CHAPTER 7

CONCLUSION

The experimental investigation were carried out for roller, ball, internal and low plasticity burnishing process. The modelling of the process were carried out using empirical, response surface, neural and finite element method. Validation of the model was done by Pearson product moment coefficient. Optimisation of the process was done using Response Surface Methodology.

The following conclusions were drawn:

1. While ball burnishing process was carried out using CNC lathe on HCHCr Tool steel material, the minimum surface roughness obtained was 0.018 μm and the improvements in surface finish was 96.47% for the following burnishing condition: burnishing force = 220 N, speed = 600 rpm, Number of passes = 3, feed = 0.15 mm/rev, and ball diameter = 10mm.

2. While ball burnishing process was carried out using CNC machining center on HCHCr Tool steel material, the minimum surface roughness in Y direction obtained was 0.059 μm and the improvements in surface finish was 93.26% and corresponding surface roughness in X direction obtained was 0.075μm and the improvements in surface finish was 91.04% for the following burnishing condition: burnishing force = 450 N, speed = 1150 rpm, Number of passes = 2, feed = 300 mm/min, step over = 0.15 mm and ball diameter = 10mm.
3. While roller burnishing process was carried out using CNC lathe on HCHCr Tool steel material, the minimum surface roughness obtained was 0.088 μm and the improvements in surface finish was 91.83% for the following burnishing condition: burnishing force = 1000 N, speed = 150 rpm, Number of passes = 5, feed = 0.04 mm/rev, and roller width = 2mm.

4. While roller burnishing process was carried out using CNC machining center on HCHCr Tool steel material, the minimum surface roughness in Y direction obtained was 0.053 μm and the improvements in surface finish was 90.69% and corresponding surface roughness in X direction obtained was 0.319 μm and the improvements in surface finish was 81.87% for the following burnishing condition: burnishing force = 450 N, speed = 1000 rpm, Number of passes = 3, feed = 700 mm/min, step over = 0.2 mm and roller width = 2mm.

5. While internal ball burnishing process was carried out using lathe on Aluminum material, the minimum surface roughness obtained was 0.141 μm and the improvements in surface finish was 66.9% for the following burnishing condition: burnishing speed = 140 rpm, Number of pass = 1, feed = 0.23 mm/rev, depth of cut = 0.075 mm and ball diameter = 10mm.

6. While low plasticity burnishing process was carried out using lathe on Brass material, the minimum surface roughness obtained was 0.264 μm and the improvements in surface finish was 79.83% for the following burnishing condition: burnishing speed = 580 rpm, Number of pass = 1, feed = 0.07 mm/rev, force = 13.4N and tool speed = 8700rpm.

7. While low plasticity burnishing process was carried out using lathe on EN24 steel material, the minimum surface roughness obtained
was 0.312 μm and the improvements in surface finish was 72.27% for the following burnishing condition: burnishing speed = 580 rpm, Number of pass = 1, feed = 0.07 mm/rev, force = 13.4N and tool speed = 9100 rpm.

8. While low plasticity burnishing process was carried out using lathe on AISI 1020 steel material, the minimum surface roughness obtained was 0.32 μm and the improvements in surface finish was 73.51% for the following burnishing condition: burnishing speed = 580 rpm, Number of pass = 1, feed = 0.07 mm/rev, force = 13.4N and tool speed = 8200 rpm.

9. While low plasticity burnishing process was carried out using lathe on Aluminum material, the minimum surface roughness obtained was 0.224 μm and the improvements in surface finish was 84.36% for the following burnishing condition: burnishing speed = 580 rpm, Number of pass = 1, feed = 0.07 mm/rev, force = 13.4N and tool speed = 8800 rpm.

10. The Pearson product moment coefficient was used to validate the predicted equations. The neural network model was better correlated with experimental reading than empirical and response surface model for all burnishing process.

11. The FEM simulation was carried out for the Brass CDA110, Aluminum 6061 and tool steel material on lathe. For the simulation finite element based software DEFORM-2D and DEFORM-3D were used. The surface roughness and residual stress were measured from FEM simulations and were compared with experimental results. The minimum and the maximum deviations between the experimental and simulation values of surface roughness for aluminum are 2.3% and 14.4%, for brass are 7.1% and 12.8% and for tool steel are 3.22 % and 8.69%. The minimum
and maximum deviation between the experimental and simulation values of residual stress for aluminum are 8.2% and 20%, for brass are 5.7% and 8.4% and for tool steel are 1.23% and 3.57%. The deviations between FEM simulation and experimental result for the surface roughness and residual stress are minimal.