

Development of electric vehicle cabin thermal model by using international standard language (Fifth Report)

- Multi-Domain Analysis of Heat Transfer, Humidity and CO₂ Concentration in EV Cabin -

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In the 1st and 2nd reports, EV cabin thermal model was developed using international standard language VHDL-AMS. In the 3rd and 4th reports, we developed the MBD model by using VHDL-AMS that can simulate solar heat load of cabin in order to investigate the effect of solar energy.

In the fifth report, as the extension of the EV cabin thermal model, we report on multi-domain analysis of heat transfer, humidity, and CO₂ concentration in EV cabin. And we report the results of simulation accuracy compared with the experiments.

Fig.1 shows the cabin thermal model, humidity model and CO₂ concentration model. Fig.2 shows the detail of humidity model.

Fig.3 shows the comparison of humidity model with experiments on 28 October 2019. Good agreement is obtained between the simulation and experiments.

One of the ways to improve the cruising range of EV is to improve the internal air circulation rate of air conditioner and reduce the power consumption of air conditioner. But the window glass becomes cloudy, which makes driving dangerous. In addition, the CO₂ concentration increases, causing sleepiness and headaches to passengers, which makes driving dangerous. The way to improve cruising range is the problem that should be considered at the same time as humidity and CO₂ concentration.

By using the multi-domain analysis model of heat transfer, humidity, and CO₂ concentration in EV cabin, it is possible to investigate ways to improve the cruising range of EV while maintaining proper humidity and CO₂ concentration.

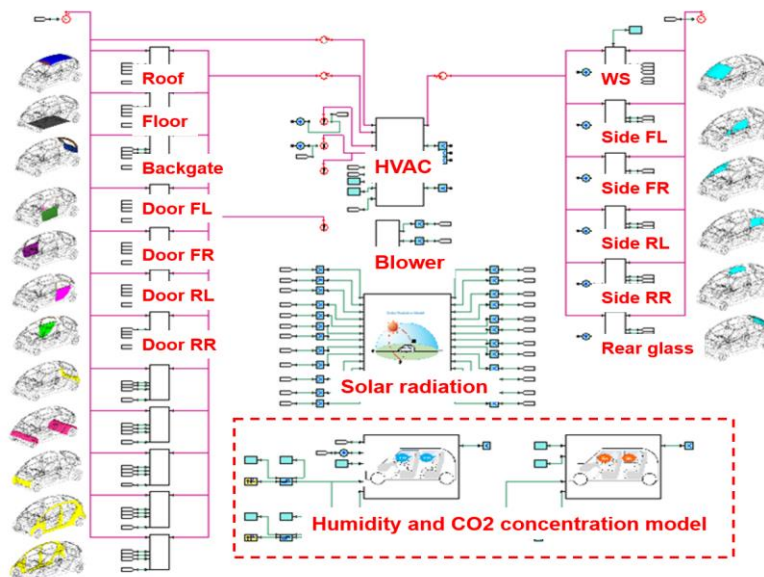


Fig.1 Cabin thermal model, humidity model and CO₂ concentration model.

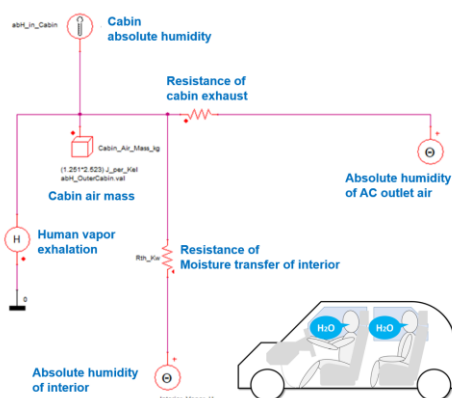


Fig.2 Humidity model.

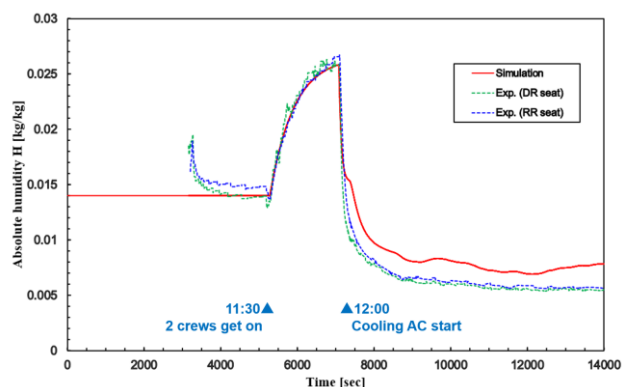


Fig.3 Comparison of humidity model with experiments on 28 October 2019.