Developments and Challenges in Grid Integration & Power Systems Stability

CIGRE UK SC C4 Technical Event – 21st January 2025

Hosted by CIGRE UK at Scottish Power HQ, Glasgow, UK

Spyros Karamitsos – CIGRE SC C4 Elected Regular Member for the UK,
Lead Electrical Design Manager at Scottish Power Renewables

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CIGRE UK Study Committee-C4 Liaison Meeting & Technical Event 2025

Developments and Challenges in Grid Integration and Power Systems Stability

AGENDA

Time	Topic	Presenter
10:00- 10:25	Arrival and Welcome Refreshments - Tea/Coffee	
10:25	**Welcome**	**Dr Sofia Koukoura**, Innovation Manager at Scottish Power
10:30	**Welcome from the Regular Member the CIGRE UK Study Committee C4 - Event Introduction & Overview of CIGRE SC C4 Activities and Updates, incl. Paris Session 2024**	**Dr Spyros Karamitsos**, Chair-Elected Regular Member of CIGRE UK Study Committee C4, UK Lead Grid and System Studies Manager at Scottish Power / Iberdrola (SPR/IBR)
10:50	**CIGRE and Energy Innovation: Technical Committee Introduction**	**Dr James Yu**, Chair of CIGRE UK Technical Committee
11:00	**Clean Power 2030, Power System Stability Challenges**	**Dr Xiaoyao Zhou**, Operability Policy Manager at National Energy System Operator (NESO), Honorary Professor at the University of Birmingham
11:30	**Overview of CIGRE TB 909: "Guidelines for Sub-synchronous Oscillation Studies in Power Electronics Dominated Power Systems", JWG C4/B4.52**	**Dr Afshin Pashaei**, Power Quality & Dynamic Performance Manager at National Grid, UK Member of the CIGRE JWG C4/B4.52
12:00- 12:30	Q&A - Break - Networking Lunch	
12:30	**Advancing Grid Stability, System Modelling and Risk Mitigation Techniques in Power Systems - Insights from the National HVDC Centre**	**Ben Marshall**, HVDC Technology Manager at The National HVDC Centre **Dr Colin Foote**, Senior Simulation Engineer at The National HVDC Centre **Dr Dong Chen**, Senior Simulation Engineer at The National HVDC Centre
13:00	**Stability Challenges in Converter Dominated Networks**	**Prof Agusti Egea Alvarez**, Network Operational Performance Manager at Scottish Power Energy Networks (SPEN), Professor at the University of Strathclyde
13:30	**Addressing the Complexity and Uncertainty in Future Power System Dynamic Behaviour**	**Dr Panagiotis Papadopoulos**, Reader (Associate Prof.) at the University of Manchester
14:00 - 14:30	Q&A - Comfort/Coffee Break	
14:30	**Identification of IBR-driven Subsynchronous Oscillations - Overview of CIGRE 2024 Paris Session Papers SC C4-11096, SC C4-11099**	**Dr Diptargha Chakravorty**, Principal Consultant at SIEMENS Energy
15:00	**Harmonic Power Quality Standards and Compliance Verification - Works of the CIGRE WG C4.63, Oscillation Modes Identification via SVD and PCA - CIGRE 2024 Paris Session Paper SC C4-11448**	**Dr Kah-Leong Koo**, Technical Director - Power System Studies at Power Systems Consultants (PSC) **Dr Carlos Ferrandon**, Senior Strategic Advisory Consultant at Power Systems Consultants (PSC)
15:30	**Grid Integration Challenges for Co-locating BESS with existing Onshore Windfarms in Scotland, Overview of CIGRE TB 913: "Evaluation of Temporary Overvoltages in Power Systems due to Low Order Harmonic Resonances", WG C4.46**	**Dr Isaac Gutierrez**, Principal Electrical Engineer - Control and Grid Integration team - UK Technical Services SPR **Kiran Munji**, Grid Services Manager at Scottish Power (SPR)
16:15 - 16:30	Q&A - Session Closing Remarks - AOB	
16:30 - 17:00	Networking - Refreshments	

AGENDA	CIGRE UK Study Committee-C4 Liaison Meeting & Technical Event 2025 Developments and Challenges in Grid Integration and Power Systems Stability	
Time	**Topic**	**Presenter**
10:30	**Welcome from the Regular Member the CIGRE UK Study Committee C4 - Event Introduction & Overview of CIGRE SC C4 Activities and Updates, incl. Paris Session 2024**	**Dr Spyros Karamitsos**, Chair-Elected Regular Member of CIGRE UK Study Committee C4, UK Lead Grid and System Studies Manager at Scottish Power / Iberdrola (SPR/IBR)

Dr Spyros Karamitsos (MEng, MSc, PhD) is the Chair and Elected Regular Member of the CIGRE UK Study Committee C4. He is the UK Lead Grid and System Studies Manager at Scottish Power – Iberdrola Renewables, where he oversees the power system studies, electrical design, performance and grid code compliance for the East Anglia Hub Offshore Wind Complex (EAH ~3.1GW). He is also the Innovation Lead of SPR's Electrical Department and actively contributes to several Technical Working Groups, within organisations like CIGRE, IEEE, IET and the Carbon Trust.

With extensive experience in HVDC systems and renewable energy integration technologies, Spyros previously worked as Senior HVDC Engineer for the East Anglia 3 Offshore Windfarm Project, as a Power Systems Consultant at HVDC TECH and as an Industrial-Researcher at the University of Strathclyde focusing on power and converter control systems modelling, studies and analysis.

He holds a PhD degree in Electronic and Electrical Engineering from the University of Strathclyde, an M.Sc. degree from the University of Nottingham and an M.Eng. degree from the Aristotle University of Thessaloniki.

