Electrical Transient Analyzer Program

Electrical Transient Analyzer Program (**ETAP**) is an electrical network modeling and simulation software tool[1] used by power systems engineers to create an "electrical digital twin" and analyze electrical power system dynamics[2], transients and protection.[3]

ETAP originated in the (postdoctoral) thesis of Dr. Farrokh Shokooh at Louisiana State University in the mid 1970s. ETAP was improved and used by Dr. Shokooh while he worked at Fluor Corporation[4] and he founded Operation Technology, Inc. in 1986 for commercial and nuclear utilization of ETAP for power system analysis [5] and system operations.

Power system simulation requires an electrical digital twin consisting of a power system network model that includes system connectivity, topology, electrical device characteristics, historical system response and real-time operations data in order to make offline or online decisions. ETAP power engineering software utilizes an electrical digital twin in order for electrical engineers and operators to perform following studies in offline or online mode:

- Load flow or power flow study[6]
- Short circuit or fault analysis[7]
- Protective device coordination, discrimination or selectivity[8]
- Transient or dynamic stability [9].
- Substation design and analysis[10]
- Harmonic or power quality analysis[11]
- Reliability[12]
- Optimal power flow
- Power system stabilizer tuning[13]
- Optimal capacitor placement[14]
- Motor starting and acceleration analysis[15]
- Voltage stability analysis[16]
- Arc flash hazard assessment[17]
- Ground loop impedance calculation[18]
- Battery modeling and simulation[19]

Software applications

ETAP software applications include:

- Power system design for ANSI and IEC networks[20]
- Electric supply substation simulation[21]
- Monitoring and feeder analysis[22]
- Simulation of distributed photovoltaic power[23]
- Study of a DC network[24]

- Open-phase fault analysis[25] - Multiple events across the nuclear power industry have highlighted the need for greater understanding of what happens during an open phase fault. These open phase events have occurred on the high side of offsite power supply transformers and have involved loss of one or two phases.
- Diesel power plant analysis[26]
- Combined cycle power plant analysis[27]
- AC-DC hybrid system simulation[28]
- Wind turbine design and analysis[29]
- Harmonics in railway power systems[30]
- Rural distribution system analysis[31]
- Distributed generation protection[32]
- Reliability assessment of renewable energy systems[33]
- Wind and PV penetration studies[34]