

electricity **DINIS**[®]

Electrical Network Analysis **System**

ITC
Software

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Main System Features

- ◆ *Comprehensive load flow and fault analysis of radial and interconnected networks*
- ◆ *Network switching and select circuit facilities*
- ◆ *Mixed 3, 2, single phase and SWER line analysis*
- ◆ *Fully detailed transformer modelling of winding losses, tap changes including combinations of wye/delta/tertiary windings*
- ◆ *Automatic allocation of loadings based on total primary feeder input current*
- ◆ *Optional non-linear (polynomial) loads*
- ◆ *Summary calculations on minimum two phase unbalanced allocation*
- ◆ *Summary reliability calculations*
- ◆ *Data exchange with other databases via ASCII, NTF or customised interface*
- ◆ *Automatic positioning and displays of full analysis results including amps, volts, ohms (actual or per unit), kW, kVAR, pf, phase or sequence with limit values to reduce congestion*
- ◆ *Automatic calculation and insertion of effective source impedance*

Other Features

- ◆ *Dual geographic and schematic display switch option*
- ◆ *Data entry using base or plant rating*
- ◆ *“Compare and update” networks*
- ◆ *Personal analysis files for all users (what-if? studies)*
- ◆ *Fast spatial data capture using “heads-up” digitising from scanned map backgrounds or digitizer tablet*
- ◆ *Substation inset facilities with integrated controls and results automation*
- ◆ *Retrieve multiple feeder files*

Advanced Network Analysis

for Cost-Effective **Electricity Supply Management**



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Load Management Module

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Main Features

- ◆ Plan future network requirements
- ◆ Project capital requirements
- ◆ Ten different growth categories can be defined each having a unique 10 year growth/decay profile for 3 types of load
- ◆ Full load flow analysis can be invoked to sequentially analyse each period and accumulate losses adjusted to present day depreciated cost values
- ◆ Network areas for growth can be specified by free polygon draw. Polygons can overlap or be enclosed
- ◆ Uses time switches to enable and disable existing or new circuit elements at specified intervals
- ◆ “Snap-shot” load flow analysis can be applied to any period in the study
- ◆ Line current checking against winter rating

Other Features

- ◆ *Load profiles are easily changed on a geographic basis using free polygons*
- ◆ *Any snap-shot year can be extracted into a DINIS personal file*
- ◆ *Display and plot the result of the analysis*
- ◆ *Maximum current overload and voltage drop limits are user selectable*
- ◆ *All standard DINIS facilities available for network update and results display*

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Protection Co-ordination Module

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Main Features

- ◆ *Static model of power system - voltage behind subtransient reactance modelling of rotating machines*
- ◆ *Wide range of protective devices including:*
 - ◆ *IDMTL relays*
 - ◆ *Fuses*
 - ◆ *Miniature or moulded case circuit breakers (MCBs)*
 - ◆ *Auto-reclosers*
- ◆ *Phase quantities used for device operation*
- ◆ *Fault types include L-L, L-G, L-L-G, L-L-L-G with optional fault path impedance*
- ◆ *Relays open switches with time delays, and can operate any switch*
- ◆ *Switches can be operated by more than one relay*
- ◆ *Other devices switch out connected element without delays*

Other Features

- ◆ *Default settings in library - up to 100 variations for any supported device*
- ◆ *Unique settings for individual relays without limit*
- ◆ *Device data in pre-defined tables in library*
- ◆ *Graphical display of device operating curves and fault currents*
- ◆ *Study stages end when system is switched - hold/continue facility for stepping through analysis or amending settings and re-starting*
- ◆ *Detailed or summary reports available at end of study*

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Transient Stability Module

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Main Features

- ◆ *Comprehensive modelling of power system*
 - Infinite bus capability*
 - Modelling of synchronous machines*
 - *Voltage behind transient reactance*
 - *Parks' equations with AVR and governor modelling*
 - Dynamic modelling of induction machines*
- ◆ *Assessment of dynamic behaviour of system when subjected to:*
 - Small disturbances (steady state stability)*
 - Loss or application of loads*
 - Loss of generation*
 - Switching in or out of system shunt or branch elements*
 - Coarse synchronising of generators or disconnected networks*
 - System faults, three phase and unbalanced*
 - Starting of large motors, synchronous or induction*
 - Failure of control devices, AVRs or Speed Governors*

