CHAPTER – 7

CONCLUSIONS AND FUTURE SCOPE

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CHAPTER – 7

CONCLUSIONS AND FUTURE SCOPE

The design and development of RDC system using modified ATO technique over wide speed range has been discussed in the chapter five. The system has been fabricated, assembled and tested in the laboratory. Experimental results are carried out to evaluate the performance of the proposed technique over wide speed range i.e. from 300 rpm to 2400 rpm. This chapter presents the conclusions that are drawn from the simulation results and the experimental results; and also the future scope for the work is presented.

7.1 CONCLUSIONS:

In the present study, the performance of designed RDC system over wide speed range is investigated. This thesis covers the major issues and solutions dealing with angular position techniques over wide speed range. Two main techniques related to measurement of angular position of motors have been studied and the following conclusions are drawn from the simulation and experimental results.

- The angular performance of arctangent technique is good at low speeds i.e. less than 600 rpm only and gives very low value of angular error. As the speed of the motor increases beyond 600 rpm, the angular position error also increases. This is due to this method is an open loop method and the angular performance of the system is measured without tracking of past positions.
- ATO technique is a closed loop method and the present value of the rotor angle is estimated based on the past rotor angles. It gives better angular

position values at low speeds. As the speed of the motor increases, this exhibits pulsating rotor shaft angle estimation even though it is a closed loop method. This method is not robust and the resolution needs to be increased at higher speeds.

- The performance of the proposed RDC system using modified ATO technique using MATLAB® SIMULINK® in chapter four is evaluated without inclusion of any noise interferences. This RDC system angular performance is evaluated for the wide speed ranges i.e. from 60 rpm to 4200 rpm and the angular error is varying from 0.0013^0 to 0.0871^0.
- The angular performance of arctangent algorithm and modified ATO Algorithm are given in Table 7.1. Figure 7.1 presents the comparison of the angular performance of these two methods.

Table 7.1 Angular performance of arctangent and modified ATO techniques using MATLAB® SIMULINK®

Speed (in rpm)	**Angular position error of MATLAB® Simulink® based RDC System (in degrees)**	
	Arctangent method	**Modified ATO method**
300	0.0093	0.0064
600	0.0185	0.0128
900	0.0278	0.0191
1200	0.0371	0.0255
1500	0.0463	0.0319
1800	0.0556	0.0384
2100	0.0649	0.0448
2400	0.0741	0.0504
2700	0.0834	0.0576
3000	0.0927	0.0640

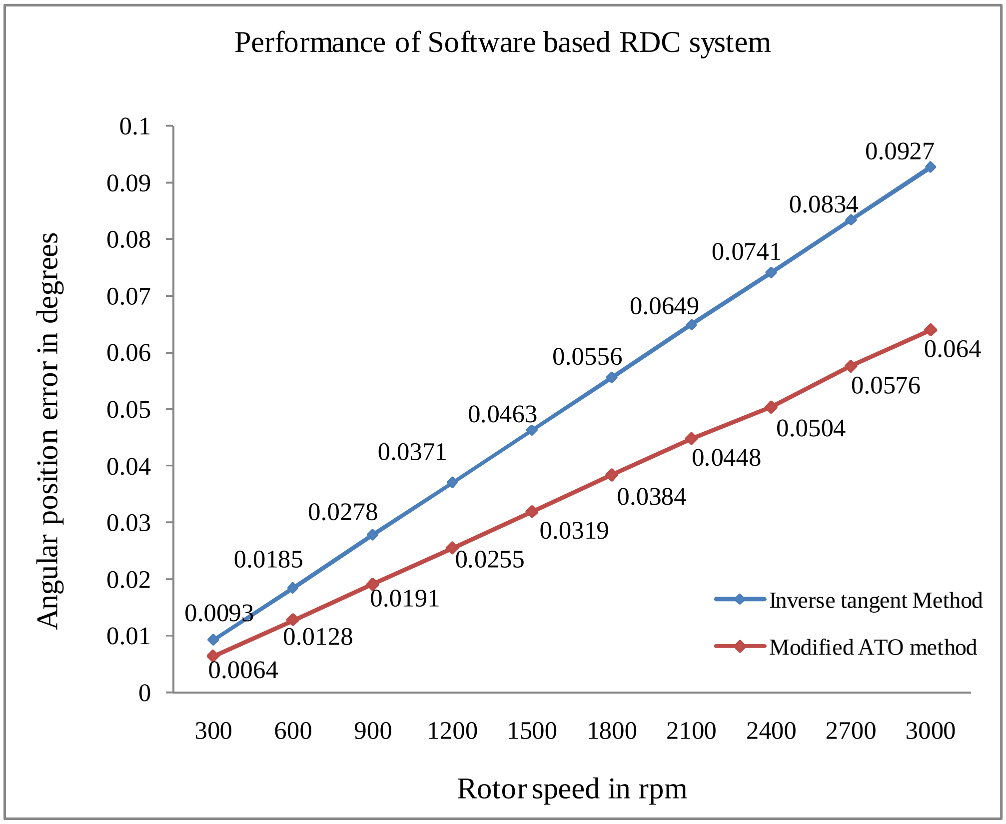

Figure 7.1 Angular performance of arctangent and modified ATO techniques

- The performance of ARM7 LPC2148 based RDC system as in chapter – 5, is also evaluated for wide speed ranges i.e. from 300 rpm to 2400 rpm and the angular error is varying from very low value to 0.09^0.
- Table 7.2 gives the comparison of the simulation and experimental results of the angular performance of the proposed RDC system.
- The graph between motor speed and the measured angular position error values using both simulation and experimental of the proposed modified ATO technique is shown in Figure 7.2.

