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Q6

Power quality assessment

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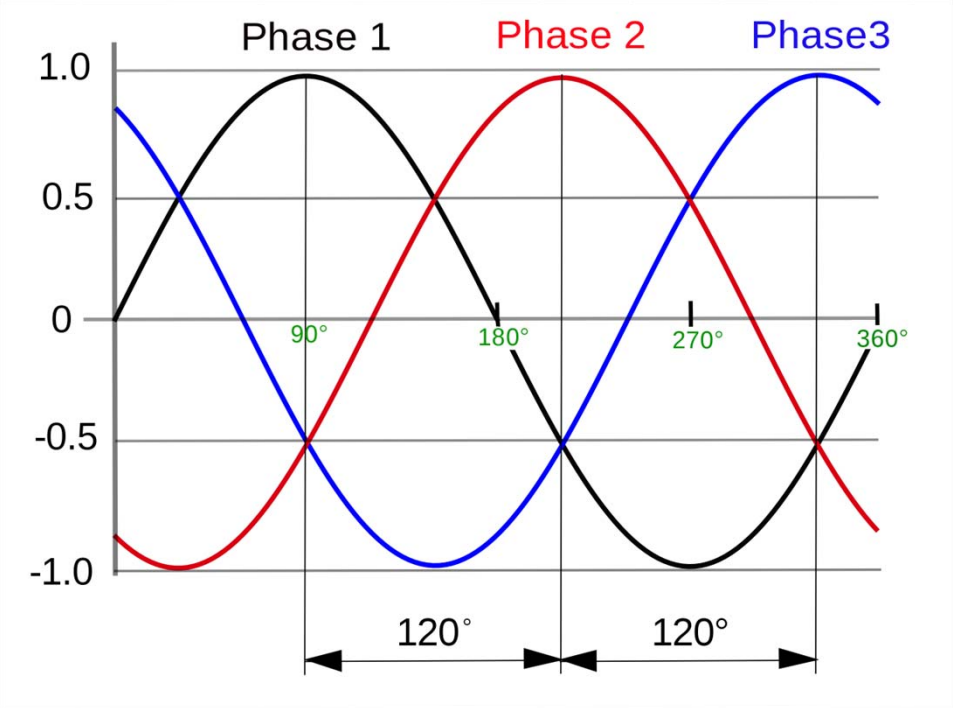
What is Power Quality Assessment?

Power quality assessment and audit is an activity to evaluate that the electrical energy entering the equipment has enabled the system to operate properly, efficiently and minimizes long-term risk to the equipment.

Ideal Power Conditions

- The current is in phase with the voltage for each phase. Power Factor = 1.
- The phase voltage and currents are exactly 120 degrees apart and all equal to each other. No unbalance.
- The voltage and current sine waves are not distorted or interrupted in any way.
- The source impedance is zero, so that events at the load don't affect the source voltage.
- The actual frequency is equal to the nominal frequency.



