This intermediate level tutorial is intended for the practicing engineer who has some familiarity with motor control or power factor correction or grid tied 3 phase converter but wants to apply more sophisticated control techniques. The derivation of DQ vectors will be provided from first principles so a common baseline can be established. Then, the application of the DQ technique will be applied to three phase power factor and motor applications. Subsequently, current loops will be closed using standard techniques which will highlight some of the issues with these standard approaches.

In many cases where three phase current or voltage loops are closed, periodic disturbances need to be eliminated. One way to accomplish this is using the internal model principle and the application of adaptive noise cancelling or harmonic regulators. Theoretical analysis and simulation will be used to demonstrate the effectiveness of these techniques. Methodology for tuning of voltage, speed and current regulators for electrical drives and grid tied converters will be developed. Further, the impact of PWM delays, controller processing time, filtering etc will be shown using analysis and simulation. This impact will be augmented with experimental results and compared to the simulated predictions.