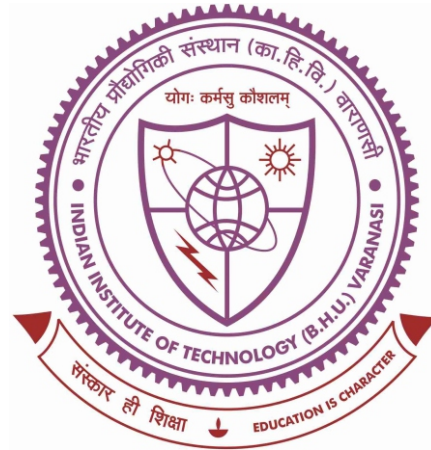


**EVALUATION OF BLAST INDUCED GROUND VIBRATION
AND POWDER FACTOR IN SURFACE LIMESTONE
QUARRIES USING STATISTICAL
AND ANN APPROACH**



**Thesis submitted in partial fulfillment for the
Award of Degree**

Doctor of Philosophy

By

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CHAPTER 7

CONCLUSION

7.1 Conclusions

The following case specific conclusions can be drawn from the present study:

1. The statistical based blasting design parameter selection and elimination methodology to develop a prediction equation, as suggested and used in the present study, has yielded promising results by way of reducing the number of redundant parameters and identifying the most influential parameters only. This, in turn, holds sufficient merit in simplifying the blasting designs and their associated complex problems.
2. Validation by two different statistical techniques (PCA and SSE), in the statistical domain has been established.
3. In prediction of PPV, the equation developed by PCA has been found to be highly correlating with measured values of PPV in by the standard USBM square root equation based prediction.
4. The efficacy of MLP based ANN technique has been found to be significantly higher in comparison to statistical techniques, in assessment of PPV and PF in all the study quarries.
5. Verification of the validated parameters (using ANN techniques) has also been established successfully to demonstrate efficacy of both statistical and A.I. (MLP based ANN) techniques in rock blasting. Since, AI technique has used the parameters already identified by the statistical techniques, therefore, this distinctly reveals the compatibility between statistical and MLP based ANN technique in rock blasting.

7.2 Limitations of the research work

1. The research work has been carried out in three limestone quarries of Nimbahera limestone deposit of Rajasthan. Given the size and nature of the blasting in limestone deposits, the proposed equations need to be thoroughly scrutinized for their application in different blasting condition.
2. In the study quarries, the absence of significant geological anomalies in the limestone deposit was observed. Therefore, in the similar type of limestone deposits with presence of geological anomalies, the strength and related parameters of the limestone will have to be altered to propose the relevant models.

7.3 Suggestions for future work

1. This study has used only one of the AI tool, namely, multi-layer perceptron (ANN) technique, it paves the way to use another artificial intelligence technique like big data analytics, machine learning etc.
2. Nonlinear statistical studies may also be investigated in future work.
3. Similar study can be used for blasting in other mineral deposits.