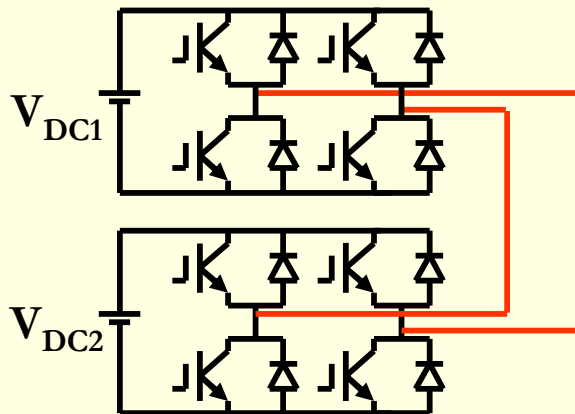
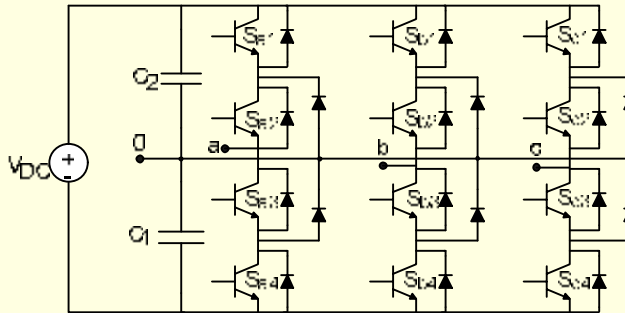


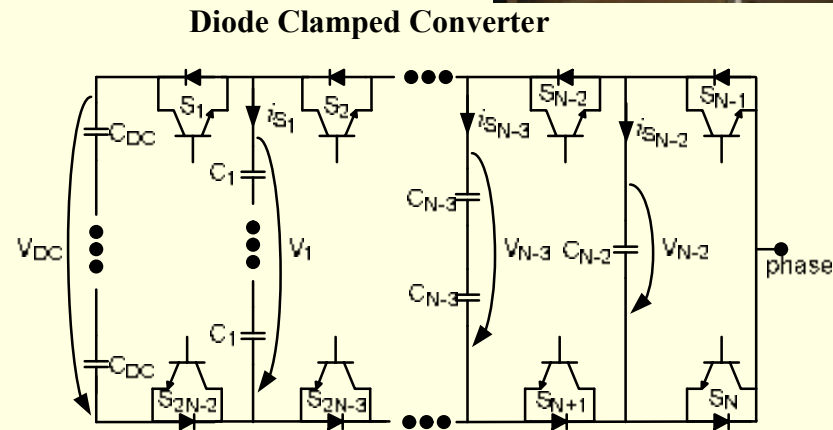
Multilevel Inverters. Topologies, Modulation Techniques and Practical Problems

- Inverter Topologies
 - Diode Clamped
 - Flying Capacitor
 - Cascade Inverters
- Modulation techniques
 - PWM
 - Space Vector
- Applications
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 - Active filters
 - ...
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 - Voltage balancing
 - Control complexity
 - ...

Multilevel Inverter Topologies:



Cascade Converter



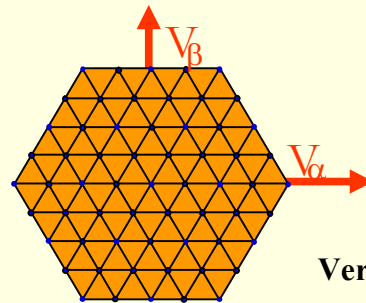
Flying Capacitor Converter

Diode Clamped Converter

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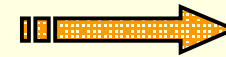
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Modulation Techniques:



Balanced Systems

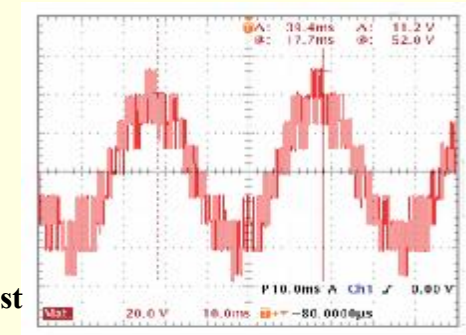
Complex problem!



