# Efficient Energy Processing and Volume Reduction of Power Management Systems

Following the recent proliferation of portable electronics, there has been a sharp increase in interest and demand for more compact, lighter, energy efficient, and economical power sources. As this trend continues, the requirements are becoming more and more challenging. Tighter output voltage regulation, faster response time to load and/or input voltage changes and lower volume are of major concern in the design of present-day switch-mode power suppliers (SMPS) and pose a 'bottleneck' in the advancement of the technology. These limitations stem primarily from the present lack of advanced design methods for SMPS and control methods that are specifically oriented toward the load and line transient requirements.

The primary objective of this research program is to enhance our understanding in fundamental aspects of transient-oriented design of power management systems. In practical terms, *the overall goal of this program is to devise a new generation of highly flexible SMPSs for low to medium power applications. Such flexible SMPSs would combine advanced digital control methods with novel converter topologies, thereby drastically minimizing the overall volume and improving power processing efficiency.* It is expected that the combination of a converter configuration that can accommodate the load requirements and a controller specially 'tailored' to the converter characteristics will result in improved transient response, higher system efficiency, smaller device volume and lower cost of the converter.

Investigations have already confirmed that a separation between the operation of the SMPS in the steady-state and during a transient event results in reduced size output filter and lower component stress and can lead to improved system dynamics, better energy processing efficiency and higher power density design.

The potential contributions of this study lie in providing a natural, streamlined, approach for the design and control of digital power management systems. This will lead to better design and improved performance of in closed-loop. The contributions of the study will be evident in both the theoretical and practical realms. It will establish an analytical foundation for transient response oriented, time domain design of digital power management systems that will be useful to manufacturers that are already in this area and to others who may wish to further enhance their power processing efficiency.