circe
CENTRO DE INVESTIGACIÓN DE RECURSOS Y CONSUMOS ENERGÉTICOS

TECHNOLOGICAL SERVICE

Electrical studies
Electrical Grids & Smart Grids

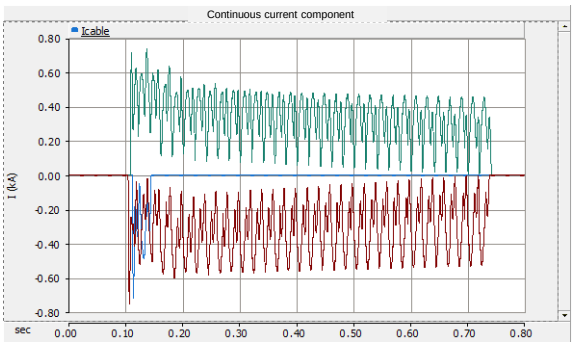
CIRCE has more than 15 years of experience in electrical power system modelling and simulation. We have the software tools required to carry out every kind of grid analysis and we are able to adapt to the needs of each of our customers.

Service Offer

- ✓ Renewable and conventional electrical power system modelling and simulation.
- ✓ Transient analysis.
- ✓ Verification of the requirements fulfilment for power generation grid connection
  - ✓ Load flows
  - ✓ Short-circuits
  - ✓ Instruction tracking
  - ✓ Grid quality
  - ✓ LVRT & HVRT
- ✓ Field tests: grid code compliance verification.
- ✓ Mobile test lab design, modelling, simulation and operation.
- ✓ FACT devices modelling.
- ✓ Generation connection to electrical grid impact.
- ✓ Ground connection and isolation coordination analysis.
- ✓ Electrical lines repowering.
- ✓ Conventional power plant control systems identification and characterisation.
- ✓ Static and dynamic load modelling and characterisation.

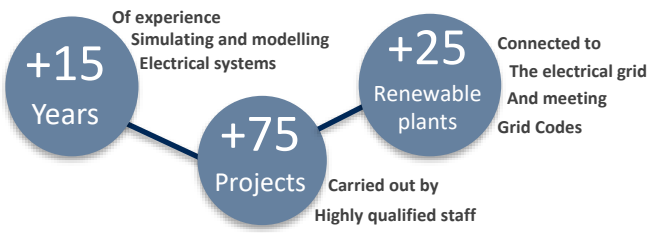
BENEFITS

1. Detection of the non-fulfilment of power generation system requirements before their start-up.
2. Provide with models that emulate power generation systems real behaviour.
3. Development of operation strategies that enable to optimise the exploitation of already working installations.
4. To understand phenomenon that occur in electrical systems and to seek solutions in order to improve their operation.



VRT analysis –zero-missing

Key figures



Aimed to

System operators, power generation systems manufacturers, engineering companies, electrical companies, power generation plants developers, etc.

Simulation Tools

- ✓ PSS/E (SIEMENS), DIgSILENT Powerfactory, PSCAD/EMTDC, etc.

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Most demanded analysis

POWER GENERATION SYSTEMS CONNECTION TO GRID IMPACT ANALYSIS: Grid code compliance verification.

- ✓ **Load flows:** voltage profiles, losses, load level, tap optimal adjustment, etc.
- ✓ **Short-circuits:** short-circuit current rise in the PCC.
- ✓ **Power Quality:** harmonics level and flicker in the PCC, according to IEC 61400-21, resonance, imbalances, etc.
- ✓ **LVRT/HVRT:** evaluation of the reaction agaisnt low and high voltage perturbances.
- ✓ **P-f regulation:** response of the renewable installation to frequency changes and active power instruction tracking.
- ✓ **Q-V regulation:** response of the renewable installation to voltage changes and reactive power instruction tracking.
- ✓ **Voltage changes caused by inrush current:** maximum voltage drop caused by transformer energising and possible connection strategies aimed to minimise it.

POWER GENERATION SYSTEMS MODELLING

CIRCE has ability and experience in electrical systems modelling in general. Due to its long career, CIRCE offers his customers the possibility to adapt to the available information in order to achieve the optimum model for every situation.

- ✓ Wind farms modelling
- ✓ Solar plants modelling
- ✓ Hydraulic power plants modelling
- ✓ Thermal power stations modelling
- ✓ Cogeneration power plants modelling

WORK REFERENCES

CIRCE has a renowned experience in the execution of works regarding grid analysis, both at national and international level. CIRCE has collaborated with the following companies:

SISENER INGENIEROS S.L.

acciona Energía

RED ELÉCTRICA DE ESPAÑA

Some of the countries CIRCE has worked in are: Mexico, the United Kingdom, Romania, Costa Rica, Italy, Austria, EE.UU. Namibia, Senegal, etc.

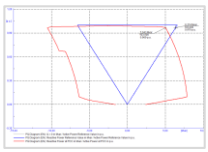
FIELD TESTS: Grid code compliance verification.

- ✓ CIRCE is able to carry out voltage gap, overvoltage, frequency changes, phase differences, flicker and harmonics tests in power generation systems and FACT devices, according to different Grid Codes.

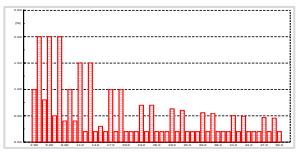
ELECTROMAGNETIC TRANSIENTS SIMULATION

Thanks to the advanced simulation tools usage, CIRCE is able to carry out the analysis of electromagnetic transients in electrical power systems. For example:

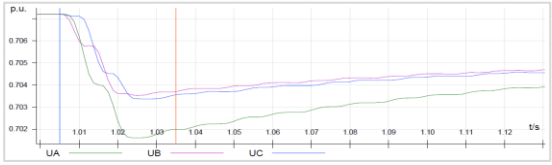
- ✓ **TRV analysis:**
  - Zero-missing phenomenon analysis, after the energising of submarine and underground links.
  - Adjustment of the controlled closure switch automatism in order to minimise the effect and to allow the opening after the energising in case of failure.
  - Longitudinal overvoltages and restart phenomenon analysis.



PQ requirements fulfilment verification



Harmonics content evaluation



Voltage drop caused by inrush current in the transformer energizing (?)

R+D projects carried out in this field:

- BESTPATHS – European project for the implementation of 5 demonstrators which help remove barriers in high renewable penetration scenarios in the pan-European transmission grid.
- IRPWIND – European project that aims to find solutions to accelerate the transition to a high wind power penetration scenario.
- AZIMUT – Wind Offshore Power 2020. (CENIT Programme) Offshore power generation technologies. CIRCE carried out the development, analysis, modelling and simulation of new wind turbine concepts.

CONTACT

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