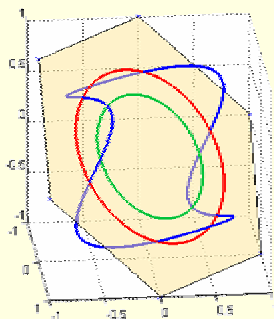
Simple algorithms

Very low computational cost

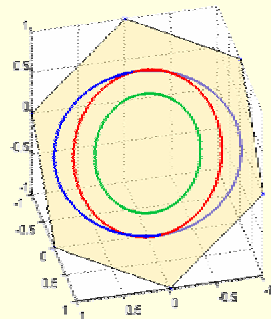
High efficiency



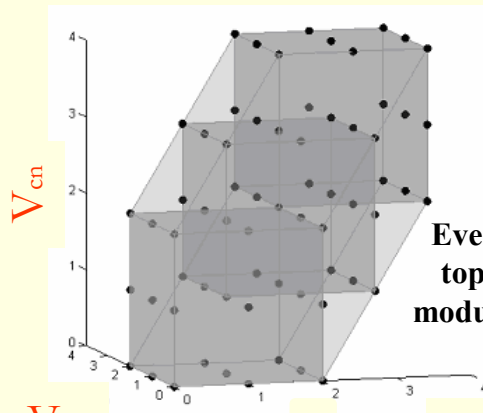
2D Modulation results



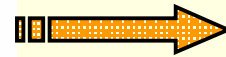
3-phase unbalanced system
with the third harmonic



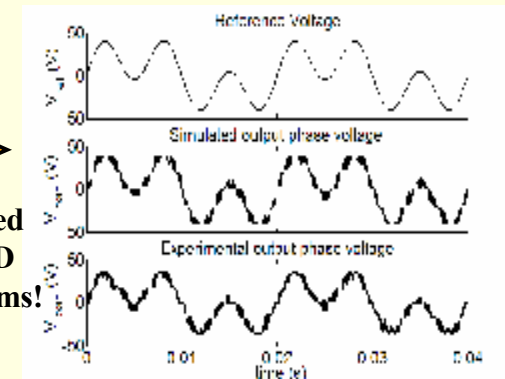
3-phase unbalanced system
with zero sequence



Unbalanced Systems



Even for unbalanced
topologies using 3D
modulation algorithms!

