CHAPTER 7

CONCLUSION AND FUTURE SCOPE

Quasi-Resonant Buck Converter is a discrete, time-variant system which experiences a high degree of non-linearity in its control characteristics and hence it is imperative to utilize a control methodology to obtain the desired performance at the output. As an initial step, a PI (Proportional-Integral) control algorithm was initially designed and its application to the regulation of 54V, 2.916kW Quasi-Resonant Buck Converter was investigated under five operating conditions. Simulation was performed in time-domain and the two vital time-domain specifications namely peak overshoot and settling time were used to measure the system performance. It was verified that the linear PI controller optimized for a small-signal transient at an operating condition offers an excellent dynamic performance; on the other hand, for large-signal disturbances, the transient response at start-up was associated with overshoot and undershoot resulting in sluggish response. In order to enhance the system performance, as a secondary step, Fuzzy logic based on Artificial Intelligence was propounded since its control function is described by fuzzy sets and IF-THEN predefined rules which greatly reduces the development time and therefore needs less data storage in favour of membership functions and rules and the output of such Fuzzy controller was compared with the linear PI controller at the same operating conditions. It was verified that the control algorithm based on Fuzzy logic confirms the ability to control Quasi-Resonant Buck Converter despite line and load variations resulting in better stability.
Typical method doesn’t exist for the transformation of expert’s knowledge into the rule base and data base of a fuzzy inference system and the choice of membership functions still depend on trial-and-error method. It is henceforth that human-like reasoning method of fuzzy systems was synergized with the learning ability of neural networks and a control algorithm based on Neuro-Fuzzy hybridization was finally designed and the closed-loop performance of Quasi-Resonant Buck Converter was again compared with the linear PI controller at the aforesaid operating conditions. It was observed that the Neuro-Fuzzy Controller was adaptive with the various operating conditions and it exhibits superior performance as compared with the conventional PI controller; in particular, its ability to achieve good time-domain characteristics was clearly established by simulation. In order to validate the control strategy, for instance, the two-term PI control algorithm was implemented using National Semiconductor’s low cost, quadruple operational amplifier LM324 and the experimental results for $J_i/H_i = -0.2$ at five different operating conditions were in good agreement with simulation.

7.1 SCOPE FOR FUTURE WORK

Methods based on Fuzzy logic and Fuzzy Inference System was focused in this literature in order to assign membership values to fuzzy variables and in future, for instance, a Fuzzy system may perhaps be used for the controller and Genetic Algorithm which uses the principle of evolution, natural selection and genetics from natural biological system in a computer algorithm could be used to tune the scaling factors.