A 3-dimensional linear classifier for long-term probabilistic prediction of rock burst hazard

Ning Li*, R. Jiménez*

* ETSI Caminos, Canales y Puertos
Universidad Politécnica de Madrid
C/ Profesor Aranguren s/n, 28040 Madrid, Spain
e-mail: leening3436@gmail.com, web page: http://www.caminos.upm.es/

ABSTRACT

Rock burst is a complex dynamic hazard that can lead to casualties, to failure and deformation of the supporting structures, and to damage of the equipment on site [1] ; hence producing an urgent need to study its prediction in underground facilities. We present a novel computational method to predict rock burst based on the application of linear classifier theory [2]. An extensive database with observations about rock burst occurrence (or not) is collected from the literature, including projects from all over the world [3]. Several models with different combinations of five possible and easy-available input parameters (tunnel depth, H; maximum tangential stress, MTS or $\sigma\theta$; elastic energy index, Wet; uniaxial compressive strength of rock, UCS or σc; uniaxial tensile strength of rock, UTS or σt) are trained and validated, which allow us to compute new class-separation surfaces to estimate the probability of rock burst. The results show that an adequate model could be developed in H-W_{et}-UCS space, with an error rate of 6.1%. The proposed model is also validated with 9-fold cross-validation, showing that it provides a predictive capability (with an error rate of 9.1%) that compares well with previously proposed empirical methods. The results also confirm that the probability of rock burst increases with excavation depth; and that both W_{et} and UCS have a similarly significant influence on rock burst occurrence.

REFERENCES

[1] Dou L, Chen T, Gong S, He H and Zhang S, Rockburst hazard determination by using computed tomography technology in deep workface, *Safety Science*, 50(4): 736-740 (2012).
[2] Jimenez R and Recio D, A linear classifier for probabilistic prediction of squeezing conditions in Himalayan tunnels, *Engineering Geology*, 121(3): 101-109 (2011).
[3] Zhou J, Li X and Shi X, Long-term prediction model of rockburst in underground openings using heuristic algorithms and support vector machines, *Safety Science*, 50(4): 629-644 (2012).