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Introduction to CIGRE Study Committee C4 - Brief Overview and Updates

CIGRE UK SC C4 Technical Event – 21st January 2025

Presented by:

Spyros Karamitsos – CIGRE SC C4 Elected Regular Member for the UK, UK Lead Grid and System Studies Manager at SPR

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CIGRE SC C4 – Power System Technical Performance

CIGRE SC C4 Scope: Methods and Tools for Power System Analysis & Studies

Power System Technical Performance Issues for the entire range of Phenomena & Time Frames.

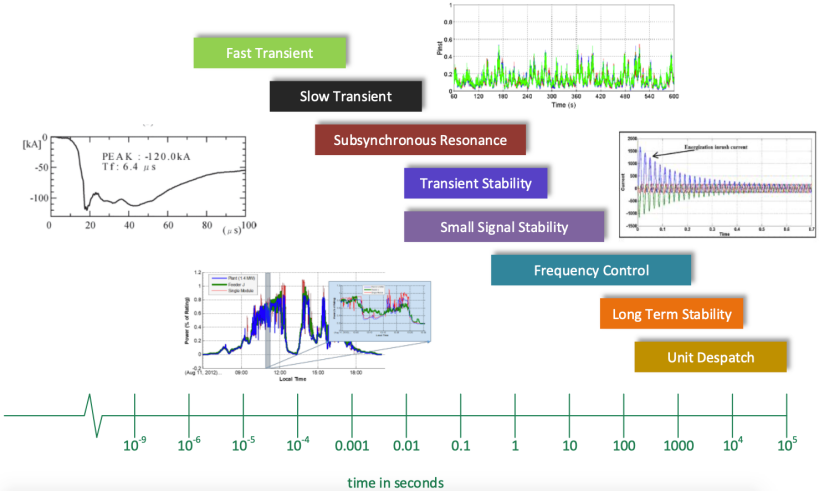

Figure C4: Time Frame of Various Phenomena of Interest in Power System Studies.

The broad Power and Control Systems topics that define the SC C4 activities are:

- Steady State, Dynamic Performance, Transients, and Numerical Analysis
- Power Systems Stability & Dynamics – Voltage, Frequency, Harmonic, Rotor Angle Stability
- Power Quality, EMC/EMI, Insulation Coordination & Lightning/Switching
- Interactions with own subsystems, external causes of stress and other installations
- Advancements in Power Systems Operation, Planning, Modelling, Study Methods and GC Compliance

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CIGRE SC C4 – Organisational Structure

Organisational Structure, Members and Strategic Advisory Groups

CIGRE Awards to SC C4 Members :

- Babak Badrzadeh (AU): Technical Council Award;
- Angélica Rocha (BR): Women in Energy (WiE) Award
- Jinliang He (CHN): Fellow Award;
- Distinguished Member Award;
  - Australia: Sarath PERERA, Andrew HALLEY, Don GEDDEY
  - Canada: William CHISHOLM
  - Croatia: Božidar FILIPOVIĆ GRČIĆ
  - Denmark: Filipe FARIA DA SILVA
  - France: Manuel MARTINEZ DURO
  - Russia: Stanislav UTTS

More information available in the CIGRE SC C4 Website: https://c4.cigre.org/

27 Regular Members

Arab States of The Gulf	Mohamed ALSHAIKH	2024
Australia	Babak BADRZADEH	2022
Austria	Lukas SCHWALT	2022
Brazil	Ricardo PENIDO DUTTROSS	2024
Canada	Wayne GUTTORMSON	2022
Chile	Bernardo BRAVO	2024
China	Chongru LIU	2024
Denmark	Chris Liberty SKOVGAARD	2024
Finland	HARJULA Antti	2022
France	Yannick VERNAY	2024
Georgia	Teona ELIZARASHVILI	2024
Germany	Mohammad NAZEMI	2024
Ireland	Geoff LOVE	2024
Italy	Cosimo PISANI	2022
Japan	Masahide HOJO	2022
Jordan	Bani Saeed WALA	2024
Netherlands	Peet SCHUTTE	2022
Portugal	Andreia LEIRIA	2022
Romania	Miron ALBA	2024
Slovenia	Janez RIBIC	2020
South Africa	Andreas BEUTEL	2024
Spain	Sergio SANTOS CARRO	2020
Sweden	Christer NORLANDER	2022
Switzerland	Mats LARSSON	2024
Turkey	Melih GUNERI	2020
United Kingdom	Spyros KARAMITSOS	2020
United States	Gaurav SINGH	2022

+3 Additional Members

China	Daochun HUANG	2024
Japan	Naotaka OKADA	2024
United States	Julia MATEVOSYAN	2024

+1 NGN +1 WiE RM

Spain NGN	Alexander GALLARRETA	2024
Jordan WiE	Suad S. AL-MATAR	2024

10 Observer Members

Argentina	Fernando ISSOURIBEHERE	2022
Belgium	Gilles CHASPIERRE	2024
Bosnia Herzegovina	Mladen BANJANIN	2024
Colombia	Ernesto PEREZ	2018
Croatia	Nina STIPETIC	2024
Iran	Mohammad Reza AGHAMOHAM	2024
Peru	Manfred BEDRINANA	2024
Romania	Lucian TOMA	2022
Russia	Alexander SHCHEPOTIN	2024
Thai	Witchaya PIMJAIPONG	2024

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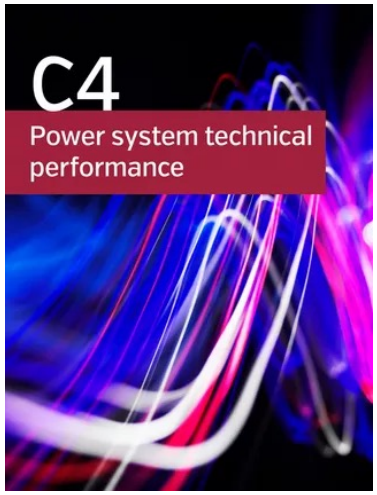
CIGRE UK SC C4 – Organisational Structure

