Preface

Electrical power is becoming one of the most dominant factors in our society. Power generation, transmission, distribution and usage are undergoing significant changes that will affect the electrical quality and performance needs of our 21st century industry. One major aspect of electrical power is its quality and stability – or so called Power Quality.

The view on Power Quality did change over the past few years. It seems that Power Quality is becoming a more important term in the academic world dealing with electrical power, and it is becoming more visible in all areas of commerce and industry, because of the ever increasing industry automation using sensitive electrical equipment on one hand and due to the dramatic change of our global electrical infrastructure on the other.

For the past century, grid stability was maintained with a limited amount of major generators that have a large amount of rotational inertia. And the rate of change of phase angle is slow. Unfortunately, this does not work anymore with renewable energy sources adding their share to the grid like wind turbines or PV modules. Although the basic idea to use renewable energies is great and will be our path into the next century, it comes with a curse for the power grid as power flow stability will suffer.

It is not only the source side that is about to change. We have also seen significant changes on the load side as well. Industry is using machines and electrical products such as AC drives or PLCs that are sensitive to the slightest change of power quality, and we at home use more and more electrical products with switching power supplies or starting to plug in our electric cars to charge batteries. In addition, many of us have begun installing our own distributed generation systems on our rooftops using the latest solar panels. So we did look for a way to address this severe impact on our distribution network. To match supply and demand, we are about to create a new, intelligent and self-healing electric power infrastructure. The Smart Grid. The basic idea is to maintain the necessary balance between generators and loads on a grid. In other words, to make sure we have a good grid balance at all times. But the key question that you should ask yourself is: Does it also improve Power Quality? Probably not!

Further on, the way how Power Quality is measured is going to be changed. Traditionally, each country had its own Power Quality standards and defined its own power quality instrument requirements. But more and more international harmonization efforts can be seen. Such as IEC 61000-4-30, which is an excellent standard that ensures that all compliant power quality instruments, regardless of manufacturer, will produce

the same results when connected to the same signal. This helps reduce the cost and size of measurement instruments so that they can also be used in volume applications and even directly embedded into sensitive loads. But work still has to be done. We still use Power Quality standards that have been written decades ago and don't match today's technology any more, such as flicker standards that use parameters that have been defined by the behavior of 60-watt incandescent light bulbs, which are becoming extinct.

Almost all experts are in agreement - although we will see an improvement in metering and control of the power flow, Power Quality will suffer. This book will give an overview of how power quality might impact our lives today and tomorrow, introduce new ways to monitor power quality and inform us about interesting possibilities to mitigate power quality problems.

Regardless of any enhancements of the power grid, "Power Quality is just compatibility" like my good old friend and teacher Alex McEachern used to say.
Power Quality will always remain an economic compromise between supply and load. The power available on the grid must be sufficiently clean for the loads to operate correctly, and the loads must be sufficiently strong to tolerate normal disturbances on the grid.

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