CHAPTER-7

CONCLUSIONS AND FUTURE SCOPE OF THE WORK
CHAPTER-7

CHAPTER-7: CONCLUSIONS AND FUTURE SCOPE OF THE WORK

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Name of the Sub-Title</th>
<th>Page No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>7.1</td>
<td>Conclusions</td>
<td>160-162</td>
</tr>
<tr>
<td>7.4</td>
<td>Future scope of the work</td>
<td>163</td>
</tr>
</tbody>
</table>
7. CONCLUSIONS AND FUTURE SCOPE OF WORK

7.1 CONCLUSIONS

In this work the influence of various process parameters on material removal rate and surface roughness in wire electric discharge machining of Cr-Mo-V alloy steel of different thickness were studied using Taguchi design of experiments. Based on the experimental result the wire electric discharge machining process was modeled using artificial neural network to predict the material removal rate and surface roughness. Multi-objective optimizations using controlled elitist genetic algorithm was used to optimize the ANN model to obtain Pareto optimal solutions to get maximum material removal rate and minimum surface roughness. Based on this work the following conclusions were drawn;

1. The experimental results indicated that the MRR and surface roughness are increased with increase in discharge current from 5 A to 15 A and idle voltage from 20 V to 45 V in machining of 10mm thick Cr-Mo-V alloy steel due to higher discharge energy. Whereas for the same material with increase in pulse duration from 5 µs to 10 µs MRR is decreased and from 10 µs to 15 µs it is increased. Whereas the surface roughness is increased with increase in pulse duration from 5 µs to 15 µs.

2. In machining of 10mm thick Cr-Mo-V alloy steel with increase in wire tension the MRR and surface roughness are first increased and then decreased. Whereas for the same material with increase in wire speed from 60 mm/s to 100 mm/s the MRR is
first decreased and then increased, but surface roughness is first increased and then decreased. With increase in flushing pressure the MRR is first increased and then it is decreased, whereas the surface roughness is decreased with increase in flushing pressure.

3. The Analysis of Variance (ANOVA) results indicated that discharge current, idle voltage, pulse duration, wire speed and flushing pressure are relatively more significant parameters on MRR and surface roughness than type of wire and wire tension in machining of 10 mm thick Cr-Mo-V alloy steel.

4. The relative influence of discharge current, idle voltage, pulse duration, wire speed and flushing pressure with wide range of levels are studied in machining of 15 mm thick Cr-Mo-V alloy steel and similar results are obtained as in the case of 10 mm thick material. In machining of 15 mm thick material the MRR increases significantly with increase in discharge current and idle voltage than the other selected parameters. The experimental results also indicated that the surface roughness is increased with the increase in discharge current, idle voltage, pulse duration and wire speed in machining of 15 mm thick material. Whereas surface roughness decreased with increase in flushing pressure.

5. Optimal Artificial Neural Network (ANN) model was developed using feed forward back propagation method to predict MRR
and surface roughness based on the experimental results. In this work it was found that feed forward back-propagation neural network with Levenberg-Marquardt training algorithm having 2 hidden layers, 12 neurons in 1st hidden layer and 11 neurons in 2nd hidden layer i.e. 5-12-11-2 architecture is the most suitable network to predict MRR and surface roughness in machining of Cr-Mo-V alloy steel. The value of correlation coefficient between experimental and ANN predictions of training, validation found for 5-12-11-2 architecture are 0.9553 and 0.9682. The average mean square error of training, validation for 5-12-11-2 configured ANN model are 1.03% and 1.12%.

6. The Controlled Elitist Genetic Algorithm (controlled NSGA-II) was successfully implemented for Multi-objective optimization of ANN model of WEDM process parameter to get maximum MRR and minimum surface roughness. Pareto-optimal front obtained with 0.5 Pareto fraction are superior optimal set of solutions based on the domination of solutions and the length of the Pareto-optimal front. The Pareto front consisting of 75 optimal set of solutions with parameter setting was generated.
7.4 FUTURE SCOPE

In this work the neuro-genetic approach is used to model and optimize WEDM process to get maximum material removal rate and minimum surface roughness. The developed Neuro-genetic model is suitable for prediction of MRR and surface roughness in machining of Cr-Mo-V alloy. This work can be extended to different types of materials. The work can be extended by modeling and optimization using Adaptive Neuro Fuzzy Inference System (ANFIS) with Genetic approach instead of Neuro-genetic approach.