

Power Quality Studies in Water Pumping and Water Treatment Plants

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Overview: We propose to conduct theoretical research and experimentation on characterizing and improving power quality in water pumping and waste-water facilities that are equipped with variable frequency drives (VFDs).

Introduction: Most water pumping and water treatment plants use VFDs to control the speed of AC motors in order to reduce energy consumption while meeting pumping needs. VFDs, however, produce harmonic distortion which can adversely affect the quality of power. We propose to investigate the effect of various parameters on the quality of power through simulations and laboratory experiments, in an effort to develop effective mitigation techniques.

Method: A laboratory test bench that consists of a dynamometer, motors, VFDs, and instrumentation was recently completed (see Fig. 1 below). Computer modeling of various components using PSCAD and SPICE software is also underway.

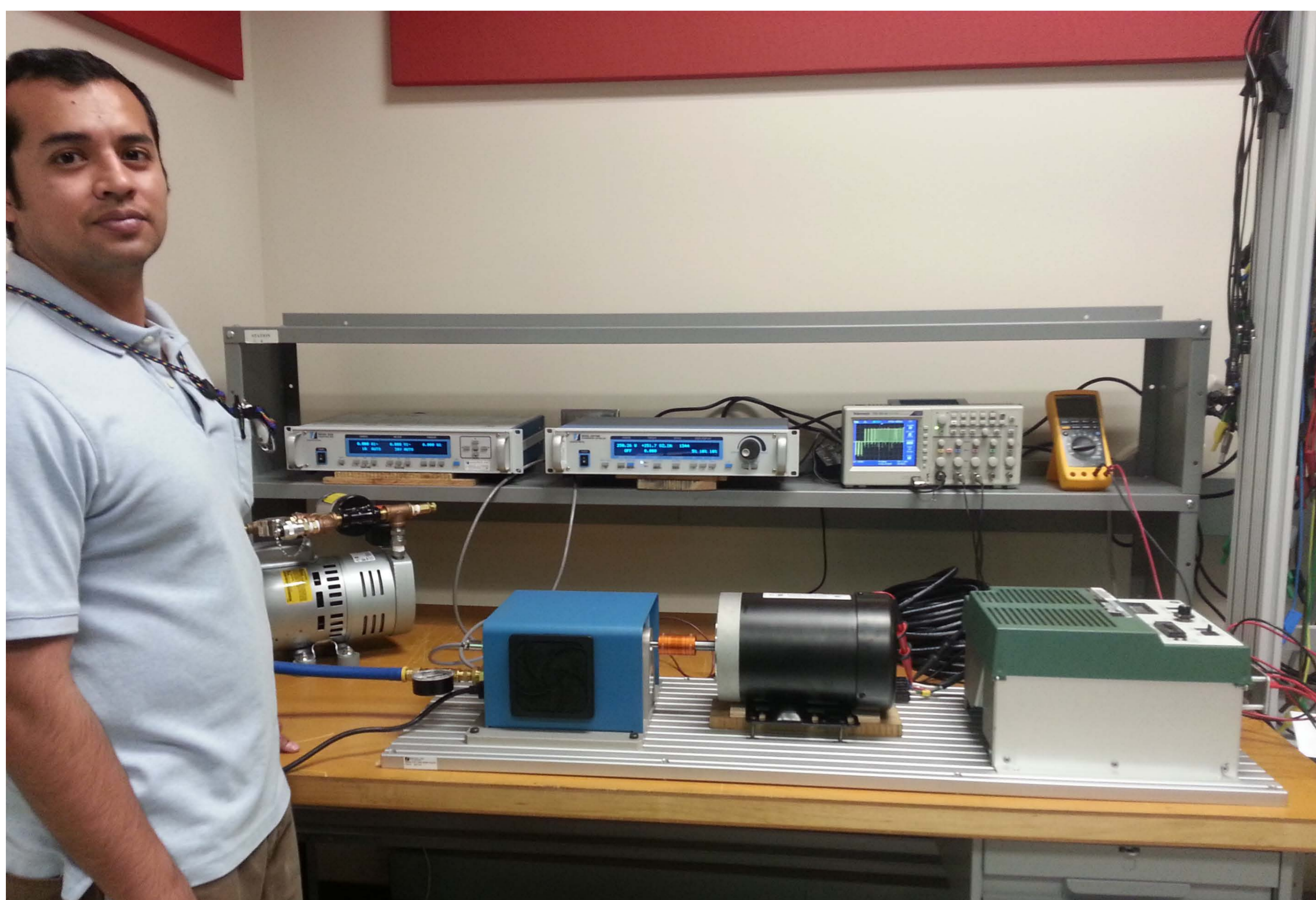


Fig. 1: Laboratory Test Bench.