CIGRE UK SC C4 Technical Panel 2024



For nominating new UK C4 TP members - a brief current CV to the CIGRE UK SC C4 RM e-mail: spyros.karamitsos@ieee.org

CIGRE SC C4 – Working Groups

CIGRE SC C4 WGs 2022 – 41 Active WGs; 30 with UK SC C4 Members

Number	Title (RAG Status)	UK Member
WG C4.36	Winter Lightning – Parameters & Engineering Consequences for Wind Turbines	
JWG C4.40/CIRED	Revisions to IEC Technical Reports 61000-3-6, 61000-3-7, 61000-3-13, and 61000-3-14	Emin, Zia Foster, Sarah Koo, Leong Thomas, Dave Djokic, Sasa Vujatovic, Davor
JWG C4.42/CIRED	Continuous assessment of low-order harmonic emissions from customer installations	Djokic, Sasa Moore, Fabian
WG C4.43	Lightning problems and lightning risk management for nuclear power plants	Siew, Wah-Hoon Knott, Robert
WG C4.44	EMC for Large Photovoltaic Systems	Siew, Wah-Hoon
JWG C1/C4.46	Optimizing power system resilience in future grid design	Panteli, Mathaios
WG C4.47	Power System Resilience (PSR WG)	Rapier, Aisling Panteli, Mathaios Skarvelis-Kazakos, Spyros Strbac, Goran Zhou, Yutian
WG C4.50	Evaluation of Transient Performance of Grounding Systems in Substations and Impact on Primary & Secondary System	Negi, Himanshu
WG C4.51	Connection of Railway Traction System to Power Network	Vujatovic, Davor-Convenor Emin, Zia Ghassemi, Forooz
JWG A1/C4.52	Wind generators and frequency-active power control of power systems	Vujatovic Davor, Jamil Shakin
WG C4.54	Protection of high voltage power network control electronics from the High-altitude Electromagnetic Pulse (HEMP)	Hoad, Richard
WG C4.55	EMC related very-fast transients in gas-insulated substations - EMI, measured characteristics, modelling and simulations	James, Jonathan Haddad, Manu
WG C4.57	Guidelines for the Estimation of Distribution OHL Lightning Performance and Application to Lightning Protection Design Scope	Haddad, Manu
JWG C4/C2.58/IEEE	Evaluation of Voltage Stability Assessment Methodologies in Transmission Systems	Awadallah, Selma
WG C4.59	RT Lightning Protection of the Electricity Supply Systems of the Future	
WG C4.60	Generic EMT-Type Modelling of Inverter-Based Resources for Long Term Planning Studies	Li, Rui Vozikis, Dimitrios Nieto Calvo, Alejandro Larkins , Andrew Vaheeshan,Jeganathan Abiri Jahromi, Amir
WG C4.61	Lightning transient sensing, monitoring and application in electric power systems	Siew, Wah-Hoon
JWG B5/C4.61	Impact of Low Inertia Network on Protection and Control	Zhang, Ray - Convenor
JWG: C4/C2.62/IEEE	Review of Advancements in Synchrophasor Measurement Applications	Blair, Steven Clark, Stuart Simmons, Clarke Li, Yun Cowan, Ian L Shams, Negar

Number	Title (RAG Status)	UK Member
WG C4.63	Harmonic power quality standards and compliance verification – a comparative assessment and practical guide	Emin, Zia Shore, Nigel – Convenor Koo, Kah-Leong Pampana, Ramesh Blair, Steven Ghassemi, Forooz
WG C4.64	Application of Real-Time Digital Simulation in Power Systems	Ponnalagan. Bharath Wijesinghe, Sarath
WG C4.65	Specification, Validation and Application of Harmonic Models of Inverter Based Resources	Pampana, Ramesh Monteiro, Jose
WG C4.66	New concept for analysis of multiphase back-flashover phenomena of overhead transmission lines due to lightning	Nurashikin, Jamil
WG C4.67	Lightning Protection of Hybrid Overhead Lines	
WG C4.68	Electromagnetic Compatibility (EMC) issues in modern and future power systems	Ragusa, Antonella Frosinou, Asimina
WG C4.69	Quantifying the lightning response of tower-footing electrodes of overhead transmission lines: methods of measurement	Fabian Koehler
JWG B1/C4.69	Recommendations for the insulation coordination on AC cable systems	
WG C4.70	Application of space-based lightning detection in power systems	Fabian Koehler
WG C4.71	Small signal stability analysis in IBR dominated power system	Tatiana Assis Can Li
JWG C4/B4.72	Lightning and Switching Induced Electromagnetic Compatibility (EMC) issues in DC power systems and new emerging power electronics-based DC equipment	Oheidhin, Gearoid
JWG B4/B1/C4.73	Surge and extended overvoltage testing of HVDC Cable Systems	
JWG B2/C4.76	Lightning & Grounding Considerations for Overhead Line Rebuilding and Refurbishing Projects, AC and DC	
WG C4.73	Insulation Coordination of HVDC Overhead Lines	
WG C4.74	Accurate Line and Cable Models for Steady-State and Transient Studies	Alexander Yanushkevich, Ross Falconer
JWGC4/A3/B2/B4.75	Guide to Procedures for the Creation of Pollution Maps Required for Outdoor Insulation Coordination	
WG C4.76	Protection in Switching Inductive Devices with Vacuum Circuit Breaker	Garret Dakin
WG C4.77	Best practices for individual and collective conformity assessment	Jayaraman Ramachandran Colin Foote
JWG B5/C4.79	Protection Roadmap for Low Inertia and Low Fault Current Networks	
JWG B4/C4.93	Development of Grid Forming Converters for Secure and Reliable Operation of Future Electricity System	Dechao Kong – Convenor Peng, Jinsheng
JWG B4/C4.97	Benchmarking of simulation Models for control interaction in meshed AC networks with multiple converters	
JWG B4/C4.103	AC Network Equivalents for HVDC and FACTS Project Studies	

