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Topic of the Speech:
Research on Human Thermal Regulatory Model based on Real Human Geometry and Arterial Vascular Tree

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In the past, he proposed the model of heat and moisture transfer in clothed human body system by the FEM to consider the 3-D real geometry of human body. Also he proposed a mask model of heat moisture and virus transfer, etc. And he published more than thirty thesises in these fields, meanwhile, he chaired and participated in many of the National Natural Science Foundation.

ABSTRACT SUBMISSION
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Research on Human Thermal Regulatory Model Based on Real Human Geometry and Arterial Vascular Tree

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ABSTRACT (NO MORE THAN 500 WORDS:)

As a hot topic in international research, the human thermal regulatory model plays an increasingly significant role in the study of thermal comfort theory, indoor artificial environment, and clothing comfort etc. The perfect human body thermal regulation model can simulate the thermal response of the human body under the influence of external environmental factors according to the input parameters of the human body and the environment, and provide safe and reliable technical support for the research of clothing, the design of artificial environment comfort. The existing human thermal regulation models can be divided into nodal model, finite difference model and finite element model according to the treatment methods of passive systems. Among them, the finite element method is suitable for simulating complex human body geometries and large temperature gradients, and has been widely used. However, there is a big gap between the current finite element model and the reality in terms of human geometry and human circulatory system.

In this paper, a new finite element model of human thermoregulatory system model is developed. In order to make up for the shortcomings of the previous model in terms of geometry and blood circulatory system, firstly, a geometric model that is highly close to the real human body and a circulatory system model considering the heat exchange effect between the arterial vascular tree and human tissues are established. The aortic vascular tree was used to simulate the blood circulation system, and on the basis of calculating the cross-sectional area and flow rate of the blood vessels at each moment, the average cross-sectional area and flow rate of the blood vessels in the cycle were obtained by using the method of averaging in the cycle, and the calculated terminal blood flow of the arterial vessels in the human body replaces the perfused blood flow in the traditional model to regulate tissue temperature. Secondly, the finite element method was used to realize the simulation of the passive system, including metabolic heat production, heat transfer and heat exchange between the tissue itself and the blood. Thirdly, based on the core temperature of the lungs and the average skin temperature, the simulation of the active system of the model was realized. The model predictions were compared with the experimental data, and the calculation results show that the model has satisfactory accuracy. The conclusion shows that the model developed in this paper can intuitively obtain the temperature profile of any part of the human structure, and on the basis of retaining the original classical sweating and trembling heat regulation model, a more realistic blood flow model is established, which makes the simulation prediction data more in line with reality, and the calculation results are more clear, which can be applied to the prediction and analysis of human thermal response and related fields.