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Analysis of Alkaline Foam to Water Temperature Model

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Abstract

Factors affecting bath water temperature model include the shape and size of a bath, people's gesture, volume, individual temperature adaptation as well as body movement in the bath. In addition, the bathroom space, ambient temperature and bath materials will also affect changes of the water temperature to a certain extent. In this paper, the cooling function and linear regression method are used and the MATLAB software is also used to simulate the model of water temperature, alkaline bath foams that obtained can accelerate changes in water temperature.

Keywords

Water Temperature Model, Cooling Function, Linear Regression Analysis

1. Introduction

In this article, the tap water injection of the liquid flow rate, flow velocity obtained is the speed of the water and can make the water temperature keep the minimum flow rate balance. Balance, each point temperature in cylinder meet, therefore only needs in the convection heat transfer equation of the model and the conditions can be obtained by temperature reach stable each point of the temperature distribution in cylinder. Bath tub, not with auxiliary heating system insulation, but it is just a simple tank. When a person is in the bath, in order to maintain the temperature of the bath and to make people feel a degree of comfort, faucet will continue to increase a certain amount of hot water bath and then heat to maintain the temperature of the bath. When the water bath reaches its capacity, the excess water will overflow through the gutter.

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2. The Influence of Detergent on the Model

In this subject, when volume of bath crock is certain, its shape and posture and body movement of man will have an effect on the temperature of bath crock model in certain degree, which has a great influence on the water temperature model of the human body movement for the design. Define the cooling function [1]:

$$f(x) = a(x+b)^2 \tag{1}$$

a—the opening arc coefficient, *x*—the bath side arc width, *f*(*x*)—the bath side arc height, *b*—parameter.

From **Table 1**, due to the different factors to the water temperature model, in order to simple the model reflection, using linear regression analysis method [2] to analyse.

From **Table 2**, we can see the average height of the top three countries in the world [3]. They are Holland, Denmark, and Norway, the male average height of each country is 183.8 cm, 182.6 cm and 182.4 cm. Therefore, taking a man's height that is 185 cm, by the equation, we can get the man's shoulder width and back breadth, back length, respectively, these are 47 cm, 43.5 cm 36 cm.

When $b = 0$,consider establishing the cylinder wall surface equation: $y = ax^2$, The bathtub is a parabolic, due to the known his height is 185 cm covers the average height of most countries in the world, so I can take this one back long as the height of the bath, Because the man's shoulder breadth also know, so to determine the surface $y = ax^2$ coefficient of a value, considering the bathtub openings at least just match with the man's shoulder width, it can be concluded:

$$l = a*(0.5*W)^2, a = l/(0.5*W)^2 \tag{2}$$

L and W in (2) type, get $a = 0.079$, namely, the cylinder wall surface equation: $y = 0.079*x^2$, $0 < z < L - l = 141.5$. Add detergent temperature field of cylinder in the inland waters mainly has two aspects: the influence of the first, detergent foam. Foam floating on the surface of the water, which is equivalent to add a protective layer on the surface of the water. Second, add detergent will change of water quality acid and alkali. The first effect is conductive to the stability of the internal temperature field in cylinder [4], and the second case, access to information, general cleaning agent is basic for alkaline substances, after adding detergent, it has the greatest influence on water quality to the acid and alkaline water, the greater, the PH conductivity factor, this leads to the border cooling effect on the waters of the temperature field in cylinder. By using the second case, a proper increase will affect the function of parameters, the concrete numerical value can be achieved by experimental data fitting. Using an appropriate value of MATLAB software to calculate the numerical solution, and draw the image with no detergent temperature field image comparison [5].

Table 1. Linear element regression of each position and height.

Correlation coefficient		Unitary regression value		The regression equation	Simplified expression
		M	B	Y = MX + B	
Full shoulder	0.935228	0.176737	9.60326	Y = 0.18X + 9.6.	Y = 0.2X + 10
Back length	0.997725	0.290118	−11.5919	Y = 0.3X − 11.6	Y = 0.3X − 12
Back width	0.980125	0.203581	1.031154	Y = 0.2X − 1	Y = 0.2X − 1

Table 2. The average height of four countries.