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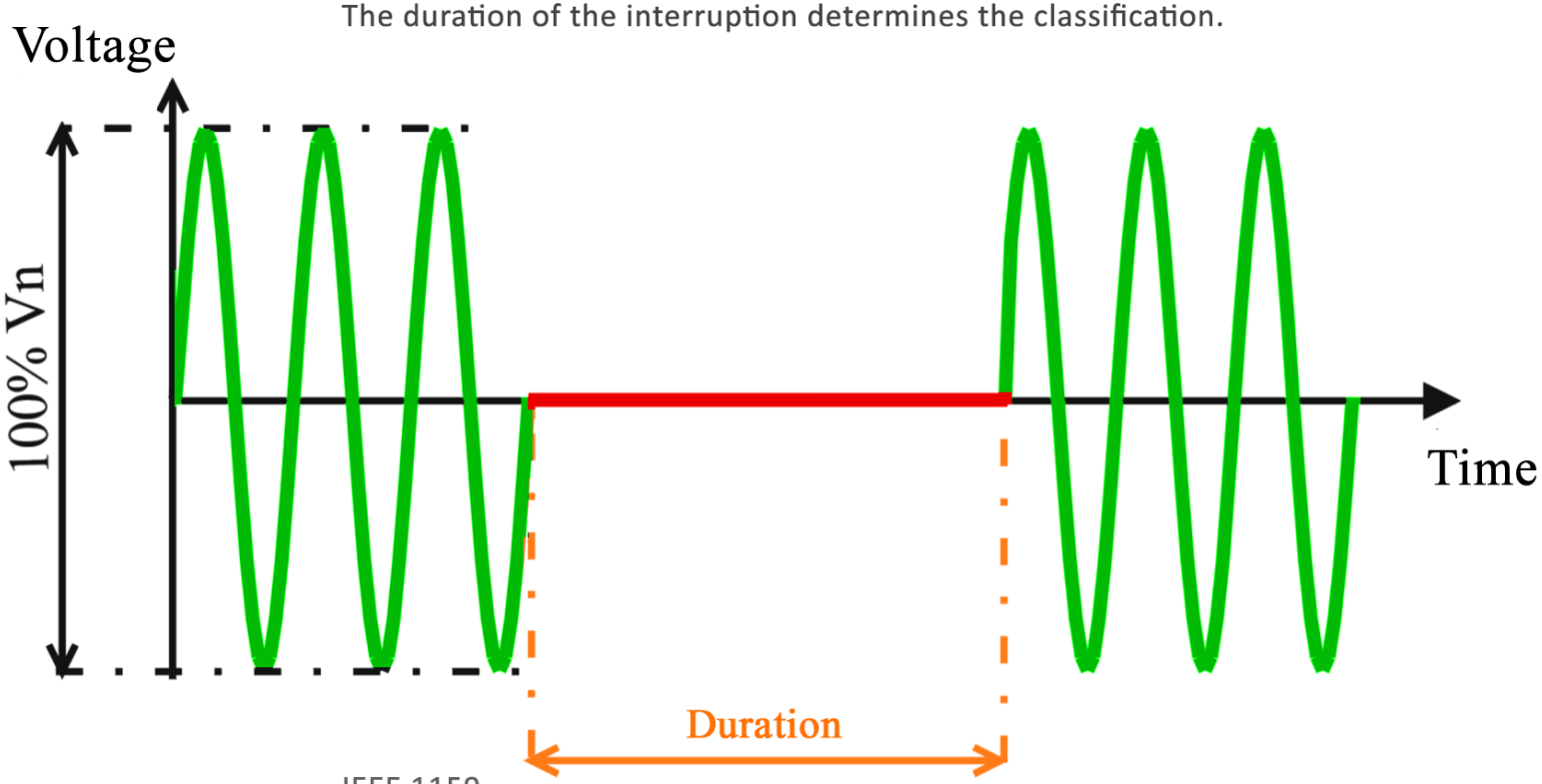
Power Interruptions

- A **momentary interruption** is a complete loss of voltage on one or more phase conductors for a time period between 0.5 cycles and 3 seconds.
- A **temporary interruption** is a complete loss of voltage on one or more phase conductors for a time period between 3 seconds and 1 minute.
- A **sustained interruption** is a complete loss of voltage on one or more phase conductors for more than 1 minute.

Power Interruptions

Interruptions

Occurs when power delivered to an electrical load goes away.
The duration of the interruption determines the classification.

