Abstract
High efficiency DC-DC converters make up one of the important blocks of state-of-the-art power supplies. The trend toward high level of transistor integration has caused load current demands to grow significantly. Supplying high output current and minimizing output current ripple has been a driving force behind the evolution of Multi-phase topologies. Ability to supply large output current with improved efficiency, reduction in the size of filter components, improved transient response make multi-phase topologies a preferred choice for low voltage-high current applications.

Current sensing capability inside a system is much sought after for applications which include Peak-current mode control, Current limiting, Overload protection. Current sensing is extremely important for current sharing in Multi-phase topologies. Existing approaches such as Series resistor, SenseFET, inductor DCR based current sensing are simple but their drawbacks such low efficiency, low accuracy, limited bandwidth demand a novel current sensing scheme.
This research presents a systematic design procedure of a 5V – 1.8V, 8A 4-Phase Buck regulator with a novel current sensing scheme based on replication of the inductor current. The proposed solution consists of detailed system modelling in PLECS® which includes modification of the peak current mode model to accommodate the new current sensing element, derivation of power-stage and Plant transfer functions, Controller design. The proposed model has been verified through PLECS® simulations and compared with a transistor-level implementation of the system. The time-domain parameters such as overshoot and settling-time simulated through transistor-level implementation are in close agreement with the results obtained from the PLECS model.