Abstract

Various analytical models have developed to determine fire flame length under tunnel ceilings during fire emergency based on the regression and dimensional analysis. Artificial intelligence techniques are now being used as an alternate to statistical techniques. In this study, the artificial neural network (ANN) is applied to forecast fire flame length in tunnels. Moreover, particle swarm optimization algorithms were used for ANN training in order to overcome very slow convergence and easy entrapment in a local minimum of back propagation training algorithms. The model predicts flame length using Fire Heat Release Rate, Air velocity, Tunnel Width, Tunnel Height and Tunnel Cross Section. The predictive PSO-ANN model was implemented on the MATLAB and developed based on a database including 44 data sets from large scale fire test programs. The coefficient of determination (R2), the variance account for (VAF) and the root mean square error (RMSE) were calculated to check the prediction performance of the model. The R2, VAF and RMSE indices were obtained as 95.88%, 99.86% and 1.05. These indices revealed that the developed model is suitable for practical use in tunnels.


Ingason H., Li Y. Z. 2010, Model scale tunnel fire tests with longitudinal ventilation, Fire Safety Journal, 45,371-384

Ingason H., Li Y. Z. 2010, Model scale tunnel fire tests with point extraction ventilation, SP Report 2010:03, SP Technical Research Institute of Sweden, Borås, Sweden,


French S. E. 1994, EUREKA 499—HGV Fire Test (Nov. 1992)—Summary Report, in
Proceedings of the International Conference on Fires in Tunnels, E. Iverson (Ed.), SP Swedish National Testing and Research Institute, Borås, Sweden, pp. 63–85


**Index Terms**

Computer Science  
Artificial Intelligence

**Keywords**

Fire  
large scale fire test  
flame length  
ANN  
PSO.