Electric Energy Distribution Network Analysis Program
( PADEE )

Author: Ing. Jorge Matheus

www.padeepro.com/padeeing.html
Ingeniería y Construcción MATMOR was formed in 1998 with 30 years of engineering staff experience in Electric Energy Distribution Projects, Transmission and Substations. All this experience was continuously used in developing PADEE software.

MATMOR also does electrical works inspection and minor construction projects.

It also helps clients with budgeting, buying, and receiving electric power equipment and computer hardware and software.
PADEE is a group of tools in CAD, CAE y GIS to do all calculations and load flow analysis inside the distribution network maps environment. It also strongly support works executions, and customers offices tasks.

- Information Systems
- Analysis Systems
- Work budgeted
PADEE Highlights

- Covers and integrates Planning, Operation, Projects, Commercial and Maintenance areas with a unique and coherent data base easy to visualize
- Use simple methodologies.
- Computer Hardware requirement is low.
- Quick Learning curve
- More than 300 seats in use
- Easy to buy for consulting companies and publics utilities companies due to Flex Licenses opportunities
Intelligent Map Design Program (IMP)

It uses AutoCAD drawing engine to make network maps easy to draw, share and maintain with a very fast learning curve.

Take advantage of AutoCAD's layers and symbols.
The information needed to make all kind of analysis is available in networks maps, and these maps are already inside a computer (Autocad drawing), PADEE take advantage of this and use the computer to extract the distance, loads, capacities and other data available in the map and transfer into the analysis programs automatically and transparent to Users.

- **Maps Type**
  - Streets and parcels
  - Electric Network
  - Equipment Locations
  - One Line Diagrams and schematics drawings

- This programs use the same visual symbols we had use for many years and but it may be customize to local drawing standards

- **Layers and Blocks to makes maps**

- **Drawing Procedures to make intelligent maps**
  - Distances, Conductor Sizes, R y X
  - Transformers Capacities, switches, cut-outs and other equipments
PADEE programs are called and loaded using “pulldown menus” or icons toolbars. Symbols are selected graphically from specials libraries menus.
Equipment Information and Photo (EIPP)

- Equipments in maps are linked to image, Excell Data, movie, or any other kind of multimedia documents. As example, pole may be photograph and linked to the network map.
- With this program you may click the symbol in map and it will deploy the information.
All analysis are inside the maps. PNAP results are graphics. It use “Flags” or colors to highlight problems at points or sections. Tabular results is just for detailing results and are similar to older programs.
Primary Network Analysis Programs (PNAP) – Automatically Feeder COLORED
CIRCUITO: 1  Canales PTA. DEL OESTE

- **Caida de tension**
- **Ampellos**
- **Pérdidas**

**Longitud total del circuito**: 49.57 (Km)
**Longitud total del troncal**: 12.86 (Km)
**Pérdidas total del circuito**: 710.10 (Kw)
**Pérdidas total del troncal**: 897.00 (Kw)
The following analysis may be performed:

- Load Flow and profiles graphics results (voltage, loads, losses in each feeder sections and summaries)
- Capacitor Locations by minimum loss or minimum voltage drop criteria.
- Short Circuit calculation, three phase, two phases, two phase to ground and single phase to ground.
- Substation placing by load center criteria.
Secondary Network Analysis Program (SNAP)

Calculates operation conditions of secondary network base on customers loads linked to poles and taking data directly form maps. Perform load flow calculation for low voltage network

Results are output with a simple diagram as shown on right side figure. Highlights are show directly on map.
**Customers Programs (CP)**

Customer Data is Linked to Poles and Parcels in maps.