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CIGRE SC C4 – Working Groups

CIGRE SC C4 WGs 2024 – 2 New and 5 Upcoming WGs

Number	Title (RAG Status)	UK Member
WG C4.77	Best practices for individual and collective conformity assessment Convener Babak Badrzadeh (Australia)	Jayaraman Ramachandran Colin Foote
JWG B4/C4.103	AC Network Equivalents for HVDC and FACTS Project Studies Convener iranya Suriyaarachchi (Canada)	

Latest WG ToR proposals under Review by SC C4 include:

- Development of network equivalents for assessment of large IBR projects and use of EMT for large scale stability analysis in planning and operations timeframes. ToR by Nilesh Modi (AU)
- Interference effects between DC transmission lines and nearby pipelines/ telecom lines. JWG with B2 & B4. ToR by Alain Xemard (FR).
- Insulation Co-ordination of AC/DC hybrid transmission lines: gap analysis in international standards. Task Force led by Hideki Motoyama (Japan)
- System Strength: concept, metrics and approaches for management from planning to real-time operations. ToR by Andrew Halley (AU).
- WG B4. “Guide for Electromagnetic Transient Studies of VSC-HVDC connected offshore wind farms”. Convenor Pierre ULT (FR) - C4 liaison member.

More info on latest active SC C4 WGs in the CIGRE UK Website under the Working Group Opportunities tab:

https://cigre.org.uk/news-2/working-group-opportunities/

For nominating new WG members - a brief current CV to the CIGRE UK SC C4 RM e-mail: spyros.karamitsos@ieee.org

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CIGRE SC C4 – Technical Brochures

CIGRE SC C4 TBs 2021 – 2022; 5 TBs, 4 with UK Members

The following Technical Brochures (TBs) were published in 2023/2024:

- **TB 909: "Guidelines for Subsynchronous Oscillation Studies in Power Electronics Dominated Power Systems", JWG C4/B4.52, 2023.**

UK JWG C4/B4.52 Members: Lapova Elisabetta, Pashaei Afshin

- **TB 913: "Evaluation of Temporary Overvoltages in Power Systems due to Low Order Harmonic Resonances", WG C4.46, 2023.**

UK WG C4.46 Members: Mills David, Munji Kiran, Peng Jinsheng

- **TB 921: "Applying Low-Residual-Voltage Surge Arresters to Suppress Overvoltages in UHV AC Systems", JWG C4/A3.53, 2023.**

UK JWG C4/A3.53 Members: Haddad Manu

- **TB 928: "Multi-frequency stability of converter-based modern power systems", WG C4.49, 2024.**

UK JWG C2/C4.41 Members: Mills David, Ding Xiaoling, Shore Nigel, Emin, Zia.

More info on published SC C4 material and Technical Brochures in e-CIGRE Website: https://e-cigre.org/

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CIGRE SC C4 – CIGRE 2024 Paris Session

CIGRE SC C4 in Paris Session 2024: Paper Session, 1-day Workshop and Tutorial

SC C4 Paper Session comprised of 81 papers covering 3 Preferential Subjects:

- **PS-1:** Power System Dynamic Analysis in the Energy Transition: Challenges, Opportunities and Advances
- **PS-2:** Power Quality (PQ) and Electromagnetic Compatibility (EMC) Analysis in the Energy Transition: Challenges, Opportunities and Advances
- **PS-3:** Insulation Coordination and Lightning Interference Analysis: Challenges, Opportunities and Advances

Number	CIGRE SC C4 Paris Session Paper Title	UK Member
C4 - 11096	Automatic Detection of Subsynchronous Oscillations	D. CHAKRAVORTY A.C. NEAGU J.L. CREMER
C4 - 11099	Framework for Identification of Subsynchronous Oscillations Risks	D. CHAKRAVORTY J. TRIVINO S. ABDELRAHMAN
C4 - 11448	Oscillation Modes Identification Via Singular Value Decomposition and Principal Component Analysis	C. FERRANDON A. ALVAREZ J. CERVANTES Z. EMIN

Joint SC C4/C1 Workshop: "Resilience by Design"

SC C4 Workshop: C4 Green Book – "Power System Dynamic Modelling and Analysis in Evolving Networks"

SC C4 Tutorial: WG C4.68 – "EMC Issues in Modern and Future Power Systems"

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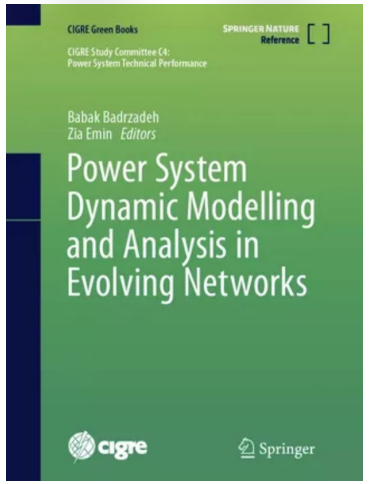
CIGRE SC C4 – 2024 Paris Session Workshop

C4 Green Book - "Power System Dynamic Modelling and Analysis in Evolving Networks"

- One of the 14 CIGRE Green Book series to date - First Green Book led by SC C4
- Completed in 3.5 years with 900 pages, it is the second longest Green Book published to date
- More than 70% of the contents were newly developed, with more than 50 authors, from 11 countries