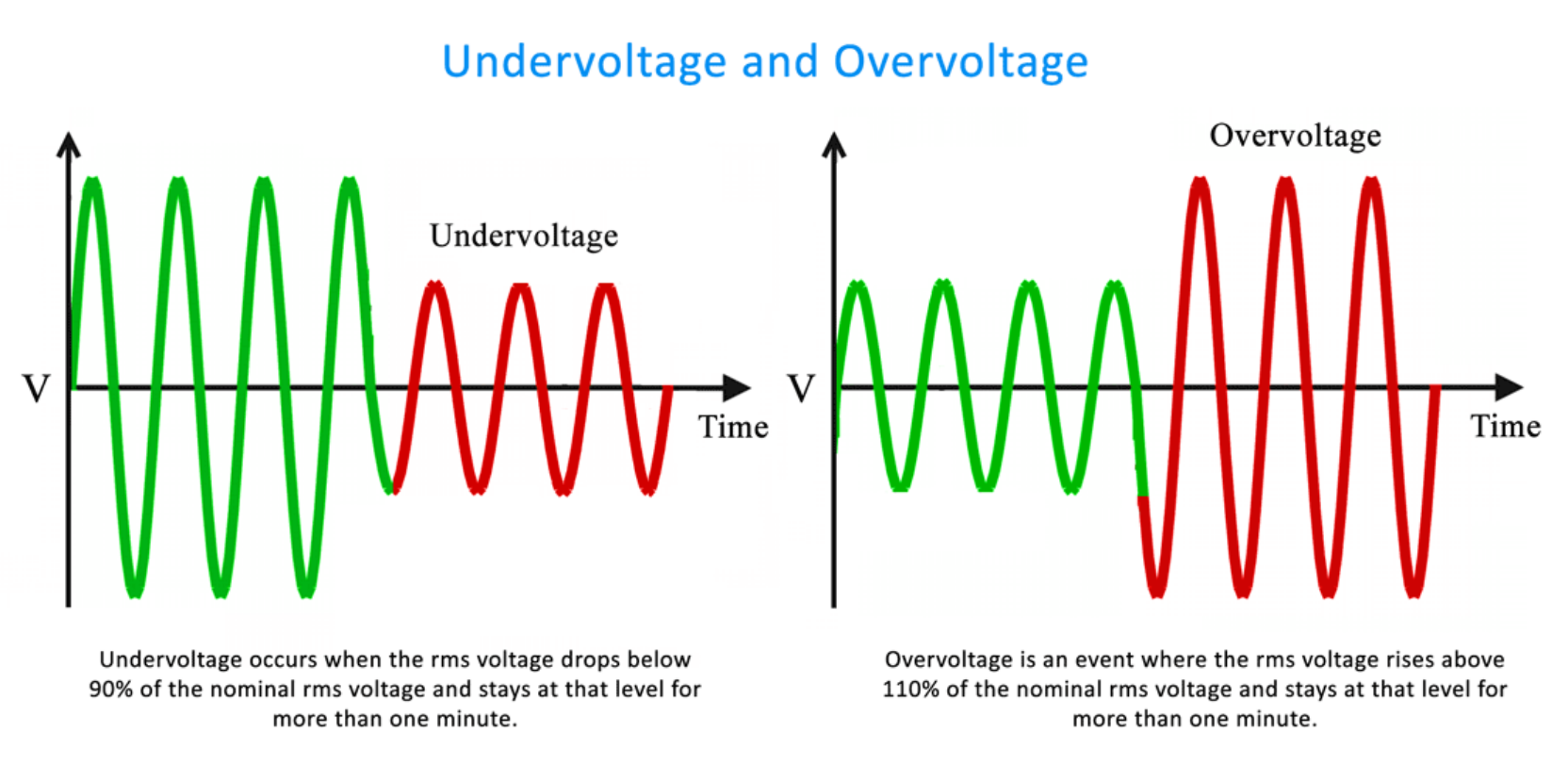


IEEE 1159

Momentary	Temporary	Sustained
0.5cy-3s	3s-1m	1m+

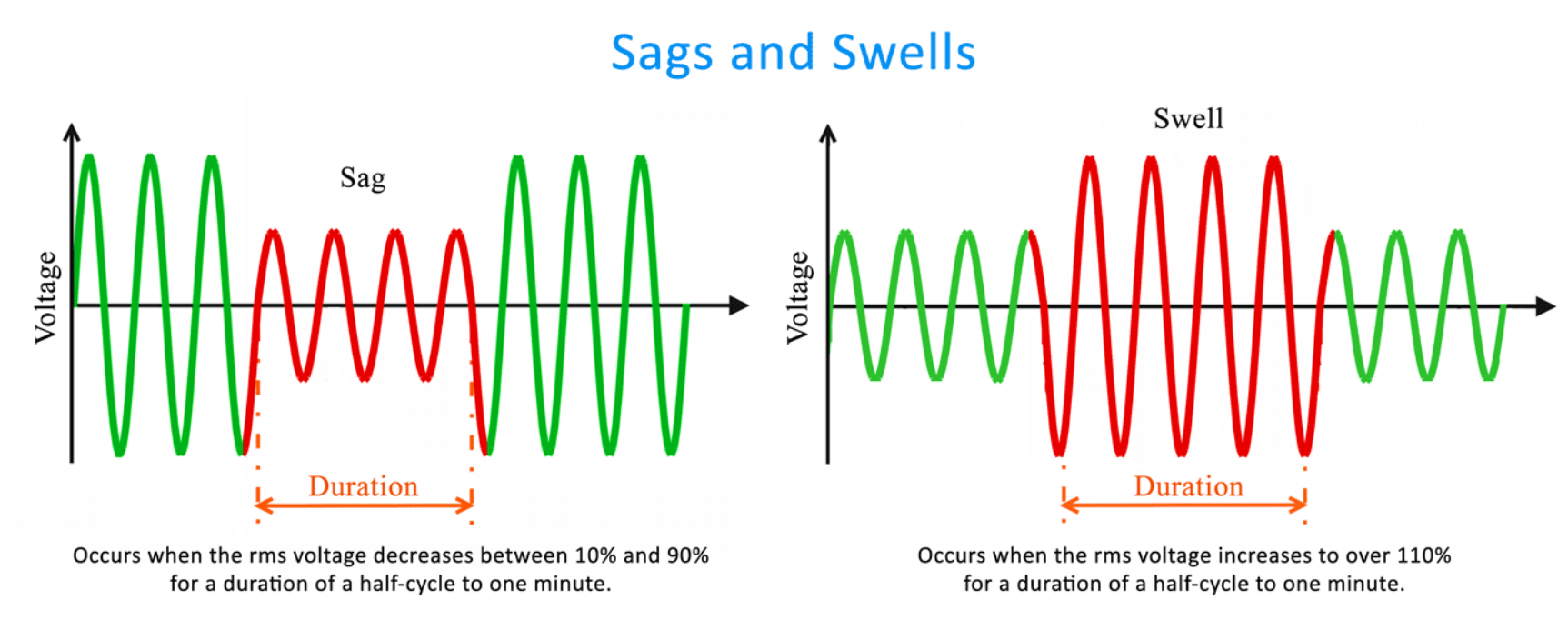
Signal deformations

- An **undervoltage** occurs when the rms voltage drops below 90% of the nominal rms voltage and stays at that level for more than one minute. The term “brownout” often refers to an intentional or unintentional drop in voltage in an electrical power supply system.
- An **overvoltage** is an event where the rms voltage rises above 110% of the nominal rms voltage and stays there for more than one minute.



Signal Deformations

- **Sags** occur when the rms voltage decreases between 10% and 90% for a duration of a half-cycle to one minute. In a 60Hz power system, a complete sine wave lasts approximately 16 milliseconds, a half cycle is approximately 8 milliseconds.
- **Swells** are defined as an increase in the rms voltage to over 110% for a duration of a half-cycle to one minute.



