ABSTRACT

Currently, technological developments have developed very rapidly, one of which is in the automotive sector. Many automotive manufacturers are actively developing their vehicles, from oil-fueled vehicles to electric ones. Electric vehicles require batteries as a supplier of electricity. However, often the process of charging batteries in electronic devices will exceed their capacity, causing overcharging, and using too much power will cause the battery to experience overdischarge.

Battery Management System (BMS) is a system designed to perform the function of monitoring the performance of a battery to avoid the possibility of the battery operating outside its specifications. The implementation of a digital twin-based Battery Management System is carried out by combining the original battery data and the virtual model. The digital twin is also a virtual model that can help humans collect data-based information and accurate predictions to make decisions that affect battery performance optimization.

The digital battery model that is made can produce the required discharging data of 10,528 data and from the stability graph it is known if the battery system tends towards the balance point so that it can be concluded that the battery model is stable. Then the hammerstain model is able to make predictions accurately, this is evidenced by the graphs produced in each training and validation process which are very close together and the results of the calculation of the resulting evaluation of performance metrics are low. In addition, the estimation results show that the hammerstein approach with the kernel method and the recursive least square method is successful in overcoming the complexity and nonlinearity in estimating SoC in batteries. From the two processes, digital twin data analysis was carried out where the results obtained had good performance because the MSE error value on the SoC was 0.0083, the RMSE value on the SoC was 0.0915 and the MAPE SoC value was 0.41% which indicates the model has an error. low prediction. However, the test results for calculating the error value still use data that is not equivalent between digital data and physical data. This system is only used as a trial of the digital twin framework, so the results obtained require further steps to perfect the digital twin framework.

Keywords: Battery, BMS, SoC, Digital Twin