

# Harmonic Analysis

## Flexible Capable Concise

With ETAP's Harmonic Analysis module, you can identify harmonic problems, reduce nuisance trips, design and test filters, and report distortion limit violations. Comprehensive load flow and frequency scan calculations are performed using detailed harmonic models and non-integer harmonic filters. Results are shown graphically, including harmonic order, harmonic spectrum plots, and harmonic waveform plots, as well as detailed Crystal Reports®.

harmonic analysis

# Powerful Tools for Performance Engineers

## Key Features

### Harmonic Load Flow

### Harmonic Frequency Scan

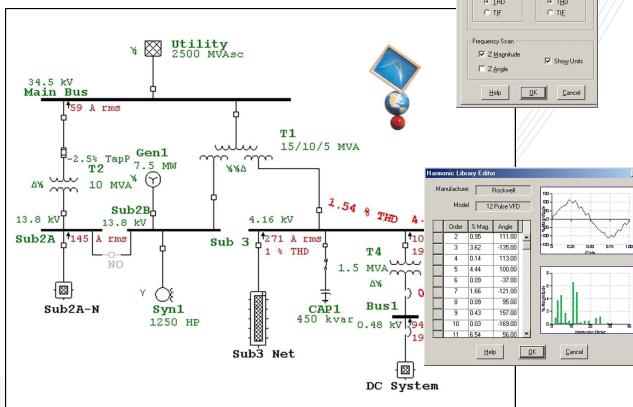
### Filter Design & Sizing

### Inter-Harmonic Filter Modeling

### Automatically Evaluate Harmonic Limits

## Flexible Operation

- Fundamental load flow results
- Bus impedance magnitude & angle as functions of frequency
- Time-domain waveform plots
- Frequency-domain spectrum plots
- Includes phase shifting transformers



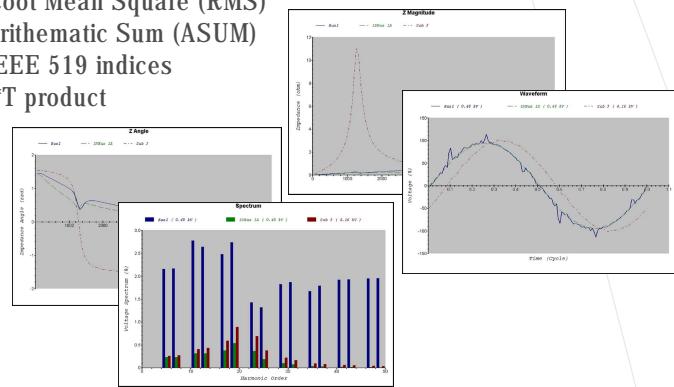
## View Impedance and Load Flow Plots Simultaneously

## Capabilities

- Temperature-dependent line & cable resistances
- Single-tuned, high-pass, & band-pass filters
- Create filters to shift resonance points to less harmful frequencies
- Model up to the seventy-first (71st) harmonic
- Identify & analyze telephone interference problems
- User-expandable harmonic source library
- Identify resonance conditions

## Calculate

- Harmonic filter performance
- Magnitude & angle of the system impedance at selected buses
- Telephone Interference Factor (TIF)
- Total Harmonic Distortion (THD)
- Root Mean Square (RMS)
- Arithmetic Sum (ASUM)
- IEEE 519 indices
- I<sup>ST</sup> product



## Reporting

- Fundamental load flow results
- Report voltage & current harmonic distortions
- Report RMS, ASUM, TIF, & I<sup>ST</sup> values
- Bus impedances (magnitude & angle) in tables
- Text output reports including violation flags
- Use Crystal Reports® for full color, customizable reports
- Export output reports to your favorite word processor
- Graphical display of harmonic results
- Export one-line diagrams to third party CAD systems

Unlimited Buses\* & Elements  
No Voltage Limitations  
Looped & Radial Systems  
Integrated 1-Phase, 3-Phase, & DC Systems  
Multiple Generators & Grid Connections  
Multiple Isolated Sub-Systems  
Customizable Libraries  
Graphical Display of Results on One-Line Diagrams  
Customizable Font Types, Sizes, Styles, & Colors  
Customizable Display of Ratings & Results  
Graphical Display of Equipment Impedance & Grounding  
Automatic Error Checking  
Graphical Display of Overstressed Devices  
Graphical Display of Over/Under Voltage Buses  
Dynamically Adjust Display of Results

\*Maximum number of energized buses during calculations is license dependent.

SYSTEM HARMONICS INFORMATION										
Bus	Voltage Distortion					Current Distortion			Voltage Distortion	
	ID	X <sup>Y</sup>	Perc. %	RI %	A.I. %	THD %	TIF	Bus ID	Fund. Amp	THD %
Bus 1	0.400	97.97	97.76	101.41	1.23	0.00	0.00	Bus 1	500.00	97.77
Bus 2	0.400	96.65	97.70	122.20	9.69	0.00	0.00	Bus 2	500.12	94.74
Bus 3	0.400	100.00	99.44	100.00	0.00	0.00	0.00	Bus 3	500.12	94.74
Bus 4	0.400	100.00	99.44	100.00	0.00	0.00	0.00	Bus 4	144.00	144.00
Main Bus	24.000	0.00	300.00	100.00	0.01	0.00	0.00	Main Bus	1000.00	144.00
MCC1	0.400	97.97	97.76	101.41	1.23	0.00	0.00	MCC1	200.00	97.77
Sub 1	13.000	0.23	301.33	101.00	0.00	2.34	0.00	Sub 1	144.00	144.00
Sub 2	13.000	0.00	300.00	100.00	0.06	0.00	0.00	Sub 2	144.00	144.00
Sub 3	4.400	96.64	96.40	104.23	1.56	0.00	0.00	Sub 3	107.12	144.43
Sub 4	4.400	97.97	97.76	101.41	1.23	0.00	0.00	Sub 4	107.12	147.97
Sub 5	4.400	97.97	97.76	101.41	1.23	0.00	0.00	Sub 5	107.12	147.97
Sub 6	4.400	97.97	97.76	101.41	1.23	0.00	0.00	Sub 6	107.12	147.97
Sub 7	4.400	97.97	97.76	101.41	1.23	0.00	0.00	Sub 7	107.12	147.97
Sub 8	4.400	97.97	97.76	101.41	1.23	0.00	0.00	Sub 8	107.12	147.97
Sub 9	4.400	97.97	97.76	101.41	1.23	0.00	0.00	Sub 9	107.12	147.97
Sub 10	4.400	97.97	97.76	101.41	1.23	0.00	0.00	Sub 10	107.12	147.97
Sub 11	4.400	97.97	97.76	101.41	1.23	0.00	0.00	Sub 11	107.12	147.97
Sub 12	4.400	97.97	97.76	101.41	1.23	0.00	0.00	Sub 12	107.12	147.97
Sub 13	4.400	97.97	97.76	101.41	1.23	0.00	0.00	Sub 13	107.12	147.97

\* Indicates THD (Total Harmonic Distortion) Exceeds the Limit  
# Indicates IHD (Individual Harmonic Distortion) Exceeds the Limit