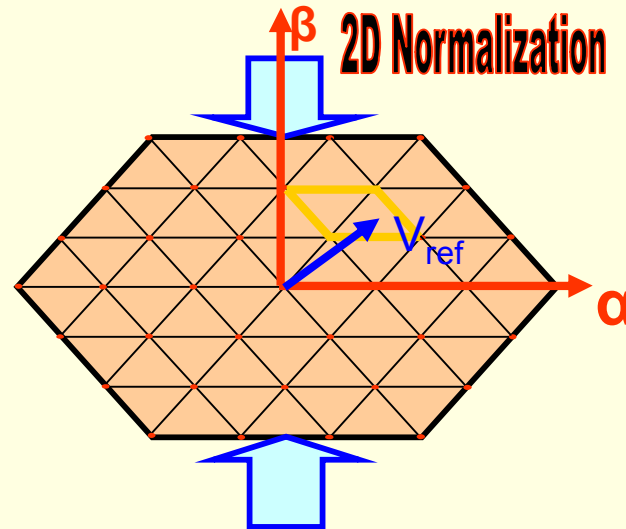


3D Modulation results

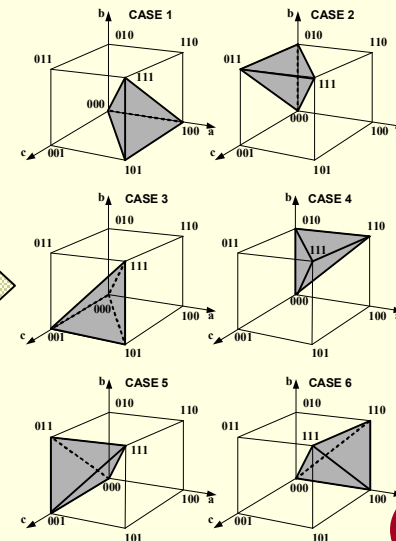
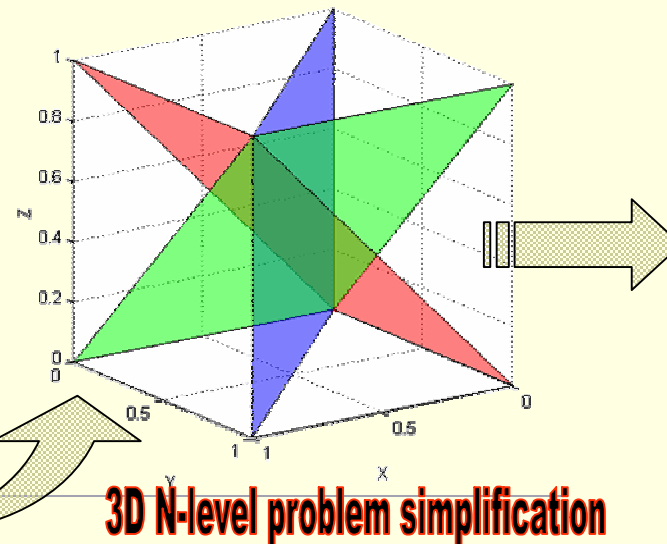
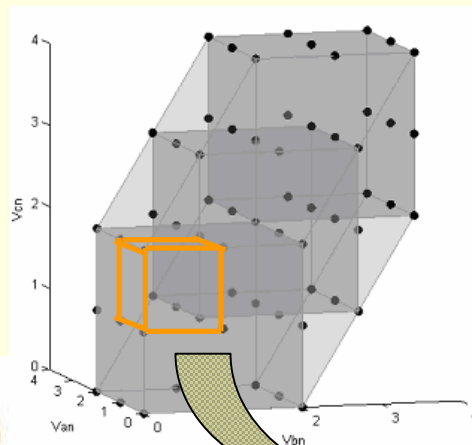
Extremely simple and generalized modulation algorithms based on geometrical considerations

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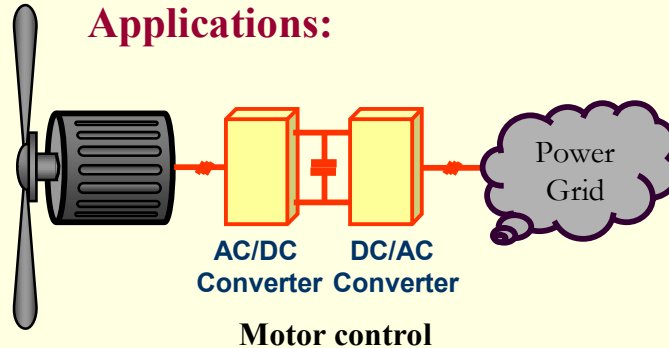


2D and 3D modulation algorithms for multilevel converters are based on the reduction of the N-level problem to an 2-level problem using normalizations and geometrical considerations

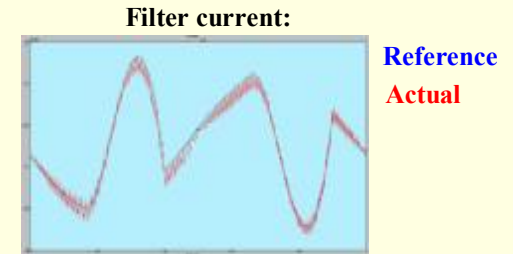


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Applications:

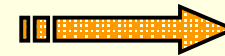


Active Filters:

- Topologies
- Control algorithms

Practical problems:

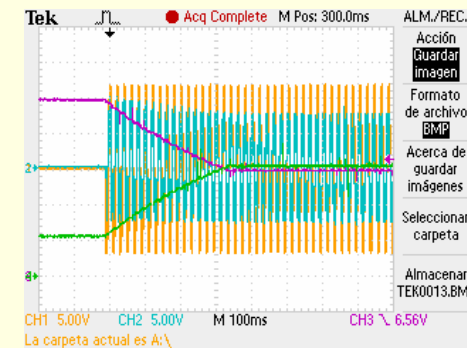
One of the most important problems in multilevel converters is the voltage balancing



Generalized algorithms for several multilevel topologies and for any number of levels

Very low computational cost

High efficiency



MATHEMATICAL MODELS



SIMULATION MODELS
MatLab/Simulink® & PSCAD®



EXPERIMENTAL RESULTS

