DISCUSSION AND CONCLUSION

Attempt is directed in the present dissertation to the study of a programme controlled machine tool. The particular one chosen for the purpose of analysing the performance of such a control system and consequently arrive at the strategy for minimising error and optimising production is one installed in the Industrial Electric Drives Laboratory of Moscow Power Institute.

The tests which were carried out on the machine tool are described in Chapter I. These tests enabled the author to identify the different functional units of the control system and thereby construct the block diagram of the system which is essential for the purpose of analysis and other objects of this work. It is shown that the block diagram may be constructed in two different ways: the first one containing two non-linear blocks whereas the second one contains only one such block. The second one materialised due to the specific suggestion of Dr. Sirotin along this line.

The construction of the block diagram for the control system renders the analysis of the system feasible for normal operating conditions. But the study
of its operation remains incomplete if vibratory conditions and probabilities of collision phenomena are excluded. However, having met with such situations in practice, the need of a deeper insight into them will be naturally felt by an engineer desirous of improving the performance of his system. The second chapter is devoted to this end. Frequency response technique has been adopted to the basic combination of elastic link, viscous friction, inertial element and limiting element, since this technique is a powerful tool for analysing a non-linear system, particularly of higher order.

The third chapter deals with the problem of increasing the accuracy of the system while working out a particular contour. Different methods are suggested above in conformity with the situations arising. The applicability of the differential equation or the frequency response approach depends on the portion being worked out. Straight segments readily yield to the differential equation approach, whereas curved portions necessitate the frequency response approach. If vibratory or colliding conditions are being investigated then the corresponding frequency response curves are to be used. For co-ordinate type of control the computer data can be readily utilised.
The fourth chapter deals with the method of optimising production by holding the tool life constant and then examines the strategy to be adopted for minimising error when the system is not fully deterministic due to the presence of surface roughness or unevenness of hardness of the material or the random fluctuation of dry friction. This analysis considers only that randomness whose effect is most predominant and situated at such location as to produce maximum influence on the system performance. This location is on the table or sliding block or beyond it as the analysis indicates. It is pointed out how the nominal input programme has to be modified in such cases.