CHAPTER 10

CONCLUSION AND SCOPE FOR FUTURE WORK

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10.1 SUMMARY

This thesis presents a simple but efficient optimized photovoltaic system using power electronics devices. The model of PV module BP SX 150S is simulated in the MATLAB. The results show that model using the equivalent circuit in moderate complexity provides good matching with real PV module. The number of iterations for convergence and theoretical energy of the PV module is found out by the simulation. The simulation performs the comparative analysis for the three MPPT algorithms at various irradiance levels. The tracking energy is found out of three MPPTs by the simulation. The P&O and Increment Conductance algorithms shows better performance in terms of tracking efficiency compared to the Decrement Resistance algorithm. Even a small improvement of efficiency could bring large savings if the system is large. The tracking efficiency is found out more than 99.95%. The DC motor pump is designed by the SIMULINK in the MATLAB. In order to develop a system for optimizing photovoltaic module, this thesis adopts the two direct control methods, one is input sensing direct control method, and another one is output sensing direct control method, which employ the three MPPT algorithms. In the input sensing direct control method, it requires four sensors while in output sensing direct control method it requires two sensors for output, so the cost of system is reduced. In these methods, the CUK converter is used for better matching and to extract more and more energy from the theoretical energy (maximum energy) of PV module. The utilization energy of PV module is found out by the simulation, the water pumped per day by DC motor pump is also found out by simulation. In the last, simulations also make comparison between system with MPPT and the system without MPPT (direct-couple) in terms of energy utilization efficiency, and total value of water pumped in a day. It performs simulation of the whole system and verifies functionality and benefits of MPPT. The results validate that system using MPPT can significantly increased the utilization efficiency.
of energy production from PV module and the performance of the water pumped by the DC motor pump to the system without MPPT.

10.2 DIFFICULTIES AND FUTURE SCOPE

Correct modeling of DC motor pump and CUK converter is an important area of study, and various difficulty remain in the current study. A more realistic model of the CUK converter would involve a switching loss in a power-MOSFET, a diode loss, and resistive losses in the capacitors and inductors, while in the proposed system the CUK converter is assumed ideal (loss-less). The simulation model used for simulation of DC motor pump gives results within a reasonable range. The accuracy of simulation model is, however, uncertain because the chosen of the parameters are only estimates. If the proposed system could be run on the real DC motor pump, or an equivalent simulation model by entering reasonable parameters. This could lead to more accurate simulation results. The PV module can be used for large motors (5hp or above) by using the SIMULINK for modeling the motor for better results.

Physical implementation of the system remains for future research. It may involve implementation of: a DSP, fuzzy logic controller, or a microcontroller, a method of supplying power to the controller, signal conditioning circuits for A/D converters, a driving circuit for Power-MOSFET, a CUK converter, and a water level sensor that detects when the water reservoir reaches full. It may also involve performance analysis on the actual system and comparisons with simulations.

10.3 CONCLUDING REMARKS

The entire world is facing a challenge to overcome the hurdle of energy crisis and global warming which are some of the biggest challenges for humanity in the 21st century. The diminishing deposits of non-renewable energy resources such as coal, natural gas, fossil fuels etc and pollution and
global warning due to these have added to this worry. The world is getting divided into two groups: the countries that have access to oil, coal and natural gas resources and those that do not. It is thus fairly evident that a need exist for developing alternative energy sources. The rapid increase in the demand for electricity and the recent change in the environment conditions led to a need for a new source of energy that is cheaper and sustainable with less carbon emission. Energy generated from clean, efficient, and environment friendly has become one of the major challenges for engineers and scientists. Among all renewable energy sources, photovoltaic power systems attract more attention while greenhouse emissions are reduced. Regarding the endless aspect of solar energy, it is worth saying that solar energy is a unique solution for energy crisis. PV has a powerful attraction because it produces electric energy from a free inexhaustible source, the sun, using no moving parts, consuming no fossil fuels, and creating no pollution or green house gases during the power generation. Together with decreasing PV module costs and increasing efficiency, photovoltaic is getting more pervasive than ever.

Finally, the author wishes that this thesis serves the interests of other students and experts who are interested in using power electronics for PV applications for optimizing them and provides encouragement towards more advanced senior project, master’s, and Ph.D thesis research.