Preliminary Results: Initial laboratory tests of a VFD indicate severe waveform distortion (unlike the case without a VFD where the signals are nearly sinusoidal). Figures 2 and 3 below show the supply-side voltage and current waveforms and the motor-side voltage waveform. The large harmonics in the supply current and voltage spikes at the motor terminal are of most concern in this study.

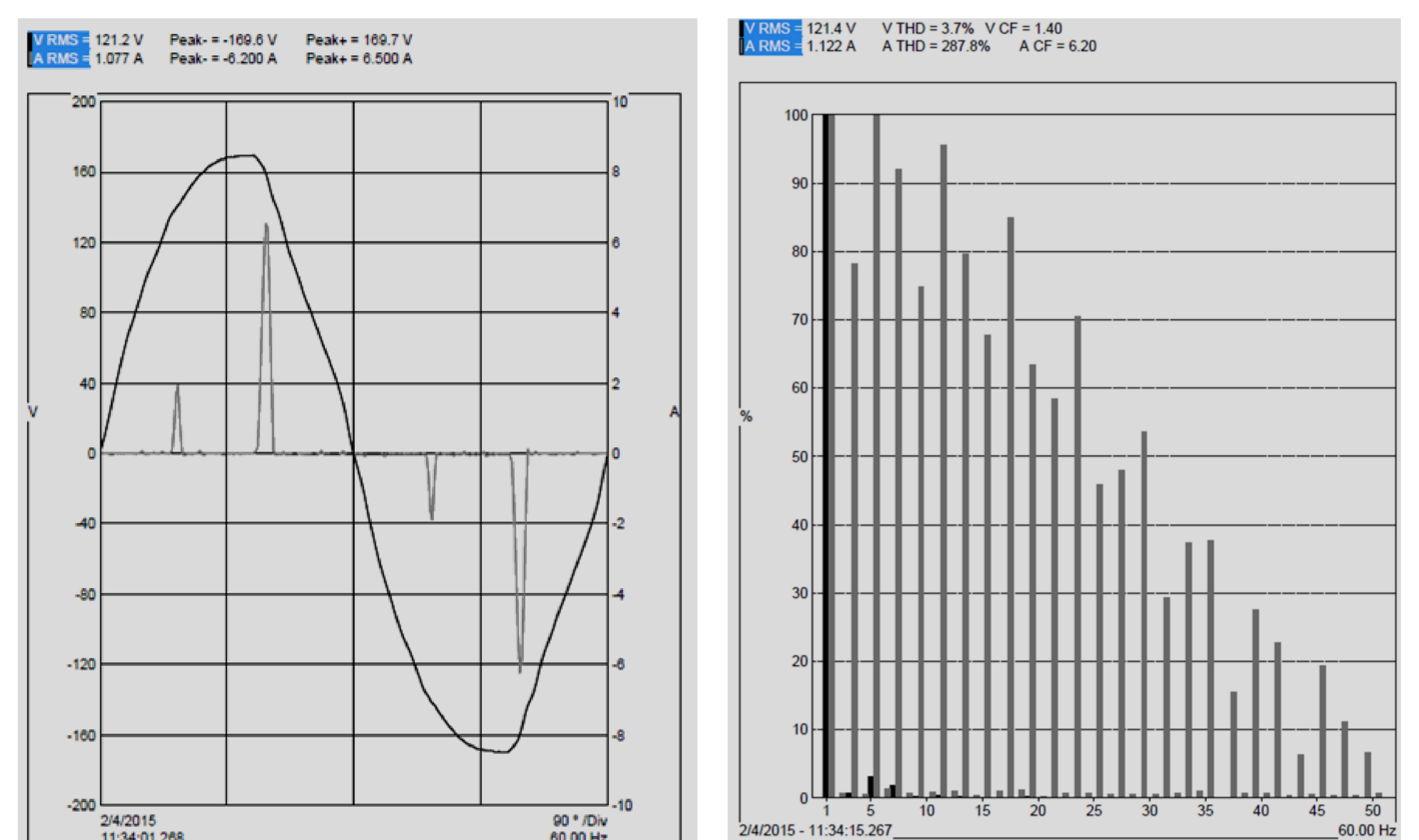


Fig. 2: Supply-side Voltage and Current Waveforms and their Harmonic Content.

