

Influence of Sampling Rate on Output Voltage of a Triphase Inverter

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MOTIVATION

The increased presence of voltage disturbances (harmonics, unbalance, overvoltage, and transients) due to the proliferation of power electronics in electric networks can stress the insulating dielectric material of equipment and systems. However, accurate assessment of signal parameters for evaluating the impact on the insulation stage of a system remains a challenge due to the influence of the measurement system on the precise definition of signal characteristics.

OBJECTIVE

To investigate the effect of sampling rates on capturing high frequency transients at the output of a Triphase inverter under different loading conditions, and provide an improved appreciation of transient characteristics and a better correlation of their impact on the electrical insulation systems.

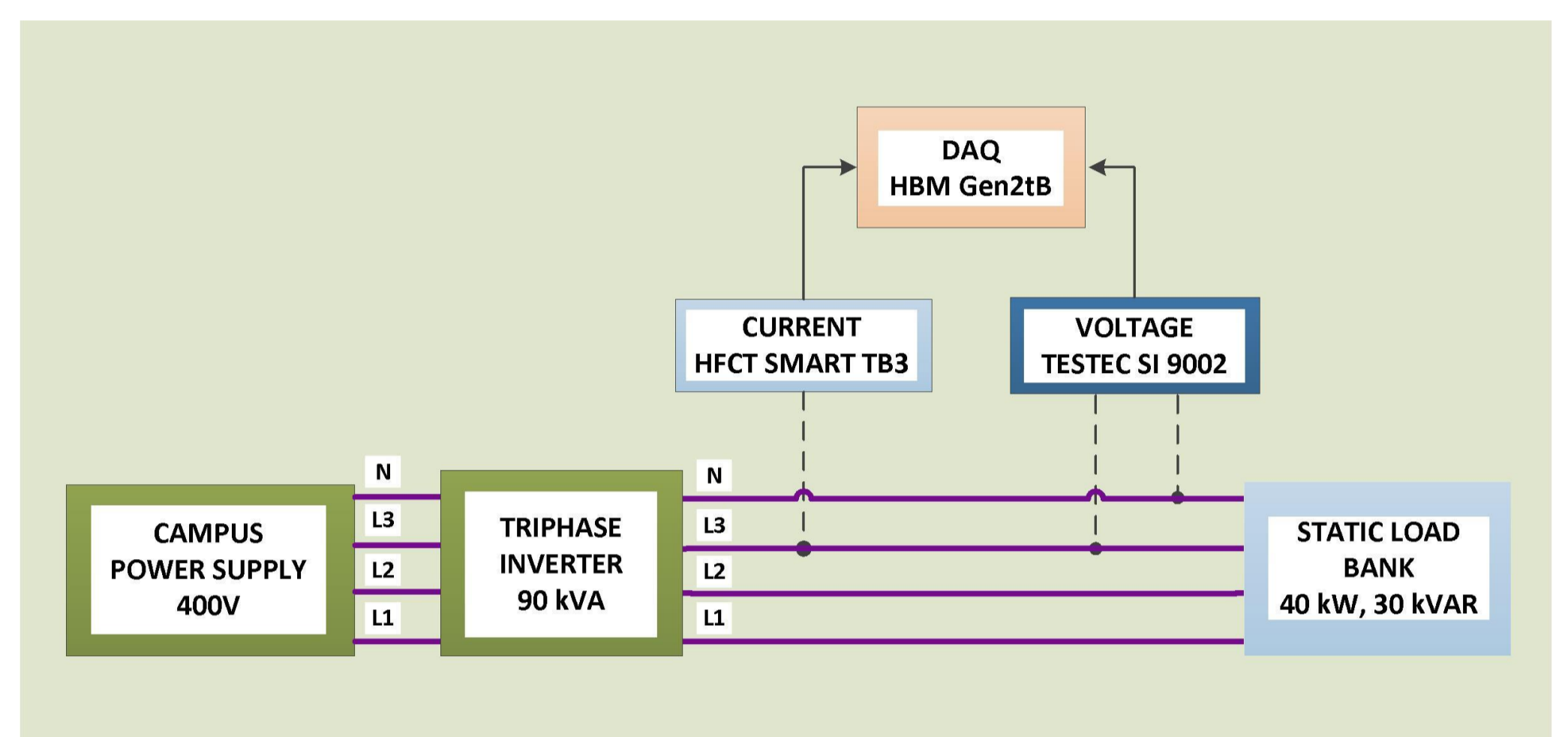
METHODOLOGY

The output voltages of a Triphase inverter were measured at sampling rates of (5, 10, 12.5, 25, 50, 100, 200, 250, and 500) kS/s as well as at (1, 10, 100, and 250) MS/s. The static load bank was configured at a power factor of 0.9 lagging and was kept constant throughout the experiments.

