

Study on Material Optimization of High Temperature Work Clothes

Xiaocan Zhong¹, Yangping Wu¹, Limin Zhou¹

¹School of Metallurgy and Energy, North China University of Science and Technology, Tangshan 063210, China.

Abstract

In order to improve the personal safety under high temperature environment, this paper designs a kind of four layers structure protective clothing for high temperature from the perspective of human protection. At the same time, based on the thermal conduction differential equation and other models, the reliability of the system is studied.

Keywords

Gaussian function, one dimensional unsteady heat transfer, high temperature.

1. Introduction

High temperature workers in high temperature or excessive thermal radiation, will cause high temperature damage, coupled with a long time of heavy physical labor, increase the heat produced by muscles, will increase the harm to workers [1]. Therefore, high-temperature workers must wear professional clothing, in order to design a low-cost, short-term research and development cycle of special work clothes, we need to study it.

2. Model Based on Thermal Conduction Differential Equation

Temperature distribution refers to the change of temperature with spatial position in a certain region of space at a given time [2] [3]. Although each layer of high-temperature work clothes has a finite thickness, the temperature of the side close to the human body will not change too much. Therefore, this problem is simplified as one-dimensional unsteady heat conduction process of semi infinite thick objects under the first kind of boundary conditions [4].

The form of Gaussian function is:

$$f(x) = ae^{-\frac{(x-b)^2}{2c^2}}$$

According to the Gaussian function, the model pictures are shown in Fig. 1 and Fig. 2

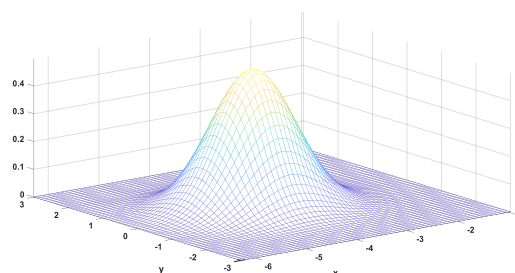


Fig 1. Three dimensional image of Gaussian function

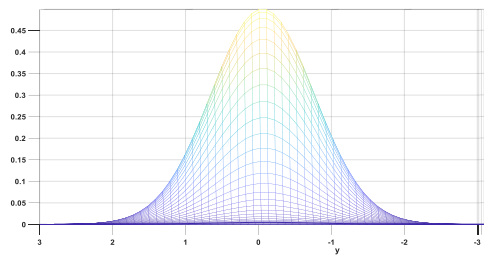


Fig 2. Image of Gaussian function dimension

3. Evaluation and Extension of Heat Transfer Model for High Temperature Work Clothes

3.1. Evaluation of Heat Transfer Model for High Temperature Work Clothes

At the end of the algorithm iteration, when the particle population gradually gathers together, the historical optimal solution of each particle gradually converges with the global historical optimal solution, but the quality is slightly poor, which can be regarded as the deteriorated global optimal solution [5]. Therefore, it can be considered that the quality of the historical optimal solution of a single particle is not as good as that of the historical global optimal solution in the later stage of the algorithm, but at the same time, it lacks randomness and loses the ability of expansion. It can be seen that the two optimal solutions should be treated equally in the whole process of the algorithm.

3.2. Extension of Heat Transfer Model for High Temperature Work Clothes

The working principle of high temperature work clothes is to reduce the heat transfer efficiency, so that the human body can work in a certain extent even in high temperature environment. Similarly, the thermal insulation of building walls and roofs, thermal equipment and thermal pipelines, cold storage room and refrigeration equipment can also be involved in thermal insulation and thermal insulation [6,7]. The model can be applied to these aspects to design the appropriate scheme more reasonably and quickly, which can play a more reasonable, effective and low-cost effect.

4. Conclusion

- (1) It has a certain update formula to guide the search of the algorithm in the solution space. It can analyze and maintain the steady-state dynamics to a certain extent, and has a strong theoretical basis.
- (2) The principle is simple, easy to understand and easy to implement.
- (3) The utilization rate of information is high.
- (4) The solution obtained by the model has trivial stability.

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