CHAPTER 9

CONCLUSION

9.1 OUTCOME OF THIS RESEARCH

Most of the researchers had conducted turning experiments on stainless steel with high cost tools like CBN and PCBN. Coated cutting tool for CNC turning of stainless steel has received less attention. Hence in this work, experimental studies were carried out for optimal setting of machining parameters for turning stainless steel using economically coated cutting tools. The main objective of this thesis is to investigate the effects of different coated tools such as TiCN/Al₂O₃, TiAlN, Ti(C,N,B), B-TiC and B-Al₂O₃ on AISI316 and AISI410 in CNC turning under dry conditions. The following are the outcomes of this research work conducted with the object of minimization of SR and TW.

1. The TiAlN coated cutting tool performed better than the other coated cutting tools during turning AISI316 and AISI410. The TiAlN coated tool had the higher harness, resistance against the wear and lower coefficient of friction. The minimum surface roughness and tool wear obtained from the TiAlN coated tool than the other coated tools.

2. Optimization of the single response problem using Taguchi method provided an effective methodology for the design optimization of turning parameters. Optimum setting for minimization of SR for turning AISI316 was cutting speed
160m/min, feed 0.2mm/rev, and depth of cut of 2.1mm \([V_2F_2D_3]\). Optimum setting for minimization of TW for turning AISI316 was cutting speed 110m/min, feed 0.2mm/rev, and depth of cut of 1.4 mm \([V_1F_2D_2]\). Optimum setting for minimization of SR for turning AISI410 was cutting speed 110m/min, feed 0.1mm/rev, and depth of cut of 0.7mm \([V_1F_1D_1]\). Optimum setting for minimization of TW for turning AISI410 was cutting speed 160m/min, feed 0.2mm/rev, and depth of cut of 0.7mm \([V_2F_2D_1]\] using TiAlN coated tool. Confirmation test results proved that the determined optimum combination of turning parameters satisfied the real requirements of turning AISI316 and AISI410.

3. Muti response optimization was performed for turning using the grey relational analysis. Optimum setting for minimization of SR and TW for turning AISI316 was cutting speed 110m/min, feed 0.1mm/rev, and depth of cut of 1.4mm \([V_1F_1D_2]\). Optimum setting for minimization of SR and TW for turning AISI410 was cutting speed 110m/min, feed 0.1mm/rev, and depth of cut of 0.7mm \([V_1F_1D_1]\] using TiAlN coated tool.

4. The response surface model for turning AISI316 and AISI410 was developed. The observed data indicated that the predicted and measured values were fairly close. This established that the developed model could be effectively used to predict the SR and TW of different coated tools. Linear effect of feed, followed by depth of cut was the most significant factor affecting the SR. Quadratic effect of depth of cut, followed by feed was the most significant factor
affecting the TW during turning AISI316. Linear effect of feed was followed by cutting speed; it is the most significant factor affecting the SR. Linear effect of cutting speed, followed by interaction effect cutting speed and depth of cut was the most significant factor affecting the TW during turning of AISI410 using TiAlN coated tool. The normal probability plots were departures from the straight line and it would indicate a departure from a normal distribution, which was used to check the normality distribution of the residuals for different coated tools.

5. The selected tool can be used for turning AISI316 when compared to AISI410 for getting minimum SR and TW. The sliding wear occurred on the chip face of the tool during turning AISI316. The plastic deformations with abrasive wear occurred on the cutting tool during turning AISI410.

9.2 SCOPE FOR THE FURTHER WORK

By adopting the analysis made in this thesis, this research can be extended with increased number of signal and noise factors with increased levels for obtaining comparatively better results.

- This research can be extended for turning composite materials using different coated tools.
- The different coated tools used in this thesis can also be used for some other machining operations such as drilling, milling etc.
- The different coated tools can be prepared by Nano materials and cutting tools can also be coated with Nano layers.