Mathematical model and simulation study of a closed-poultry house environment

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Abstrak

The temperature and humidity inside poultry houses are highly coupled through nonlinear psychrometric processes, and the limitation of actuators makes this type of system difficult to control. To understand the dynamics of such systems and further to design a suitable controller, in this study, the mathematical model for a closed poultry house was derived from the governing equations of the various components related to the poultry house, including the energy and mass balance and the psychrometric correlations of the moist air. The model was simulated and the simulation result was compared to the data collected experimentally for model verification and control gains estimation. Under the assumptions of 70 percent Active Mixing Volume (AMV) with the constant maximum ventilation rate in the case study, the temperature and the relative humidity simulated results were in the good agreement with the real physical plant data. At the front, the middle and the rear part of the poultry house, the root-mean-square error (RMSE) obtained for internal temperatures are 1.17oC, 0.68oC, and 0.46oC, respectively. And those data for relative humidity are 4.31%, 8.07%, and 53.54%, respectively.