Time domain signals and respective frequency spectra were qualitatively analysed to correlate respective changes with sampling rates of the data acquisition system.

EXPERIMENTAL SETUP AND MEASUREMENT

A static load bank of 40 kW, 30 kVAR having 256 steps is connected to a 90 kVA Triphase inverter.

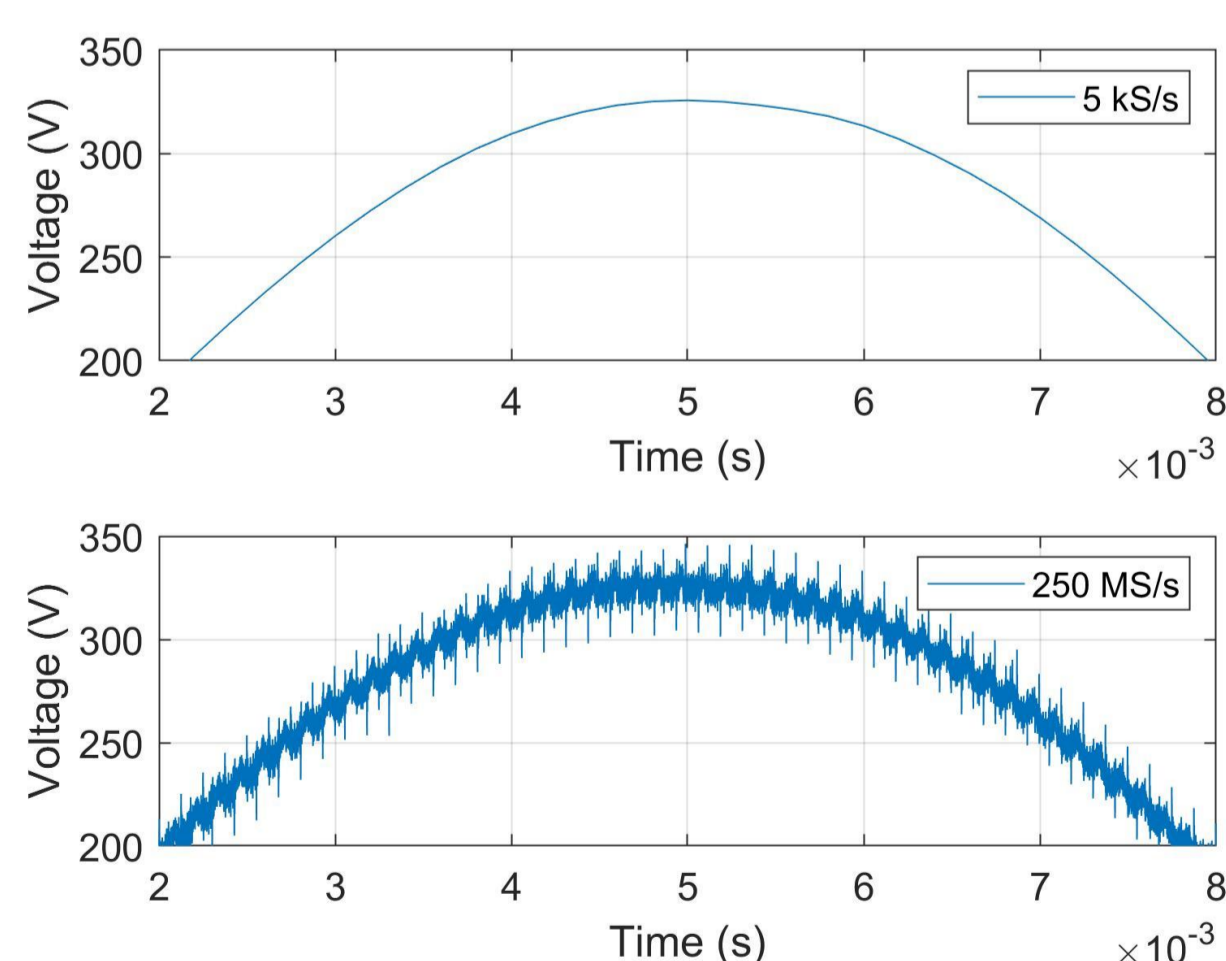


Data acquisition system model HBM Gen2tB with simultaneous sampling capability and configurable sampling rate up to 250 MS/s.

An active differential probe model Testec SI 9002 was used, capable of measuring $\pm 1400V$ (DC + peak AC) signals with DC to 25 MHz frequency bandwidth.

