SYNOPSIS

The thesis deals with the thermoelectric phenomenon in machining caused by the difference in materials of the tool and the workpiece and generation of contact heat in the cutting zone.

The Chapters 1 and 2 have been devoted to the introduction of the scheme of the work done by the author and comprehensive literature survey of the previous work done in the field of thermoelectricity in machining.

In Chapter-3, resistances in Machine-Tool-Workpiece-Machine (MTWM) circuit have been evaluated by the author. Investigation was carried out specifically to determine the factors influencing the magnitude of the thermocurrent generated under experimental condition. Author also suggested a method to find out the tool-chip resistances which plays an important part in thermoelectric phenomenon in machining.

In Chapter-4, an approach has been made to locate the factors influencing thermocurrent. An analysis of variance has been carried out to find out the significance order of the parameters. Multiple Regression Technique has been adopted to find out general expression for thermocurrent depending upon the parameters - speed, feed, depth of cut and the
machining time. A typical nomogram has been constructed for easy determination of thermocurrent under experimental condition.

Behaviour of influencing parameters has been studied in detail in Chapter-5 by the author. In this connection author studied variation of thermocurrent with respect to thermal number, which takes inherent properties of workmaterial into account. Effects of thermocurrent on tool wear and surface finish of the job have been explored. Tool wear and thermocurrent have been associated together to find out a suitable and simple expression for wear.

In the field of manufacturing one is always interested to obtain desired result under optimum values of the parameters. Author has shown in Chapter-6 three optimising techniques using different objectives like maximum production rate, minimum thermo-current and minimum surface roughness of the job. Methods used were 'Steepest ascent method', 'Optimum-seeking method' (OSM) and 'Lagrangian method'. Author has also endeavoured a practical tool life equation under OSM method. Paired comparison of the objectives has also been shown to help in taking the decision.

In Chapter-7, a new approach has been presented to use thermoelectricity as a sensor to throw light on machinability value. In this connection author presented 'Peltier coefficient
method' and 'Burn-out voltage method'. Lastly the author suggested 'Performance Index method', which considers cost factor also while evaluating machinability value. In this case thermocurrent has been used as an 'on-line' sensor of machinability rating.

In Chapter-3 author has suggested the method of reducing thermocurrent, as it is detrimental to tool life and surface finish of the job. The interruption method and compensation method have been studied in detail and compared on the basis of their effectiveness. A simulated test was carried out to find out average gain in tool life value or in other words tool wear reduction under interruption method. Surface finish gained under these methods have been reported for comparison. Optimum compensating current under experimental condition has been suggested by the author to achieve the best feasible result. Use of proper lubricants like molybdenum disulphide (MoS₂) has been suggested and results have been incorporated in the thesis.

In the last chapter the author has made a comprehensive study of the results obtained from the investigation and drawn specific conclusions.