Other Features

- ◆ *AVR models*
 - IEEE 1968 report - types 1, 2 and 3 in supplied library*
 - general modelling capability in program*
- ◆ *Speed governor/engine models:*
 - General purpose steam/diesel/hydro in supplied library*
 - General modelling capability in program including twin shaft gas turbines and multi-cylinder steam turbines*
- ◆ *Minimal additional data*

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- ◆ *Study controls and set-up use standard DINIS inter-active graphics*
- ◆ *Graphical display of selected variables during studies*
- ◆ *Comprehensive tabulations of data and results if required for post-study interrogation or report*

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Map Backgrounds Module

Main Features

- ◆ *Existing paper maps can be scanned and displayed as background data for the network*
- ◆ *Existing vector or raster map data can be displayed as background data for the network*

Other Features

- ◆ *Map background colour is user selectable*
- ◆ *All background maps are automatically scaled and synchronised with the network geographic display*
- ◆ *Multiple map bases for the same area can be held in the map background database to simplify display of congested areas*

DSQL Module

Main Features

- ◆ *“SQL”-like database querying and update facilities*
- ◆ *Master Network Database protected from unauthorised changes*
- ◆ *Can be used with Master Network database or personal files*

Other Features

- ◆ *Commands can be scripted, saved and used by other DINIS users*
- ◆ *Can be used to prepare input and output files for links to other systems*

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Debut Module

Main Features

- ◆ *Provides an interactive, graphics-based means of designing distribution networks, using the most economic cables and transformers*
- ◆ *Carry out basic electrical analysis of low voltage electrical networks*
- ◆ *Consumer types defined by 24hr load profile with allowance for weekends. Consumer profiles are user definable and 200 typical profiles are included with base software*
- ◆ *Transformer types can be fixed or left to DINIS - Debut to design*
- ◆ *Cable sizes can be fixed or left to DINIS - Debut to design, including optimisation over 3, 2, and single phase loading (4 wire)*
- ◆ *Fault level calculation ensures correct fusing*
- ◆ *Practical cable selection limits are included, such as minimum economical lengths and maximum number of types*
- ◆ *Load patterns can be entered as a single point or distributed along cables*
- ◆ *Each point can be allocated as a known load profile for a given customer. Individual points may have multiple profiles*
- ◆ *Multiple consumer types can be allocated to each cable*
- ◆ *Graphical input and update of networks*
- ◆ *Relate network graphical data to geographic coordinates*
- ◆ *Cost of losses, maximum voltage drop, recommended fusing and capitalised losses are included in the output summary*

Other Features

- ◆ *Display adjoining networks in graphical form*
- ◆ *Display associated attribute data*
- ◆ *Use standalone or in conjunction with the full DINIS system*
- ◆ *Interfaces to both DINIS - Map Server/Editor and DINIS - Map Backgrounds modules*

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Electrical Network Analysis System

Map Server/Editor Module

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Main Features

- ◆ *Provides facilities for capture, storage, editing and management of maps for display in raster behind DINIS, and DINIS - Debut networks*
- ◆ *Interfaces directly to a range of large format scanners*
- ◆ *Facilities for map registration and rectification including rotation, translation and linear stretching*
- ◆ *Provides facilities for storage of various map types in separate raster layers*
- ◆ *Maps can be joined to form a contiguous raster map base*
- ◆ *Builders plans may be scanned, rectified and edited for display with existing maps*
- ◆ *Capable of handling multiple ranges of Map Scale (e.g. 1/500 to 1/2,500 range and 1/25,000 to 1/100,000 range)*
- ◆ *Full raster and vector editing facilities*
- ◆ *Rasterisation of vector data may be carried out to generate raster map images*

Main Features

- ◆ *Uses DINIS - Map Backgrounds module for display of maps within the DINIS environment*
- ◆ *Manages raster map files in a relational database environment*
- ◆ *Optional modules for vector data import (e.g. OSTF, NTF, DXF) and database creation*
- ◆ *More advanced rectification facilities such as monument point location, flexing and least squares warping available via add-on module*
- ◆ *Automatic geographic registration of maps within the DINIS environment*
- ◆ *Integrated with DINIS for combined raster and vector plotting*

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Electrical Network Analysis System

Version 6

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Main Features

- ◆ *Motif based Graphical User Interface for greater flexibility, functionality and control of DINIS analysis capability*
- ◆ *X11 based windowing system providing Open Systems operating environment*
- ◆ *Multiple document interface with fully active, resizable views delivering increased efficiency*
- ◆ *Simultaneous analysis and display of geographic, schematic and complex sites*
- ◆ *Use of independent view filters for data and results display allowing personal view customisation*
- ◆ *X Client/Server configuration for use of Workstations, X-Terminals, PCs and other X conformant hardware as DINIS display devices*
- ◆ *Inter Client Communications Conventions Manual (ICCCM) data interchange format*
- ◆ *Floating Licence Manager for flexible licensing of core product and modules*
- ◆ *Relational database, Oracle V7.3, access for hold master network data*
- ◆ *API facility to enable DINIS to be driven via external applications*