Table 7.2: Angular performance of modified ATO technique using simulation and experimental

Speed in rpm	**Angular error of the proposed RDC System in degrees**	
	Using simulation results	**Using experimental results**
300	0.0064	< 0.08
600	0.0128	< 0.08
900	0.0191	0.08
1200	0.0255	0.08
1500	0.0319	0.08
1800	0.0384	0.09
2100	0.0448	0.08
2400	0.0504	0.09

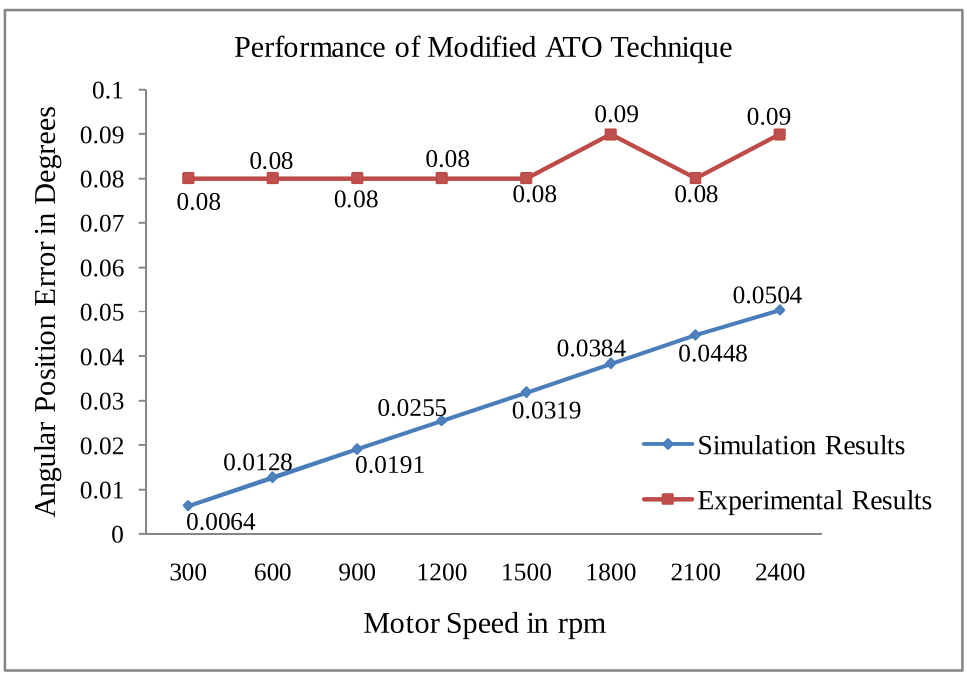

Figure 7.2 Angular performance of modified ATO technique using simulation and experimental results

- From Figure 7.2, it is observed that the angular position error of the proposed modified ATO technique using MATLAB® SIMULINK® is linear with respect to the motor speed and it is almost constant in the experimental results i.e. 0.08^0.
- The graph between motor speed and the measured angular position error values using both simulation and experimental of the proposed modified ATO technique is shown in Figure 7.2.
- The drawback of the simulation model of the proposed RDC method is that it is not affected by real world parameters like EMI and noise interferences from other systems.
- The experimental results of the proposed RDC system using modified ATO technique are less than perfect when compared with simulation results of the same system at lower range of speeds.
- But as the motor speed increases, the performance of the simulation model of RDC system using modified ATO technique is less than the experimental results.
- The designed RDC system is so effective from technical point of view and the cost of the system is also economical when using ARM7 LPC2148FBD64 microcontroller combined with the resolver.

7.2 FUTURE SCOPE

The use of the proposed RDC system using modified ATO technique over wide speed range has been examined. With the knowledge from the current design using ARM7 LPC2148FBD64 microcontroller; future research may be of interest concentrating on the following:

- Develop the modified ATO technique using fuzzy logic servo controllers instead of the proposed ATO approach, so that the delay between the measured rotor angle and estimated angle can be minimized.
- Develop the RDC system using advanced processors like ARM Cortex, so that the additional output devices like Cathode Ray Oscilloscopes can be avoided.
- Develop the RDC system using advanced DSP development boards.
- Develop the RDC system to estimate the initial torque and speed of the motor