ABSTRACT
A study was carried out to control the velocity of air mixed with granules and its ratio in an MEC shot peening machine. This is achieved by measuring the velocity of shot (air + granules), and air velocity, the control action being performed on controlling the air flow velocity and rate of flow of granules. Such control strategy in general is termed as multivariable control problem. Recent developments in these aspects have been reported in this paper.

1. INTRODUCTION
Shot peening has been found to be advantageous in manufacturing field and material engineering. Recently the shot peening field has gained momentum with the latest development of computer control. As a result better quality of shot peening operations are achievable day by day.

As per our proposal, the high quality shot peening operations still need better and high tech control systems. This is because in high quality shot peening operations, air velocity and amount of granules hitting the object per second must be controlled. Although controlling air velocity has been practised at many automatic control points, but further improvements have been felt to be required.

2. CONTROL PROBLEMS ASSOCIATED WITH SHOT PEENING.
Air velocity control
Granule flow rate control
Interdependence i.e. granules flow rate governing the air velocity and vice versa.

Air velocity is very common and is successfully tackled by many of the Indian shot peening machine manufacturers. In this scheme of control only air velocity is controlled for shot peening purpose.
With practice and experience in this field, researchers have realised that to have a reliable shot peening operation one has to go for the granule flow rate control which calls for interactive peening control.

Mixed flow problems in shot peening operations need further studies and therefore in this paper we propose a primitive technique by which one can control the granule flow rate.

3. RESULTS

Fig. 1 shows the line diagram of the shot peening machine to highlight the control strategy. It can be seen that there are two control valves and two measuring devices i.e. AV and GR. The objective is to show the Multi-input, Multi-output (MIMO) control strategy that can be followed for controlling both, the air velocity and granules flow rate.

Since we are not considering the interdependence of the MIMO controller it can be substituted by two SISO (Single-input Single-output) controllers. For simplicity it can be assumed that we are using the PID (Proportional Integral Differentiator) controller, with two set points. These set points are,

a. Set point for the velocity of air.

b. Set point for granules flow rate control i.e. granules per second getting mixed in air.

The output of this PID controller is fed to two control valves i.e. air pressure control valve and the granule flow rate control valve.

The open problem associated with the shot peening is how to direct a solid flow as per the requirement. To this end we propose a flow rate control valve which
can be implemented in order to achieve the granule flow rate control. It can be seen that the rate of flow using this valve can be controlled by a D.C. motor. For this, lot of control strategies are available. Thus the problem of granule flow rate control can be tackled.

4. CONCLUSION AND FUTURE SCOPE

We have tried tackle to the problem of granule flow rate alongwith the velocity of air wherein the principal strategy lies in designing a suitable control valve for granule flow rate. However the future scope of work from the control point of view will focus on the applicability of proper MIMO controller in shot peening machines.

5. REFERENCES

Maciejowski, J.M. 1989. Text on multivariable feedback design, Addison-welley, publication.
