CHAPTER 8

CONCLUSION AND SCOPE FOR FUTURE WORK

8.1 CONCLUSION

The following conclusions is drawn from the present study,

- Compo-casting method or semi-solid state of processing enhances the wettability of reinforcement particles and allows uniform distribution of SiC and Gr particles in aluminium matrix. The hardness of aluminium hybrid composite with 5, 7.5 and 10% weight fraction of SiC-Gr particles are 67, 80, 76BHN and their corresponding tensile strength are 170, 210, 204MPa, respectively. The higher weight fraction of graphite shows a decrease in hardness and tensile strength of Al-SiC-Gr hybrid composite.

- In conventional turning, the optimum parameters setting in machining of Al-SiC-Gr composite for multiple performance characteristics is obtained at 113m/min of cutting speed (level 3), 0.25mm/rev of feed rate (level 1), 0.2mm of depth of cut (level 1) and 10% of combined reinforcement of SiC-Gr (level 3).

- The increase in weight fraction of SiC-Gr decreases the surface roughness because of increased brittleness and the
subsequent disappearance of built-up edge in turning of Al-SiC-Gr hybrid composites.

- The machining of Al-SiC-Gr hybrid composites with higher weight fraction of graphite is easy with maximum MRR and lesser tool wear. The addition of graphite particles reduces flank wear of the tool because crushed or removed graphite particles trapped between flank face of tool and machined surface which lowers the coefficient of friction.

- Al-10%(SiC-Gr) has better machinability of minimum surface roughness, flank wear and maximum MRR for all cutting conditions when compared to MMC with 5 and 7.5% of SiC-Gr.

- In CNC machining, the surface roughness value is directly proportional to an increase in feed rate and depth of cut, and is inversely proportional to cutting speed.

- Cost and time can be saved using ANN and RSM models for predicting surface roughness.

- The surface roughness of Al-10%(SiC-Gr) hybrid composites is high when compared to Al-10% SiC composite. This occurs due to pull out of graphite particles during turning.

- Grey-fuzzy logic algorithm is the most effective approach in determining optimal setting and can greatly simplify the optimisation procedure for the complicated multiple performance characteristics. Implementation of fuzzy logic approach in a grey system offers improved grey-fuzzy reasoning grade which definitely has a lesser uncertain output when compared to grey relational approach alone.
The recommended level of turning parameters in CNC lathe for minimising surface roughness, flank wear and maximising material removal rate are: cutting speed at level 3 (200m/min), feed rate at level 1 (0.075mm/rev) and weight fraction of SiC-Gr at level 3 (10%).

8.2 SCOPE FOR FUTURE WORK

It is suggested that the copper coated graphite particles can be used as reinforcement for future studies. The copper coating over graphite is likely to create a strong interface between Al and Gr particles in the composite, thus reducing the particle pull out during turning operation. This coating also improves both surface finish and strength of Al-SiC-Gr hybrid composite.

Machinability of Al-SiC-Gr hybrid composite characteristics can be analysed using Polycrystalline Diamond (PCD), Cubic Boron Nitride (CBN) tool inserts.

In order to obtain increased strength of Al-SiC-Gr hybrid composite at higher weight fractions of reinforcements, the weight fraction of silicon carbide can be increased up to 20% but the graphite addition is limited to a maximum of 3%.

Grey-fuzzy logic approach can be utilised, when there is more number of process parameters and experiments are involved. It is more effective approach in determining the optimal setting and can greatly simplify optimisation procedure for the complicated multiple performance characteristics.