Country	Ranking	Male average height
Holland	1	183.8 cm
Denmark	2	182.6 cm
Norway	3	182.4 cm
U.S.A	19	177.5cm
China	57	171.7cm

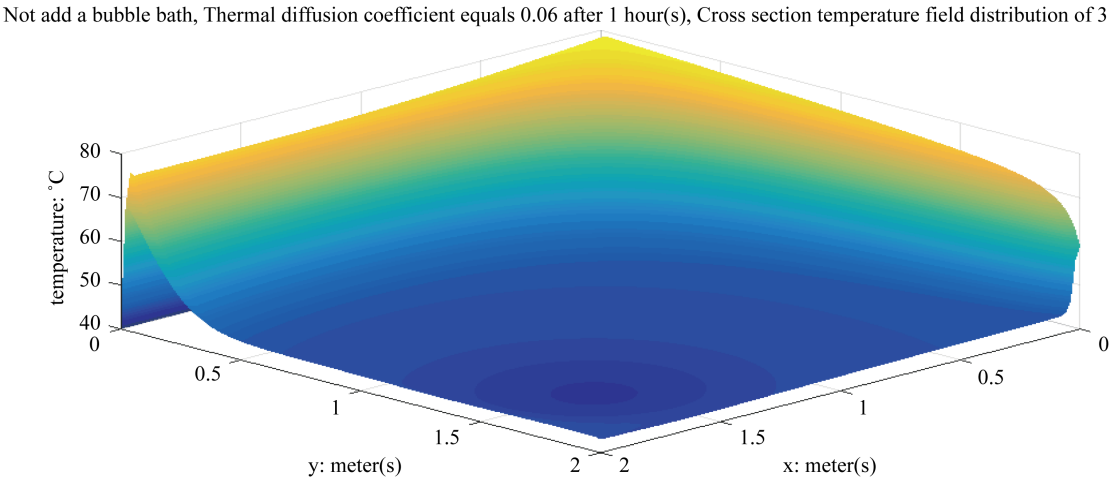

Figure 1. Not add a bubble, Pr = 0.06, get T = 1 (hour) moment in the cross section temperature field distribution of 3d diagram.

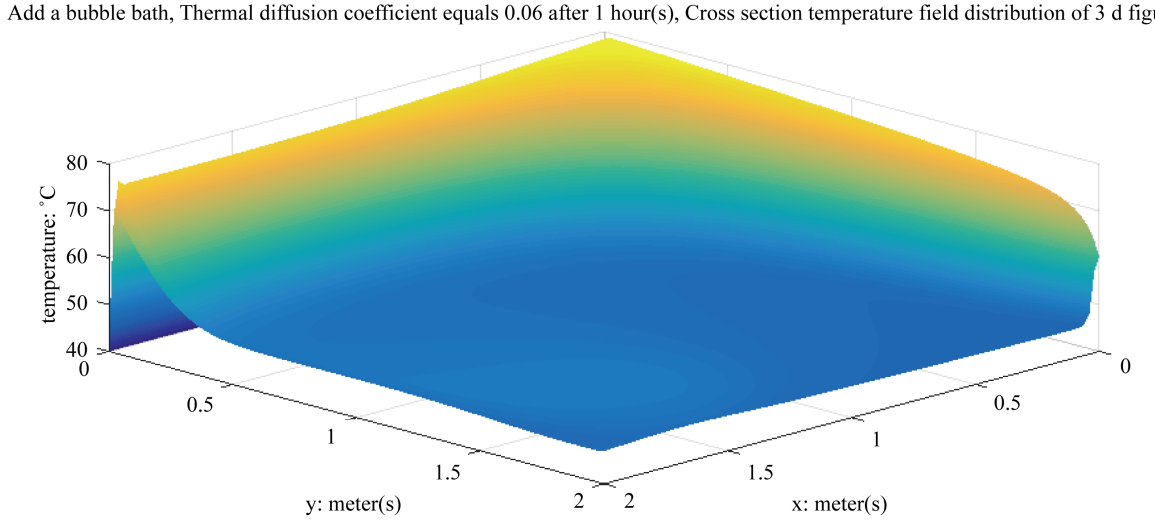

Figure 2. Add a bubble, Pr = 0.06, get T = 1 (hour) moment in the cross section temperature field distribution of 3d diagram.

3. Simulation Results

Through the analysis and comparison of **Figure 1** and **Figure 2**, we can find it is apparent that not adding detergent air near the surface of the air makes temperature fall slowly while adding detergent air near the air surface makes temperature drop quickly.

4. Conclusions

Considering the temperature distribution model of cuboid bath, we adopt the parallel section method because of the symmetry of the cuboid. The bath water temperature distribution field is obtained under the influence of different shapes and individual factors by establishing the mathematical model. Although the cylinder wall heat loss of it is very few, most of these calories from contact with the cylinder wall of water lost out, just to lower the temperature of the cylinder wall near the water, which makes us get the result of the cylinder wall near do not tally with the actual situation.

Not adding detergent air near the surface of the air makes temperature fall slowly while adding detergent air near the air surface makes temperature drop quickly.

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