Other Features

- ◆ *Customized Toolbox for frequent use functionality*
- ◆ *Continuous pan and zoom provides simple view navigation*
- ◆ *Extensive use of user definable libraries*
- ◆ *Full hardcopy device support including PostScript*

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Unbalanced Load Flow Module

Main Features

- ◆ *Comprehensive phase coordinate modelling of power system*
One, two or three phases and neutral for all system elements
 - ◆ *Fully compatible with existing DINIS modelling*
Automatic conversion 1 phase to phase coordinate & vice versa
 - ◆ *Generator modelling derived from Parks' Equations*
Slack, PV or PQ control
Earthed or unearthed neutral
 - ◆ *Transformers*
Core/tank effects and tapchangers
Three phase or banked single phase, open star or delta
Three phase to two phase (e.g. Scott connection)
 - ◆ *Overhead line parameters from geometric spacing and ground resistivity*
 - ◆ *Loads entered as kVA/pf or kW/kVAR*
Phase to phase, phase to neutral, phase to ground, star or delta
- | | <u>Voltage Index</u> |
|--|----------------------|
| <i>Constant power and reactive power</i> | 0 |
| <i>Constant current</i> | 1 |
| <i>Constant impedance</i> | 2 |
| <i>Power and reactive power independantly variable</i> | any |

Analysis Capabilities

- ◆ *Load flow for any mesh or radial network showing effects of :*
Unbalanced phase parameters and mutuals between conductors
Unbalanced loads
Embedded generation
Loss of phase connections for any system element
Open conductors on overhead lines
Loss of connection on any phase of a generator or transformer
Multiple unbalances
Parallel neutral and earth returns

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Electrical Network Analysis **System**

Advanced Modules

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Common Features

- ◆ *Comprehensive facilities for modelling complex distribution and transmission networks*
- ◆ *Developed through close liaison with London Electricity plc, a leading UK based Distribution Company*
- ◆ *Interactive or batch analysis of large systems for regular network assessment*
- ◆ *Customisation option for individual modules to include additional analysis or specific functionality*
- ◆ *Proven performance using enhancements to DINIS functionality*
- ◆ *All normal DINIS display and enquiry options available*
- ◆ *Comprehensive printed results summary for each analysis*

Distributed Low Voltage Load Allocation Module

Extends the standard load allocation facility within DINIS to model distribution of load on low voltage systems using primary infeed data, subtracting known loads and apportioning other loads to give an improved view of system loading.

Analysis Features include:

- ◆ *Voltage profile algorithm for accurate modelling of load distribution*
- ◆ *Comparison of calculated values with known values of distribution transformer loading*
- ◆ *Minimum loaded length selection for road crossings, service or other cables*
- ◆ *Individual line loading factors for interactive user adjustment in areas of known load pattern*

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Automatic Loss Minimiser

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Determines the optimum position of open switch positions on radial networks to provide minimum losses, including checking for limiting conditions of overload and voltage regulation.

Analysis Features include:

- ◆ User specification of switching constraints
- ◆ Comparison with initial state losses for meshed and radial systems
- ◆ Provision of sweep load change facility to determine network performance limits
- ◆ User selection of voltage levels to be switched
- ◆ Automatic elimination of feeder overloading
- ◆ Use of loading pattern produced by the Distributed Low Voltage Load Allocation Module

Fault Study Package

Identifies areas of network that are not satisfactory in terms of their resilience against potential faults, particularly meshed lv networks with reverse power sensing protective devices.

Analysis Features include:

- ◆ Operation either automatically in sequence or in interactive mode
- ◆ Placement of faults at selected locations, with clearance sequences modelled
- ◆ Subsequent loadflow checks of network behaviour under

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predetermined load conditions, including distributed load

- ◆ Identification of load at risk under planned running configurations
- ◆ Checking for support via fuses and for backfeed through transformers where possible
- ◆ Calculation of fault levels at all nodes, checks are made to ensure that minimum and maximum fault levels are not exceeded
- ◆ Selection of various fault conditions including L-L-L-G, L-L and L-G
- ◆ Various loadflow start options available

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DINIS Rdb Access

DINIS API +Toolkit

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