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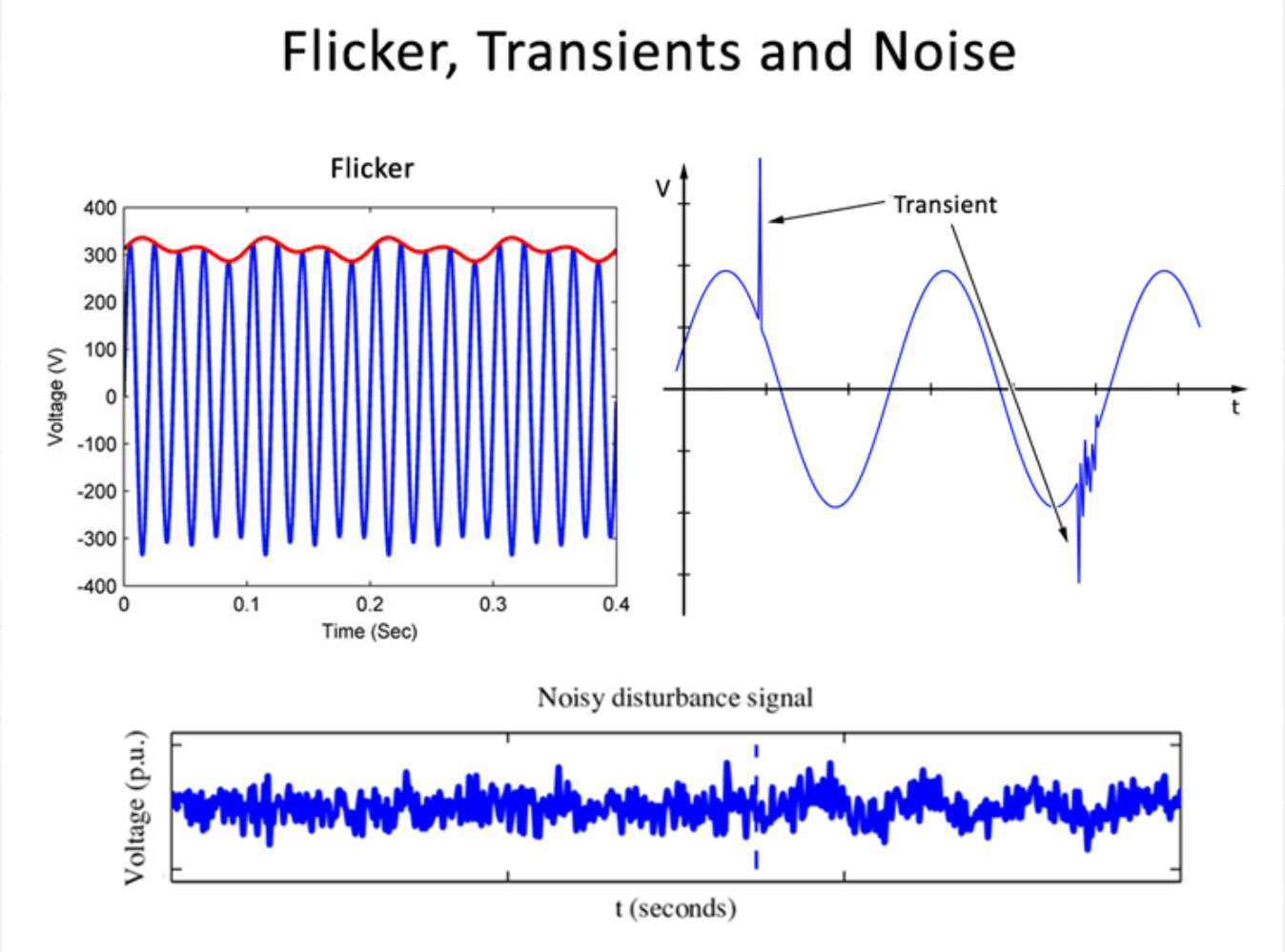
