

SIMULATION AND OPTIMIZATION OF A HYDROGEN
STORAGE TANK FOR A PROTOTYPE FUEL-CELL
CAR BY USING GENETIC ALGORITHMS

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SCHOOL OF OCEAN ENGINEERING
UNIVERSITI MALAYSIA TERENGGANU
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SIMULATION AND OPTIMIZATION OF A HYDROGEN STORAGE TANK FOR
A PROTOTYPE FUEL-CELL CAR BY USING GENETIC ALGORITHMS

By
HENG CHEE CHING

Thesis submitted in partial fulfilment of the
requirement for the award of the degree of
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THESIS CONFIRMATION AND APPROVAL

This is acknowledged and confirmed that thesis entitled: Simulation and optimization of a hydrogen storage tank for a prototype fuel-cell car by using genetic algorithms by Heng Chee Ching Matric No.: S39170 have been checked and all the suggested corrections have been done. The thesis is submitted to School of Ocean Engineering, Universiti Malaysia Terengganu in partial fulfillment of the requirements for the award of the degree of Bachelor of Applied Science (Electronics and Instrumentation Physics).

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ABSTRACT

With the current world situation where pollutions are destroying our world, clean technologies are emerging fast and rapidly due to the demand for a better world. To meet this demand, the idea of hydrogen fuel-cell vehicles are introduced in order to reduce the pollutions by introducing the hydrogen as the energy source. Hydrogen fuel-cell vehicles combine both fuel cell and hydrogen storage tank to generate the electricity for the vehicle. In this research, a simulation and optimization of hydrogen storage tank for a prototype fuel-cell car were conducted by using genetic algorithms. The mathematical equations of the car system were derived from hydrogen tank, fuel cell, amplifier and motor and simulated using SIMULINK. The hydrogen tank was optimized by minimizing the cost of hydrogen tank using the OPTIMIZE TOOL. By comparing the different values for diameter and height, the values obtained from the OPTIMIZE TOOL is effective and could estimate the minimum cost to develop the hydrogen tank. The results seem to be promising and could be further extended to real size of car, to realize the future car powered by hydrogen as a fuel.

SIMULASI DAN OPTIMISASI TANGKI PENYIMPANAN HIDROGEN UNTUK PROTOTAIP KERETA SEL-FUEL PROTOTAIP DENGAN MENGUNAKAN ALGORITMA GENETIK

ABSTRAK

Pencemaran alam sekitar telah sedang memusnahkan bumi kita, teknologi hijau telah muncul dengan cepat dan pantas untuk memenuhi permintaan terhadap dunia. Untuk menyelesaikan masalah pencemaran tersebut, idea tentang kenderaan hidrogen diperkenalkan untuk mengurangkan pencemaran dengan menggunakan hidrogen sebagai tenaga untuk kenderaan. Kenderaan hidrogen mengandungi sel-fuel dan tangki hidrogen untuk menghasilkan tenaga elektrik kepada kenderaan. Simulasi dan optimasi tangki hidrogen untuk prototaip kereta sel-fuel telah dilaksanakan dalam penyelidikan ini. Persamaan matematik tentang tangki hidrogen, sel-fuel dan motor dalam kereta sistem telah diperoleh dan seterusnya dengan simulasi persamaan matematik dalam bentuk blok dengan menggunakan SIMULINK. Tangki hidrogen telah dioptimumkan daripada segi meminimumkan kos tangki dengan menggunakan OPTIMIZE TOOL. Berbanding dengan nilai-nilai tentang diameter dan ketinggian yang berbeza, nilai yang telah dapat daripada OPTIMIZE TOOL adalah yang paling bagus dan dapat menghasilkan kos tangki hidrogen yang paling rendah. Hasil penyelidikan ini boleh dikembangkan kepada kereta biasa untuk merealisasikan bahawa hidrogen menjadi tenaga kenderaan untuk kereta masa depan.