CIGRE Green Book Contents - Editors: Babak Badrzadeh, Zia Emin	
Part I Changing Power Systems and Impact on Dynamic Phenomena & Analysis	1. Changing Power Systems and Impact on Power System Dynamic Phenomena and Analysis Methods
Part II Power System Studies Under a High Penetration of PE Interfaced Devices	2. Power System Dynamic Studies Under a High Penetration of Power Electronic Interfaced Devices
Part III Power System Dynamic Analysis Tools and Techniques and Their Evolution in Practice	3. Principles and Practical Considerations for the Use of Time-Domain Simulation Software Programs in Power System Dynamics Analysis 4. Practical Examples of the Use of PDT and EMT Simulation Including Their Unique Applications and Complementary Use 5. Screening Methods as Preliminary Calculations to Determine the Level and Type of Dynamic Modeling Required 6. Linear Analysis Methods to Characterize Inherent Small-Signal Behavior of the Plant and Overall Power System 7. Operational Decision Support Tools for System Dynamic Response Awareness in Real-Time and Near-Real-Time Power System Operations
Part IV Model and Data Requirements in Power Systems with a High Share of Power Electronic Interfaced Devices	8. Considerations, Challenges and Evolution in Dynamic Modeling of Synchronous Machines and Inverter-Based Resources 9. Summary of High-Voltage Direct Current (HVDC) Link Models for Operational and Planning System Dynamic Studies 10. Modeling Loads and Distributed Energy Resources with Focus on Wide-Area Power System Dynamic Performance Impact 11. Approaches in Transmission Network Modeling for EMT Dynamic Studies Including the Impact of Relevant Protection Systems
Part V Dynamic System Study Guide from Operations to Planning	12. Grid Interconnection Study Procedures with Practical Examples for IBRs, HVDC and FACTS 13. Power System Planning and Operational Studies in Inverter- Dominated Networks: Interactions and Oscillation Studies, System Strength, and Inertia Determination 14. The Impact of Power System Plants Other Than Large-Scale Generation and Transmission Network on Wide-Area Power System Dynamic Performance Using Case Studies of DER, Microgrids, Industrial Power Systems, and Network Protection Systems
Part VI Confidence in the Accuracy of Plant and Power System Models	15. Model Acceptance Testing 16. Power System Plant and Network Dynamic Model Validation
Part VII Contemporary Enablers on Dynamics in Evolving Power Systems	17. Computational Intelligence-Based Learning Techniques to Handle Uncertainty and Large Data Sets 18. Improving Case Creation Robustness Using Optimisation and Standardisation Techniques



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More info on published SC C4 material and Green Books in e-CIGRE Website: https://e-cigre.org/

G-PST/ESIG Webinar: CIGRE Green Book "Power System Dynamic Modelling and Analysis in Evolving Networks", Wednesday, January 22/2025 @ 9:00 – 10:00pm UK

CIGRE SC C4 – 2024 Paris Session Tutorial and GDM

SC C4 Tutorial - "EMC Issues in Modern and Future Power Systems"

SC C4 Tutorial – WG C4.68 – Topics:

1. Introduction
   - ✓ EMC Basic concepts;
   - ✓ Electromagnetic concepts and quantities;
   - ✓ Electromagnetism and circuit theory.
2. Types of electromagnetic disturbances (EMDs)
   - ✓ Classification of EMDs according to how they arrive to the victim.
3. EMC of the power system, internal and with other systems
   - ✓ EMC of the power system with the natural ambient;
   - ✓ Internal EMC of the power system.
4. Conclusions

✓ Prepared by WG C4.68, Presented by Convenor of WG C4.68 - P. Munhoz-Rojas

C4 General Discussion Meeting - "UK C4 Members Contributions"

PS1 - Power System Dynamic Analysis

- EMT AC Network Modelling for Device Interaction Studies, Colin Foote
- Why SCR is an outdated measure of system strength in a converter dominated network, Colin Foote
- Machine Learning Model for Oscillation Detection, Diptargha Chakravorty
- Can Machine Learning help keep the system secure?, Panagiotis Papadopoulos
- Utilising EMT analysis in designing meshed DC/AC networks, Afshin Pashaei

PS2 - PQ and EMC Analysis

- EPRI GIC Monitoring Network, Zia Emin
- EPRI GIC Model Validation, Zia Emin

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CIGRE SC C4 – Future Events:

CIGRE 2025 Symposium Trondheim (Norway)

Preferential Subjects:

- **PS1:** Integration of renewable energy resources to the grid
- **PS2:** Technologies supporting the power grid for energy transition to carbon neutral energy production

CIGRE (NRCC) International Symposium

Trondheim, Norway | May 12–15, 2025

Call for Papers

Changes needed in the power system for the energy transition

KEY DATES:

- **Call for papers** – March 18, 2024
- **Registration starts** – August 1, 2024 - Registration and information here: https://cigrenrccsymposium2025.com/
- **Deadline for Synopses in ConfTool** – September 12, 2024
- **Selection of synopses by SCs and information to authors** – October 7, 2024
- **Received and reviewed 357 synopses from 41 different countries**
- **Deadline for full papers** – February 3, 2025
- **Acceptance and other feedback to authors of full papers** – March 3, 2025
- **Final papers to ConfTool** – April 7, 2025

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CIGRE SC C4 – Future Events:

CIGRE 2025 Symposium Montreal (Canada)

“Grid Enhancement, Strategic Planning, Technological Innovation and Climatic Adaptation for Resilient Future Energy Systems”

KEY DATES

Opening of the upload for abstracts	Sept. 10, 2024
Deadline for Synopses	**Nov. 27, 2024**
Selection of synopses by SCs and information to authors	Jan. 27, 2025
Deadline for full papers	April 25, 2025
Opening of registrations	**Spring 2025**
Feedback to authors of full papers	June 13, 2025
Final papers	July 11, 2025
CIGRE Symposium	Sept. 29-Oct.2, 2025

Preferential Subjects:

- **PS1:** System Enhancement, Markets and Regulation
- **PS2:** Application of Technologies, IT and AI
- **PS3:** Climate Change and Extreme Weather Events
- **EHV & UHV AC and DC**

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CIGRE SC C4 – Future Events:

CIGRE 2026 Paris Session (France)

C4 - Preferential Subjects:

- **PS1**: Power System Dynamics Aspects of Decarbonization of Power Systems and the Road to Net-Zero
  - Emerging methodologies for plant and system-wide modelling, model validation, advanced data analyses, screening methods and metrics, study processes and performance monitoring.
  - Power system impact of new technologies including storage, large scale inverter-based generators, loads (e.g. electrolysers), network elements and control methods (e.g. grid forming), including relevant specifications.
  - Phenomena impacting PS security and dynamic performance - e.g. wide-area, local interactions and forced oscillations.
  - Demystifying system strength
- **PS2**: Power Quality and EMC Aspects of Decarbonization of Power Systems and the Road to Net-Zero
  - Modelling and simulation for assessment of EMC and PQ phenomena and mitigation strategies in meshed transmission systems.
  - Experiences with Power Quality issues in IBR dominated systems, utilization of advanced data analytics to analyse measurements and trends. Approaches for allocation of power quality limits and compliance of new connections to power systems.
  - Experiences with EMI for large converter connected generators and loads and interference between the power system (AC or DC) and pipelines and telecom systems.
- **PS3**: Insulation Co-Ordination and Lightning Research: Paving the Way to Net-Zero in Decarbonized Power Systems
  - Future of insulation co-ordination for AC, DC and hybrid systems addressing non-standard waveforms and enhancing the resilience of power system equipment against transient disturbances.
  - Improvement of lightning detection systems, with a focus on the integration of lightning warnings and weather data into grid control rooms related to power system reliability.
  - Lightning protection designs and accepted risk of damage in particular to inverter-based resources, such as large photovoltaic and wind power plants, and assessment of the impact of thunderstorms and extreme weather events.

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Thank You!

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For more information:
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Spyros Karamitsos
Chair of CIGRE UK Study Committee C4,
UK Lead Grid and System Studies Manager at SPR

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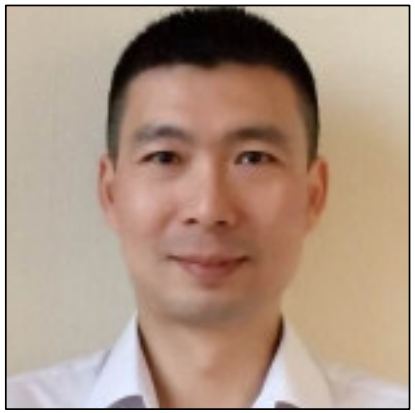
AGENDA

CIGRE UK Study Committee-C4 Liaison Meeting & Technical Event 2025

Developments and Challenges in Grid Integration and Power Systems Stability

Time	Topic	Presenter
10:50	**CIGRE and Energy Innovation: Technical Committee Introduction**	**Dr James Yu**, Chair of CIGRE UK Technical Committee



Dr James Yu is a charted engineer and an elected Fellow at IET (Institute of Engineering and Technology) and Royal Society of Edinburgh. He chairs Technical Committee for CIGRE, UK.

James joined the UK electricity transmission/distribution industry after he finished his studies from Newcastle upon Tyne. He has taken various technical, commercial and managerial roles in the industry since 2003.

James has been the principal investigator for 11 flagship innovation projects at the UK and EU level to facilitate the low carbon transition for the electricity sector with a portfolio over £150m.

His focus includes data sharing infrastructure, system stability, power electronics, pushing the innovation into business as usual.

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Time	Topic	Presenter
11:00	**Clean Power 2030, Power System Stability Challenges**	**Dr Xiaoyao Zhou**, Operability Policy Manager at National Energy System Operator (NESO), Honorary Professor at the University of Birmingham

Dr Xiaoyao Zhou is the Operability Policy manager of National Energy System Operator (NESO). He has two decades of transmission system operation, planning and investment experience.

His role is to set out operability policy for Great Britain's electricity network to enable the net zero operation, specify the Grid Code technical requirements for new technologies and define future network needs so that market and network owners can invest in the right solutions at the right time.

Dr Xiaoyao Zhou is also an Honorary Professor in University of Birmingham, UK.

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Time	Topic	Presenter
11:30	**Overview of CIGRE TB 909: "Guidelines for Sub-synchronous Oscillation Studies in Power Electronics Dominated Power Systems", JWG C4/B4.52**	**Dr Afshin Pashaei**, Power Quality & Dynamic Performance Manager at National Grid, UK Member of the CIGRE JWG C4/B4.52

Dr Afshin Pashaei holds a PhD in Voltage Source Converters (VSC) and is a subject matter expert in VSC HVDC, specialising in developing control algorithm, EMT based dynamic performance and power system studies.

Dr Afshin Pashaei is Network Operability Specialist at National Grid UK, where he plays a pivotal role in ensuring the operability of PE dominated power system networks.

As an active member of CIGRÉ, Afshin is the convenor of the B4.89 working group and has published numerous technical papers in IEEE, IET, and CIGRÉ. He is also a Fellow of the IET and serves as the industry liaison for the IEEE UK and Ireland Power and Energy Society Chapter.