<table>
<thead>
<tr>
<th>POLE ID</th>
<th>METER/STATUS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1036</td>
<td>B</td>
</tr>
<tr>
<td></td>
<td>C</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>ACCOUNT</th>
<th>NAME / ADDRESS</th>
<th>USED ENERGY</th>
</tr>
</thead>
<tbody>
<tr>
<td>11011010</td>
<td>FIANCO DE TARDE, GERTRUDIS E</td>
<td>2500.00</td>
</tr>
<tr>
<td></td>
<td>CALLE BOLIVAR ENTRE CALLE</td>
<td>2344.00</td>
</tr>
<tr>
<td></td>
<td>ROSCIO Y CALLE PIAR</td>
<td>2455.00</td>
</tr>
<tr>
<td></td>
<td>2600.00</td>
<td>3101.00</td>
</tr>
<tr>
<td></td>
<td>2600.00</td>
<td></td>
</tr>
</tbody>
</table>
TLMP obtain transformer loads from low voltage networks, it uses the relation made by SNAP and CP to get energy use by consumers. It sums all the energy use by consumers using factor “K” to get transformer bank total demand. It may reverse the analysis with an instant measure to get estimate energy dispatch by transformer bank, and estimated non-technical losses.
DFC make easy the hard work needed to input the land use data base. It also help to correlate present demand with estimated demands in small areas. May produce small area demand history.
- Has more than 150 relay type and fuse curves
- Symbols Library to aid one-line diagrams
- Curve, CT Dial and TAPS Data Automatic Identification
• Take data directly form Topographic Survey Notebook
• Do the mathematics
• Draw the topographic profile
• It has the tools with catenaries curves to manual pole placing.
• Calculates the exact catenary's conductors curve with the placed supporting structures or poles. Calculates medium span. Weight spam and real parameter, and other.
- Produce the Bill of Materials
- Work construction units
- Work Budged and other reports
- Can run stand alone or work with Autocad maps.
Energy Losses Program
No technical Losses (ELP)

- Distribute dispatched energy proportional to transformer bank demand
- Compare Dispatched Energy Vs Billed Energy
  - By small area (square area)
  - By Feeder
  - By distribution transformer
  - By Large areas
- Permit visual comparison of energy consumption between houses with similar characteristics

- Green Parcels are consumers with more than 500 kWh monthly, the rest are billing less with unknown reason
Inventory, Street Light and other service Program (NILOP)

- Directly form autocad map or stand alone
- Pole by Pole inventory and auditing
- Materials and equipment in bad shape
- Street Light auditing
- Pole rent to support other public service like, phone, Cable TV, and others
Distribution Network Manintenance Program (DNMP)

• Directly from autocad map or stand alone
• Pending Maintenance Report
• Maintenance Done Report
• Equipment and Material statistic Problems reports
• More frequently actions reports
Interruptions and Operations Programs (IOP)
Scada Interface Programs (SIP)

- The interface “shoot” events into the network map, to visualize automatic switching events.
- Visualize Status from automatic switching device.
Produce a graphic visualization of transformer banks demand readings and colors “marks” depending of transformer utilization factors.
Show vehicle position on top of distribution network map in order to improve operation and reduce outages time.
Locate over the network map historic faults by its cause, in order to make maintenance plans.
Locate over the network map pending claims, in order to locate branches faults or fault origin. Help a lot in massive events.

In figure shows an example of possible fault origin.
• Stand alone or Multiple Licenses or corporative licenses were no limitation on number of users.

• First version are operating since 25 years ago.

• PADEE have help optimized network planning in rural areas, urban areas, agricultural areas, tourist areas, industrial areas and petroleum areas.

• Use AUTOCAD as drawing platform. This is the best seller cad software in the world.

• It may work with online diagram where not maps are available

• Link High and Low Voltages, and customer analysis in one software.
Main Characteristic

- Keep distribution network information reliable, updated and Centralized.
- Produce and update and coherent information
  - Intelligent, digital and automated Network maps
  - Locate clients or customers geographically and link them to the electric network
  - Keep a geographic reference historic load demand
- Reduce required project and studies and works management
- Well planed distribution network reduce maintenance and operations cost and optimize resources.
Benefits

• Electric Distribution network knowledge
  ➔ Primary, Transformer bank, and secondary network and substations
  ➔ Map customers locations
  ➔ Customer linked to distributions network poles

• Quick
  ➔ Geographic location of elements by it’s attributes or characteristics
  ➔ Off-line emergency conditions simulation
  ➔ Speedy and secure network map update

• Distribution systems data base
  ➔ Unified
  ➔ Centralized
  ➔ Reliable
Benefits

• Engineer Applications to evaluate and planning the distribution network

• Man Hour Labor reduction in:
  ➤ Updating distribution network Projects
  ➤ Distribution line projects.
  ➤ Operation planning projects
  ➤ Budget, bill of material
  ➤ Network Inventory (Network Market Value)

• Improve activities of:
  ➤ Maintenance
  ➤ Operations
  ➤ Design
  ➤ Billing
Medium and Long Term Benefits

- Increase productivity
- Save in project efforts
- Recover clients and Improve billing performance
- Reduce Energy losses, investments and operations spends
Example of Fault Events Flow Diagrams

Fault events Flow diagram solving procedure