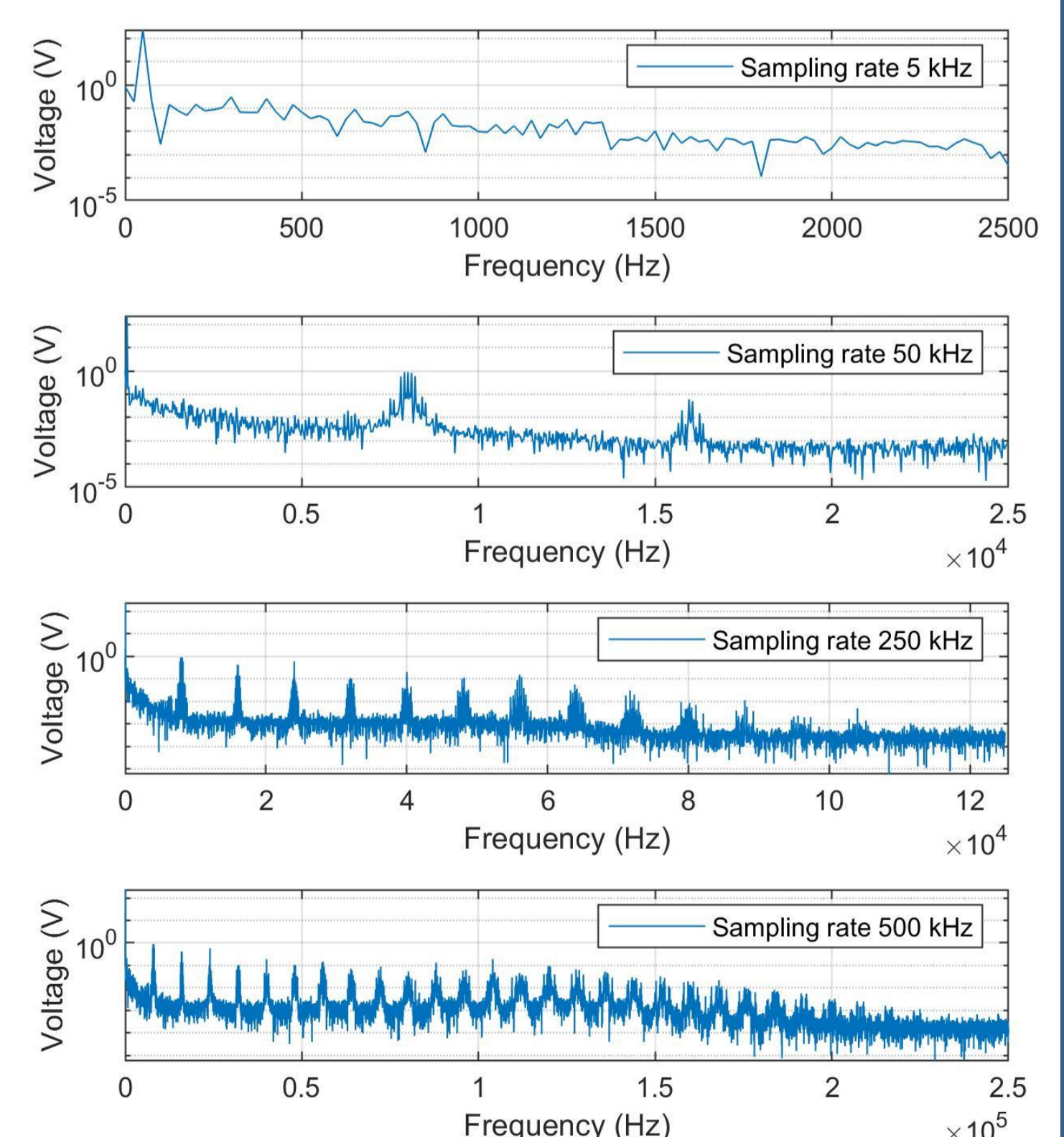


RESULTS AND CONCLUSIONS



Repetitive voltage transients of 41 V peak to peak amplitude were observed when the signals were sampled at 250 MS/s. At 5 kS/s the disturbances were absent due to limited sampling time resolution.

Frequency spectrums for the output voltage reveal increased disturbances as the sampling rate increases from 5 kS/s to 500 kS/s. The switching frequency of the Triphase inverter (16 kHz) is repeated at high frequencies.



The high-frequency detected signals shown in this study have the potential to impose additional stress on the state of electrical insulation of electrical equipment and systems. Although measurements were carried out at low voltages, high-frequency transients may be more evident in higher voltage switching systems. Monitoring and analysing their impact on the insulation system requires appropriate high bandwidth measurement systems.

Acknowledgements

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