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Time	Topic	Presenter
10:30	**Welcome from the Regular Member the CIGRE UK Study Committee C4 - Event Introduction & Overview of CIGRE SC C4 Activities and Updates, incl. Paris Session 2024**	**Dr Spyros Karamitsos**, Chair-Elected Regular Member of CIGRE UK Study Committee C4, UK Lead Grid and System Studies Manager at Scottish Power / Iberdrola (SPR/IBR)
10:50	**CIGRE and Energy Innovation: Technical Committee Introduction**	**Dr James Yu**, Chair of CIGRE UK Technical Committee
11:00	**Clean Power 2030, Power System Stability Challenges**	**Dr Xiaoyao Zhou**, Operability Policy Manager at National Energy System Operator (NESO), Honorary Professor at the University of Birmingham
11:30	**Overview of CIGRE TB 909: "Guidelines for Sub-synchronous Oscillation Studies in Power Electronics Dominated Power Systems", JWG C4/B4.52**	**Dr Afshin Pashaei**, Power Quality & Dynamic Performance Manager at National Grid, UK Member of the CIGRE JWG C4/B4.52
12:00- 12:30	**Q&A - Break - Networking Lunch**	

Questions:

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Developments and Challenges in Grid Integration & Power Systems Stability

CIGRE UK SC C4 Technical Event – 21st January 2025

Hosted by CIGRE UK at Scottish Power HQ, Glasgow, UK

Break – Back at 12:30

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AGENDA	CIGRE UK Study Committee-C4 Liaison Meeting & Technical Event 2025 Developments and Challenges in Grid Integration and Power Systems Stability	
Time	**Topic**	**Presenter**
12:30	**Advancing Grid Stability, System Modelling and Risk Mitigation Techniques in Power Systems - Insights from the National HVDC Centre**	**Ben Marshall**, HVDC Technology Manager at The National HVDC Centre **Dr Colin Foote**, Senior Simulation Engineer at The National HVDC Centre **Dr Dong Chen**, Senior Simulation Engineer at The National HVDC Centre

Benjamin Marshall oversees the team of Simulation Engineers undertaking detailed HVDC simulation studies in real-time using vendor-supplied replica hardware, to understand multi-infeed, multi-terminal and multi-vendor HVDC operation and interactions, for real schemes in GB; interpreting the results to gain insights to improve the design and operation of HVDC schemes and their associated protection. Ben previously has had a 23 year long and varied career within National Grid with a broad range of experience, particularly with respect to the analysis of the operation and design of the AC and DC transmission systems. He has experience in both offline and real-time EMT simulation and in modelling of convertors across battery, solar wind and HVDC systems; he has deep understanding of dynamic stability of power systems and how that relates to device performance.

Dr Dong Chen is a Senior Simulation Engineer and the lead of academic engagement at the National HVDC Centre. He is currently leading a team to de-risk the 1st multi-vendor-multi-terminal HVDC grid of UK by building real-time digital model for demonstration, developing control philosophies, proving specification methodologies and have led 3 patents in this area. His technical expertise also extends to control of voltage source converter and power system stability. He is a senior member of IEEE Power and Energy Society and serves as an associate editor for the academic journals of IET Power Electronics and IEEE Transactions on Power Delivery.

Ben Gomersall currently works at The National HVDC Centre as a Senior Simulation Engineer leading a team and overseeing a portfolio of project on HVDC, grid forming and network design. He is also responsible for real time hardware and software management at the HVDC Centre. Previously Ben worked for over 10 years at National Grid and National Grid ESO on stability analysis, power quality and generation connections. Ben graduated with a master's degree in electrical engineering from Durham University.

The National HVDC Centre

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AGENDA	CIGRE UK Study Committee-C4 Liaison Meeting & Technical Event 2025 Developments and Challenges in Grid Integration and Power Systems Stability	
Time	**Topic**	**Presenter**
13:00	**Stability Challenges in Converter Dominated Networks**	**Prof Agusti Egea Alvarez**, Network Operational Performance Manager at Scottish Power Energy Networks (SPEN), Professor at the University of Strathclyde

Dr Agustí Egea-Àlvarez is a Professor at the electronic & electrical engineering department and a member of the PEDEC (Power Electronics, Drives and Energy Conversion) group. Also, he is Network Operational Performance Manager in Scottish Power Energy Networks.

He obtained his BSc, MSc and PhD from the Technical University of Catalonia in Barcelona in 2008, 2010 and 2014 respectively.

In 2015 he was a Marie Curie fellow in the China Electric Power Research Institute (CEPRI).

In 2016 he joined Siemens Gamesa as converter control engineer working on grid forming controllers and alternative HVDC schemes for offshore wind farms.

He is a member of IEEE, IET and has been involved in several CIGRE working groups.

AGENDA	CIGRE UK Study Committee-C4 Liaison Meeting & Technical Event 2025 Developments and Challenges in Grid Integration and Power Systems Stability	
Time	**Topic**	**Presenter**
13:30	**Addressing the Complexity and Uncertainty in Future Power System Dynamic Behaviour**	**Dr Panagiotis Papadopoulos**, Reader (Associate Prof.) at the University of Manchester

Dr Panagiotis Papadopoulos is a Reader (Associate Prof.) in the Department of Electrical and Electronic Engineering at the University of Manchester and a UK Research and Innovation Future Leaders Fellow working on “Addressing the complexity of future power system dynamic behaviour”.

He received the Dipl. Eng. and Ph.D. degrees from the Department of Electrical and Computer Engineering at Aristotle University of Thessaloniki, in 2007 and 2014, respectively.

From 2014-2017, he was a post-doctoral Research Associate at the University of Manchester and in 2017, he joined the University of Strathclyde as a Lecturer.

His research interests are in the area of power system stability and dynamics under increased uncertainty, introduced due to the integration of new technologies. He is also interested in power system applications of machine learning to tackle complex problems related to power system stability.

