Increased demands for higher fidelity, real-time simulation of balance of plant systems has created the need for improved electrical generation and distribution models. Whether you are producing power destined for the grid or serving your internal industrial plant load, today’s changing electric energy marketplace has put additional emphasis on an operator’s understanding and ability to produce power exactly when and where it is called for.

JElectric, GSE Systems’ electrical generation and distribution modeling software, meets the needs of nuclear, fossil and industrial users by offering an accurate, high-fidelity simulation of complex AC and DC plant systems. As a part of GSE’s JADE environment, JElectric shares our single graphical user interface and offers the portability of a truly platform independent software tool.

**Benefits**

JElectric supports useful and rigorous operator training and engineering evaluation of plant electrical generation and distribution systems through:

- Increased fidelity of the model...assuring steady state and dynamic accuracy
- Graphical, drag and drop user interfaces...simplifying model development
- Ease of long-term maintenance...keeping the model true to current plant design

**Functionality**

JElectric brings a fundamental change to the traditional simulation methodology for electrical distribution systems. Unlike other solvers, it is not a tedious logic or sensitive sequential model solver. JElectric uses Kirchoff’s current law and the Norton equivalent circuit along with complex variable calculations to deliver higher fidelity than all comparable models.

By using a network matrix solution in a complex equation form, JElectric accurately calculates the interaction between electrical components and provides realistic values for:

- Voltage
- Phase
- Frequency
- Real, imaginary and total current
- Real and reactive power
This enables JElectric to successfully simulate phenomena such as:

- Multiple voltage levels per the plant single line diagram
- Dynamic fault propagation
- Paralleling of multiple source and load combinations
- Bi-directional computation of current and power (e.g., a source can be a sink under certain conditions)
- Transformer back feed from lower to higher potentials
- Accurate generator model responses for
  - Steady state transients and load changes
  - Out of phase synchronization
  - Pole slipping due to loss of excitation
- Effect of connecting multiple generators and the grid
- Load rejection and islanding
- Degraded DC voltage conditions
- Multiple networks interfacing

**Implementation**

JElectric is an auto code generator which is integrated with a drag and drop graphical user interface. The tool creates all the modeling code, database definitions, constant values, and initial conditions through the graphic screen. By constructing a network system diagram, a simulation model is a series of button-clicks away.

Configuring an electrical system is basically transferring the plant single line diagram using the graphical user interface. To construct a diagram, icons are provided in a library. These icons are the typical building blocks of electrical systems. Specific plant data can then be entered via the pop-up windows associated with the icons.

For the user it is now possible, even for very complex electrical systems, to quickly produce simulation code with minimum errors. This is true even though the resultant code is of a much higher fidelity. The auto code generation and documentation features allow for easier maintenance and modification thus extending the useful life of the model, simulator and training program.

JElectric, as a part of GSE’s JADE environment, allows system drawings to be viewed on any instructor, trainee, or engineer’s JStation. For greater model usability, JADE also provides for JElectric portability across Microsoft, Linux, and UNIX operating systems.

**Summary**

As the leader in real-time power plant simulation, GSE Systems is dedicated to providing easy to use technology for the training of nuclear, fossil and industrial operators on the most realistic simulators possible.

JElectric, one component of GSE Systems’ JADE environment, provides high-fidelity simulation of plant electrical generation and distribution systems. When JElectric is coupled with high-fidelity plant models for a primary system, boiler, turbine, main steam loop and BOP, the trainee or engineer is exposed to true interactions and relationships between electrical and thermohydraulic systems.