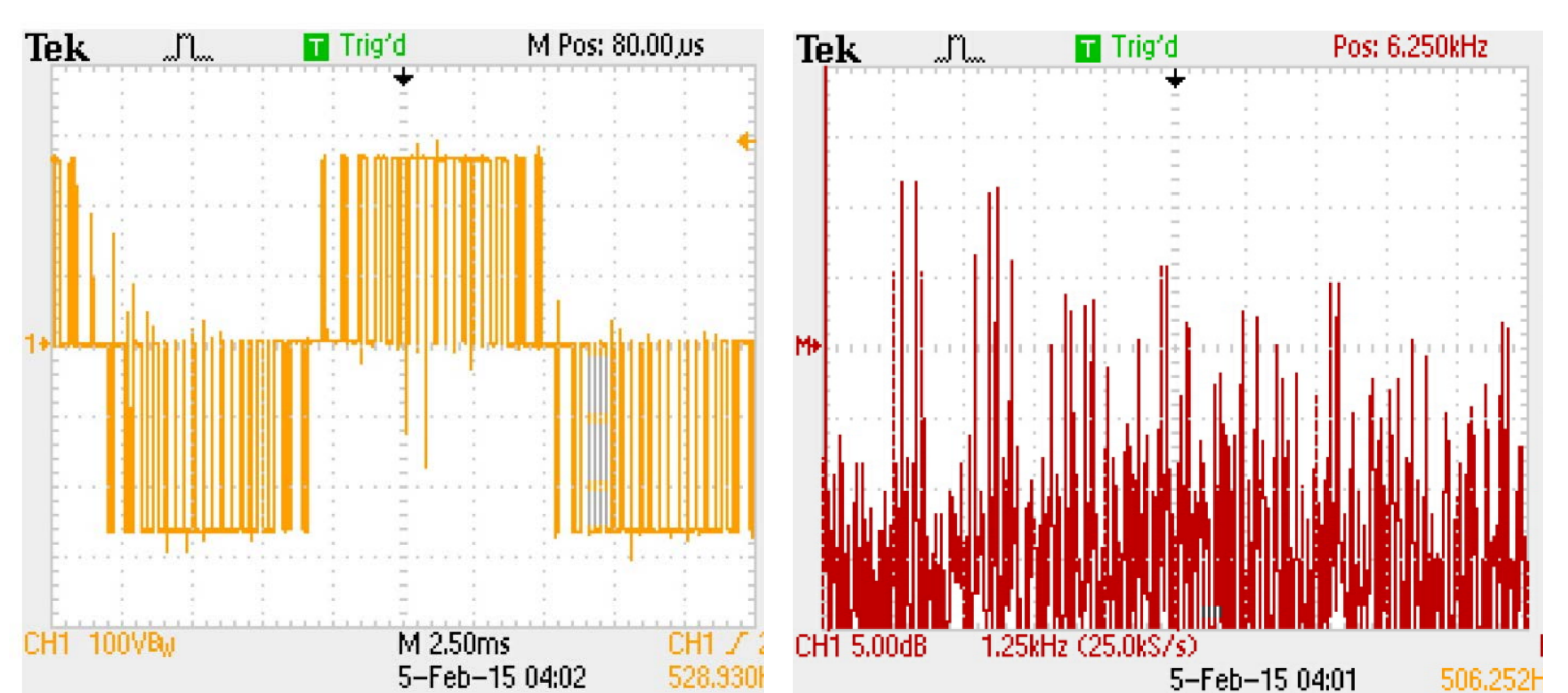


Fig. 3: Motor-Side Voltage Waveform and its Harmonic Content.

Conclusion: The research on this topic is just beginning and initial results will be expected within the next few months.

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