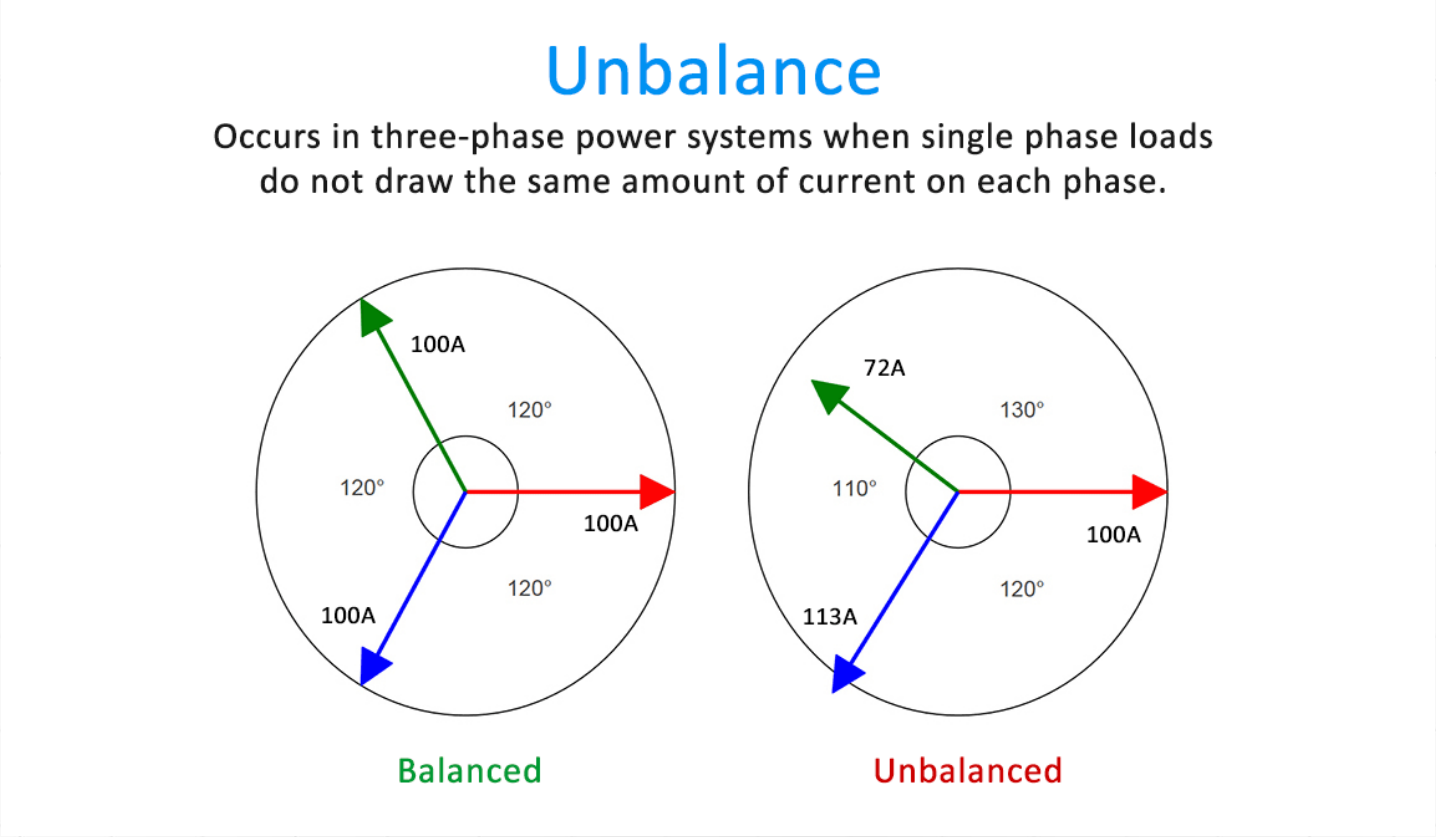
Flicker, Transients and Noise



