Constructing a Gas Explosion Inversion Model in a Straight Roadway Using GA-BP Neural Network

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Abstract

When the location and intensity of the source of the explosion is determined, the severity and impact of the explosion can be analyzed and predicted, such as the overpressure, temperature, and toxic gas propagation. In order to provide the theory of emergency rescue work, improve rescue efficiency, to protect the safety of rescue personnel. In addition, to determine the gas explosion source location and intensity of the accident investigation also has an important role, on the one hand, it helps to determine the accident-related responsible person, on the other hand, it also can more accurately judge the nature of the accident and the cause of the explosion, summarize the accident experience, for the future prevention of such accidents provide guidance experience. Therefore, the location and intensity of the source of the explosion through the field data inversion is of great significance. Based on Genetic Algorithm (GA, and similarly hereinafter) to improve the back propagation(BP) neural network theory, the use of the method through the gas explosion experiments and simulation of overpressure data inversion of roadway gas explosion source location and intensity, the establishment of roadway gas explosion disaster inversion model for emergency rescue and accident investigation to provide data support.

Full Text

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Figures

Figure 1

The schematic diagram of BP neural network [17]

Figure 2

The principle of GA improved BP neural network initial weight and threshold

Figure 3

The schematic of model

Figure 4

The maximum overpressure data of gas explosion in FLUENT simulation roadway under different working conditions

Figure 5

The maximum overpressure data of the gas explosion experiment in roadway of the China University of Mining and Technology (Beijing) [19]

Figure 6

The maximum overpressure data of gas explosion in Simtec simulation roadway from China University of Mining and Technology (Beijing) [18]

Figure 7

The maximum overpressure data of gas explosion experiment in roadway of the U.S. Mining Bureau [20]

Figure 8

The error statistics of inversion results under different hidden layer nodes and population scale

Figure 9

The comparison of inversion value and real value

Figure 10

The absolute error between inversion value and real value