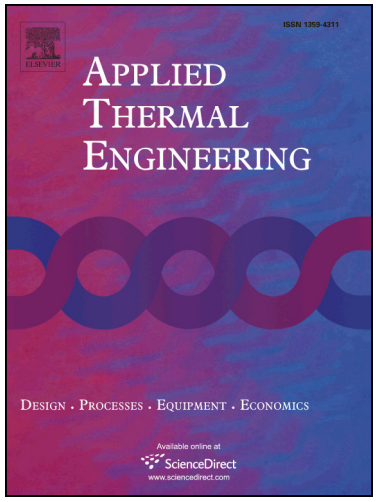

Research Paper

Research on the heat flow field synergy of electric vehicle power cabin at different charge and discharge rates

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Research on the heat flow field synergy of electric vehicle power cabin at different charge and discharge rates

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Abstract： This paper studies the effects of different air-outlet modes on the heat flow field synergy analysis of electric vehicle power cabin which is based on natural wind cooling. Based on field synergy principle, concepts of original field and function field, positive synergy and negative synergy, one-way synergy and two-way synergy are presented at first. Then the field synergy analysis method is expounded: when the function field and the original field are positive synergy, the movement trends along with the direction of original field would further increase, conversely, it would decrease; it does a more detailed definition for field synergy principle. The results indicate that: combining with simulation calculation and the field synergy analysis method, the analysis of the heat flow field characteristics and the choice for the air-outlet mode of electric vehicle power cabin will be rapid, simple and accurate; when the temperature gradient value is constant, increasing the speed value could improve the field synergy number and improve the heat dissipation performance. Then the reference basis for the choice of heat flow field synergy analysis of electric vehicle power cabin and air-outlet mode is offered.

Highlights

- When the function field and the original field are positive synergy, the movement trends along with the direction of original field would further increase, conversely, it would reduce, it does a more detailed definition for the field synergy principle.
- Combining with simulation calculation and the field synergy analysis method, it is rapid, simple and accurate to analysis of heat flow field characteristic and choice for the air-outlet mode of electric vehicle power cabin.
- Field synergy analysis method points out that: when the temperature gradient value $\left|\nabla\overline{T}\right|$ is constant, we know that increasing the speed value $\left|\overline{U}\right|$ could improve the field synergy number Fc, then improves the heat dissipation performance of wind cooling; for different air-outlet modes of electric vehicle power cabin, the heat dissipation performance of up-outlet with two holes mode is best, and both-sides outlet mode is worst, and there are validated by simulation calculation
- When the charge and discharge rates are different(0.8C, 1C and 1.2C), the heat flow field characteristic analysis of electric vehicle power cabin and air-outlet mode choosing could be obtained by field synergy principle, so the heat flow field synergy analysis of electric vehicle power cabin is not relevant to charge and discharge rate
- The curves of maximum temperature rising and temperature difference change linear along with vehicle speed, among them, the temperature variation curve of down-outlet mode is steeper than other air-outlet modes, so its heat dissipation performance improving ability along with vehicle speed increasing is also more obvious.