC of electric vehicles and charging infrastructures. ESR9 trained in development of effective methods providing EMC of electric vehicles and charging infrastructures.					
Planned secondments: @UT: follow EMC courses, perform experiments (M11); @SOLARIS: practical experience with production of charging infrastructure (M16); @PM: data exchange (M23), @URSUS: producers of the electric buses (M27); @UN: exchange progress, use power lab for experiments (M31); @RHM: experiments in the lab, model validation (M36)					
ESR10	Host: UZ	PhD enrolment: Y	Start date: M6	Duration: 36M	Del.: 6.4
Supervisor / co-supervisors: Prof. Smolenski (UZ), Prof. Nicolae (UC)(WP6), Prof. Wojciech Drozd (EO) (mentor)					
Doctoral School: Graduate School University of Zielona Gora (PL) (Joint Degree with UT, UC, PM, LUH and UN)					
Project Title and related WP: Interoperability of converter based interfaces (IGBT, SiC, GaN) and Advanced Measuring Infrastructure in power system (WP6)					
Objectives: Development of high frequency (HF) models of power electronic converter based interfaces (IGBT, SiC, GaN). Modelling of aggregated interference generated by multiple interference sources. Maintain full compatibility with commercial circuit simulators (i.e., SPICE-type) or freely available (e.g. R - project) and validate through the statistical analysis of a realistic energy conversion system for power system. Extension of the state-of-the-art concerning the statistical simulation of circuits affected by random electrical parameters (changes of HF parameters of the circuits, converter modulation effects, aggregation of interference generated by multiple sources, etc.) Evaluation of the reliability of AMI in a presence of interference generated by investigated arrangements. Recommendation of methods providing interoperability of modern power electronic interfaces and AMI in power systems.					
Expected Results: Validated parameterised HF models of interfaces for typical applications (renewable energy sources, energy storages, drives and lighting control, etc). Toolbox and techniques for statistical analysis and optimisation of system arrangements. Recommendations including good EMC engineering practice for modern power systems. ESR10 trained in modelling of EMC issues as well as development of practical solutions providing interoperability of converter based interfaces and AMI in modern power systems. ESR10 trained in interoperability between fast-switching devices and meters					
Planned secondments: @LUH: follow EMC courses (M11); @TAURON: experience with distribution networks (M13); @PM: data exchange (M18), @EO: apply in charging infrastructure in grids (M21); @UC: learn about Wavelets to apply for this subject (M30); @ABB: experiments in the lab, model validation (M36)					
ESR11	Host: UN	PhD enrolment: Y	Start date: M6	Duration: 36M	Deliverables: 5.3, 5.6
Supervisor / co-supervisors: Prof. Thomas (UN), Prof. Garbe (LUH), mentor: dr. Peter Phillips (JLR)					
Doctoral School: Graduate School University of Nottingham (UK) (Joint Degree with UT, UC, PM, LUH and UZ)					
Project Title and related WP: Statistical modelling and grid optimisation, focus on harmonic indices for micro grids or weak distribution systems and the transport sector (WP5)					
Objectives: Development of efficient methods of modelling statistical variability and optimisation techniques in the presence of uncertainty (such as point estimation and univariate and bivariate reduction). Modelling of conducted emissions and harmonics in systems with stochastic loads and sources taking into consideration different probability distributions and correlation between variables. Determination of the system critical points for conducted emissions and harmonics. Development of optimisation techniques for distribution systems with uncertain variables					

Expected Results: Validated characterisation and optimisation techniques of distribution systems with variable loads and sources. Techniques for establishing the impact on Power Quality, system control and system security in the presence of unbalanced variable resources. Toolbox and techniques for statistical analysis and optimisation of system equipment. ESR11 trained in statistical modelling and grid optimisation for harmonics.					
Planned secondments: @LUH: Measurement technology for transient signals and exchange with WP6 ESRs (M10) @JLR: practical experience, learn about the long-term and very short term (transients) statistics in automotive (M14); @UT: learn about measurement techniques (M20); @INAS: practical experience (M25); @UC: Wavelets (M30); NR: verification of methodology applied to large complex systems(M31)					
ESR12	Host: UN	PhD enrolment: Y	Start date: M6	Duration: 36M	Deliverables: 7.4, 7.7
Supervisor / co-supervisors: Prof. Thomas (UN), Prof. Grassi (PM), mentor: dr. Ian Flintoft (Atkins)					
Doctoral School: Graduate School University of Nottingham (UK) (Joint Degree with UT, UC, PM, LUH and UZ)					
Project Title and related WP: Impact of low frequency radiated emissions on communication networks for smart infrastructure internet of things, and Modelling the propagation and aggregation of conducted low frequency interference including statistical properties (WP7)					
Objectives: Development of efficient methods of modelling the impact on communication systems including statistical variability and optimisation techniques in the presence of uncertainty (such as point estimation and univariate and bivariate reduction). Modelling of conducted emissions and harmonics in systems with stochastic loads and sources taking into consideration different probability distributions and correlation between variables. Determination of the system critical points for conducted emissions and harmonics. Development of optimisation techniques for distribution systems with uncertain variables					
Expected Results: Validated characterisation and optimisation techniques of distribution systems with variable loads and sources. Techniques for establishing the impact on power quality and communication systems, system control and system security in the presence of unbalanced variable resources. Toolbox and techniques for statistical analysis and optimisation of system equipment. ESR5 trained in statistical modelling and grid optimisation for harmonics.					
Planned secondments: @UZ: To learn about polynomial chaos modelling (M9) @ATKINS: practical experience, large integrated complex systems issues (M13); @UT: learn about multichannel measurement techniques (M17); @SFT practical experience (M23); @PM: exchange data, cross-fertilization (M29); @CESi: verification of methodology applied to large complex systems (M31)					