Chapter 8
Conclusions

Modeling and control of Autonomous Underwater Vehicles is a topic of interest for many researchers. In India the Organization like Naval Research Board is working on relevant field. In this context the research undertaken and discussed through this report is related to present need in the field of modeling and control of Autonomous Underwater Vehicle (AUV).

In this thesis a complete model of AUV is obtained. The study of modular modeling method for Myring type hull profile is also studied. This method divides AUV into three regions namely the nose, hull and the tail. In addition, every module is obtained based on calculations using necessary data. Modular modeling makes the modeling process quite flexible. Based on 6 DOF dynamic model, there are three subsystems namely speed, depth and steering. The two control laws are designed and compared separately. The PID and LQR controllers are designed based on linearized model. The performances of these two controllers are compared and the study is useful to design better controller for AUV.

In this thesis the fractional order controller is newly introduced for integer order as well fractional order steering and depth subsystems of AUV. The performance of fractional order controller is compared with conventional controllers. Simulation results show that the fractional order control provides effective way of control than conventional control.

In this thesis fractional order PID controller is validated on fabricated experimental set ups of thruster, which indicates that the FOPID controller is more stable and the speed of thruster remains constant at different water pressure on propeller. During disturbance conditions also the behavior of FOPID controller is much better and with improved overshoot. The performance of FOPID controller under ice cold water is also encouraging. All the above results on FOPID controller are also confirmed as National Scientific and Technological Laboratory, Visakhapatnam. Due to above observations the use of FOPID controller in AUV may be a better option.

Observer based feedback systems are usually seen with complex structure. The control system based on static output feedback may not achieve desired response
because of incomplete pole placement assignment. In view of this, periodic output feedback (POF) technique seems to be a promising one. The application of POF technique is appropriate than observer based controller. In AUV several sensors and actuators are employed. The feedback controller is designed that can tolerate the failure of any of the actuators, designed by POF technique with multi model approach. The simulation results are encouraging. Finally, experimental results are presented showing satisfactory performance of the developed controller illustrating one of the most important contributions of this thesis.

8.1 Future Scope

In future the fault tolerant controller can be experimentally validated using additional thrusters and sensors. The fractional order control theory can be incorporated in design of fault tolerant controller in AUV.