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Time	Topic	Presenter
12:30	**Advancing Grid Stability, System Modelling and Risk Mitigation Techniques in Power Systems - Insights from the National HVDC Centre**	**Ben Marshall**, HVDC Technology Manager at The National HVDC Centre **Dr Colin Foote**, Senior Simulation Engineer at The National HVDC Centre **Dr Dong Chen**, Senior Simulation Engineer at The National HVDC Centre
13:00	**Stability Challenges in Converter Dominated Networks**	**Prof Agusti Egea Alvarez**, Network Operational Performance Manager at Scottish Power Energy Networks (SPEN), Professor at the University of Strathclyde
13:30	**Addressing the Complexity and Uncertainty in Future Power System Dynamic Behaviour**	**Dr Panagiotis Papadopoulos**, Reader (Associate Prof.) at the University of Manchester
14:00 - 14:30	**Q&A - Comfort/Coffee Break**	

Questions:

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Developments and Challenges in Grid Integration & Power Systems Stability

CIGRE UK SC C4 Technical Event – 21st January 2025

Hosted by CIGRE UK at Scottish Power HQ, Glasgow, UK

Break – Back at 14:30

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AGENDA	CIGRE UK Study Committee-C4 Liaison Meeting & Technical Event 2025 Developments and Challenges in Grid Integration and Power Systems Stability	
Time	**Topic**	**Presenter**
14:30	**Identification of IBR-driven Subsynchronous Oscillations - Overview of CIGRE 2024 Paris Session Papers SC C4-11096, SC C4-11099**	**Dr Diptargha Chakravorty**, Principal Consultant at SIEMENS Energy

Dr Diptargha Chakravorty is a Principal Consultant with Siemens Energy, renowned for his expertise in power system stability and controller interaction studies.

Prior to his current role, Dr Chakravorty served as the Head of Innovation at TNEI, where he collaborated closely with UK Network companies on numerous innovation projects, providing technical leadership.

His contributions extend to the international arena as an active member of several working groups, including the recent CIGRE B4/C4.97.

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CIGRE UK Study Committee-C4 Liaison Meeting & Technical Event 2025

Developments and Challenges in Grid Integration and Power Systems Stability

Time	Topic	Presenter
15:00	**Harmonic Power Quality Standards and Compliance Verification - Works of the CIGRE WG C4.63, Oscillation Modes Identification via SVD and PCA - CIGRE 2024 Paris Session Paper SC C4-11448**	**Dr Kah-Leong Koo**, Technical Director - Power System Studies at Power Systems Consultants (PSC) **Dr Carlos Ferrandon**, Senior Strategic Advisory Consultant at Power Systems Consultants (PSC)

Dr. Kah Leong, Koo is currently the Technical Director, Power System Studies with PSC UK. He is a chartered engineer with over 20 years' experience working in the utility, energy consulting and research and development environment.

He has been involved in all areas of power system studies and conducted studies related to power quality and transients in many recent projects. His main interest lies in power systems modelling and studies focusing in areas of power quality, rms transient stability and electromagnetic transients. His interest areas align perfectly with the main technical areas within CIGRE Study Committee C4 for System Technical Performance where he was the representative for the UK from 2016-2020.

He has contributed to many CIGRE WGs – C4.112 on Guidelines for Power Quality (PQ) monitoring, C4.24 on PQ and EMC issues for future networks, C4/C6.29 on Power Quality aspects of PVs, C4/B4.38 on Network modelling for harmonic studies, B4.68 on DC harmonics and filtering in HVDC transmissions and currently the UK RM for C4-63.

Dr Carlos Ferrandon is an Electrical Engineering Consultant with 7 years of research experience, and 7 years of industry work experience, from the distribution layer to the transmission system operator.

He has experience on power systems operations planning and security analysis of power systems, both deterministic and under a stochastic environment.

His research interests are power system optimisation studies, transient stability analysis with emphasis on low-inertia grids, out-ot-step protection studies, and recently the application of machine learning techniques to power systems data analysis.

Carlos is a control room operator by training and practice.

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AGENDA	CIGRE UK Study Committee-C4 Liaison Meeting & Technical Event 2025 Developments and Challenges in Grid Integration and Power Systems Stability	
Time	**Topic**	**Presenter**
15:30	**Grid Integration Challenges for Co-locating BESS with existing Onshore Windfarms in Scotland, Overview of CIGRE TB 913: "Evaluation of Temporary Overvoltages in Power Systems due to Low Order Harmonic Resonances", WG C4.46**	**Dr Isaac Gutierrez**, Principal Electrical Engineer - Control and Grid Integration team - UK Technical Services SPR **Kiran Munji**, Grid Services Manager at Scottish Power (SPR)

Dr. Isaac Gutierrez works as a Principal Electrical/Grid Engineer for Grid Integration matters at ScottishPower Renewables in the UK and has over 20 years of experience in the renewable energy sector.

His main areas of expertise include ensuring grid code compliance of onshore and offshore windfarms, BESS; STATCOM design review, installation, and site testing.

He has been an active member of GB Grid Code working groups in the UK, including those on grid forming and modelling. Most recently his work has focused on enabling a windfarm to operate in grid forming mode and demonstrate the provision of black start services.

Dr Isaac Gutierrez received his BSc in Electrical-Mechanical Engineering from the Department of Electrical Engineering at the Technology University of Panama in 1996. In addition, he received his MSc and PhD degrees from Kanazawa University of Japan in 2002 and 2005 respectively. Dr Isaac Gutierrez is a member of the IET in the UK and IEEE.

Kiran Munji received his Diploma and Bachelors degree in Electrical Engineering in 2000. He recieved his Masters degree in Power Systems from Mumbai University in 2008.

He has nearly two decades of experience in the field of Power System Analysis and Electrostatic analysis of High voltage equipment.

He is currently working as a Grid Services Manager with Scottish Power Renewables.

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Time	Topic	Presenter
14:30	**Identification of IBR-driven Subsynchronous Oscillations - Overview of CIGRE 2024 Paris Session Papers SC C4-11096, SC C4-11099**	**Dr Diptargha Chakravorty**, Principal Consultant at SIEMENS Energy
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16:15 - 16:30	**Q&A - Session Closing Remarks - AOB**	

Questions:

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Developments and Challenges in Grid Integration & Power Systems Stability

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Hosted by CIGRE UK at Scottish Power HQ, Glasgow, UK

Thank You – Closing Remarks

Spyros Karamitsos
Chair of CIGRE UK Study Committee C4,
UK Lead Grid and System Studies Manager at SPR

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