Unbalance

Unbalance occurs in three-phase power systems when single phase loads (lighting, office equipment, etc.) do not draw the same amount of current on each phase, resulting in greater stress on the neutral conductor. An ideal condition occurs when the loads are balanced, meaning that the voltage and current phases are exactly 120 degrees apart from each other, although the currents might not be in-phase with the voltages.



Harmonics

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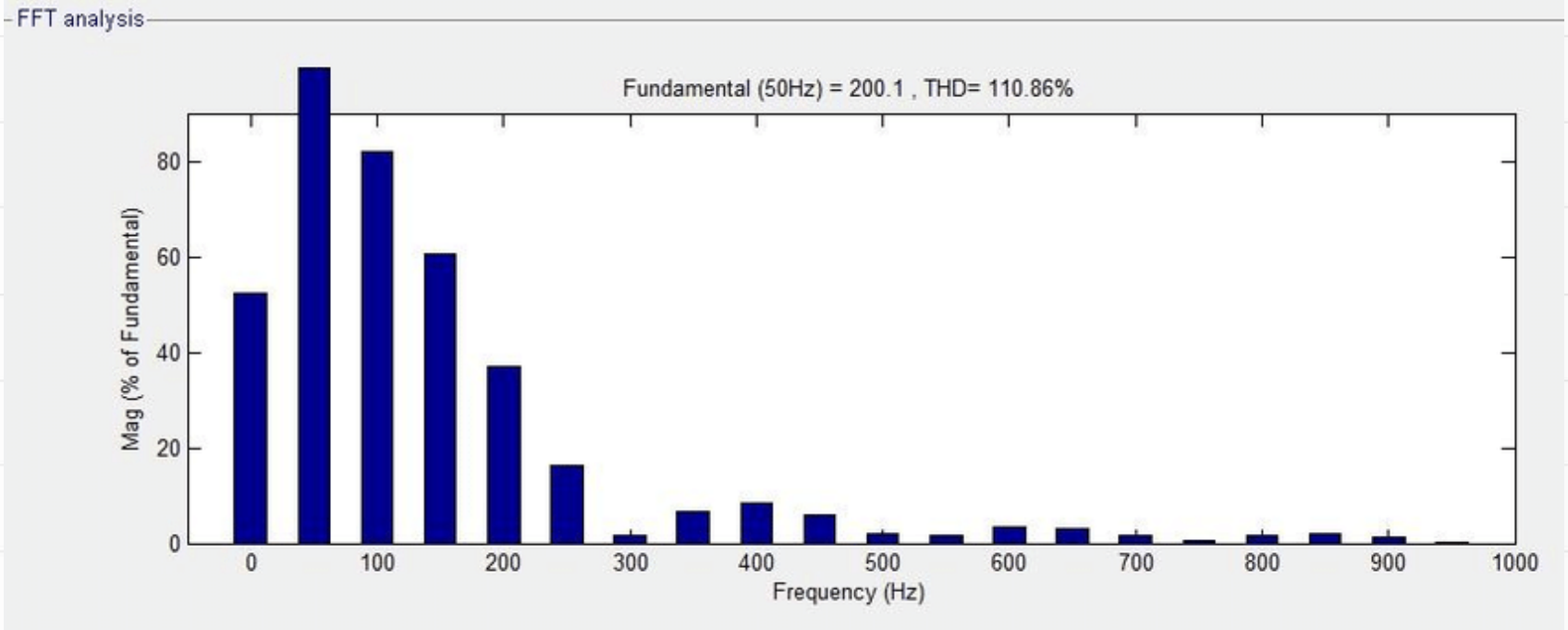

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Steps in Power Quality Assessment

1. Data collection
2. Data analysis
3. Interpretation
4. Recommendation
5. Implementation
6. Monitoring

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Technics of Improving Power Quality

1. Voltage regulation
2. Harmonic filters
3. Capacitor banks
4. Surge Protection
5. Grounding
6. Voltage stabilizers
7. Power conditioning

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Benefits of Power Quality Assessment

- Improved equipment performance
- Reduced downtime and repair costs
- Increased energy efficiency
- Compliance with standards and regulations
- Improved safety

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Thank you for attention

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