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Safety line method for the prediction of deep coal-seam gas pressure and its application in coal mines

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Abstract

Gas pressure is an important index for evaluating the outburst risk and determining the gas content in coal seams. It is recommended to predict coal-seam gas pressure of the workplace at deep levels before extending mining activities to deeper levels. According to the prediction results, measurements are taken for gas outburst prevention and control and for workload estimation. At present, regression methods are always used to process the numerous gas pressure data for prediction. Because there are many factors that influence the gas pressure which could lead to a deviation from actual values, the measured data do not possess basic conditions for regression methods; this can cause unexpected dangers if the methods are adopted.

Based on a statistical analysis of actual measured results of coal-seam gas pressure in a same geological section in certain coal mine, two symbol measured points are selected to make a line for prediction, i.e. safety line, and the other measured points should be below the line except the abnormal points due to the confined water. It has been successfully applied in numerous coal mines in China. Particularly, this method is analyzed in this paper for the case of the No. 8₂ coal seam in the Taoyuan coal mine in Huaibei coalfield, China. By comparatively analyzing the relationship between gas pressure and depth from surface using regression methods, it is found that the safety line method could lead to a better prediction for deep coal-seam gas pressure, and therefore promote early warning ability and mining safety.

Highlights

- Fundamentals of gas pressure measurement are interpreted.
- Gas pressure data do not possess basic conditions for regression methods.
- An innovative method to predict the gas pressure is presented.

Keywords

Gas pressure; Measuring principle; Prediction method; Safety line; Coal and gas outburst

Figures and tables from this article:

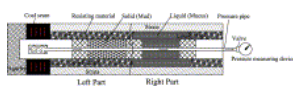


Fig. 1. Principle and methods of coal seam gas pressure measurement.

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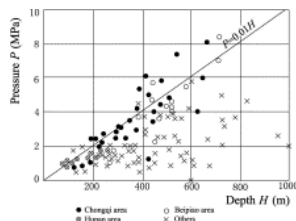


Fig. 2. Variation relation of coal seam gas pressure versus depth in different areas.

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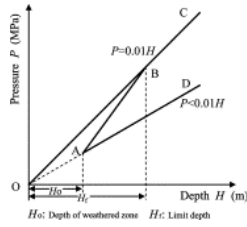


Fig. 3. Gas measured pressure variation curve versus time.

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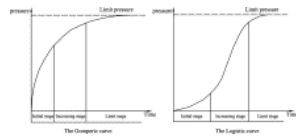


Fig. 4. Two types of gas pressure distribution laws.

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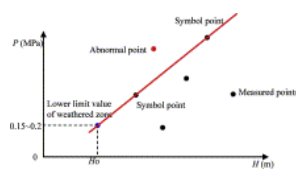


Fig. 5. Gas pressure prediction method: a safety line.

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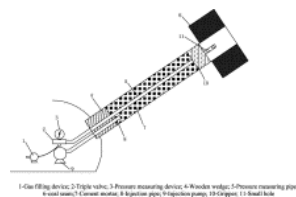


Fig. 6. Schematic diagram of the cement mortar hole sealing method.

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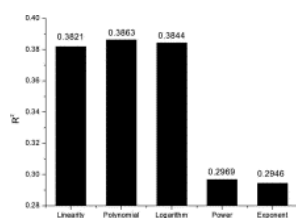


Fig. 7. R^2 analysis of correlation coefficients using different regression methods.

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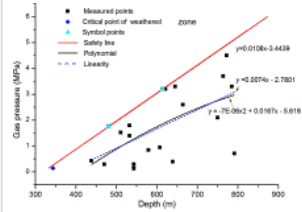


Fig. 8. Gas pressure prediction curves using different methods for the No. 8₂ coal seam in the Taoyuan coal mine.

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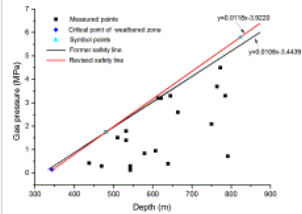


Fig. 9. Revised gas pressure prediction curves.

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Table 1. Variation of gas pressure gradient in some coal mining areas in China.

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Table 2. Gas pressure measurement results of the No. 8₂ coal seam in the Taoyuan coal mine.

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Table 3. The prediction values of the No. 8₂ coal seam gas pressure in the Taoyuan coal mine.

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