



TECHNOLOGICAL EDUCATION INSTITUTE OF  
CENTRAL MACEDONIA  
SCHOOL OF TECHNOLOGICAL APPLICATIONS  
DEPARTMENT OF MECHANICAL ENGINEERING

**Graduate Studies Program:**  
**Academic Year 2015 - 16**

**"Renewable Energy Systems: Design,  
Development and Optimization"**

**Supervisor's Name: Dr. Dimitrios Kalpaktsolgo**

**Subject:**

**Fuel cell electric vehicle using a step up converter and a DC motor**

**Introduction & Motivation:**

A fuel cell electric vehicle (FCEV) is a type of vehicle which uses a fuel cell to power its on-board electric motor. Fuel cells in vehicles create electricity to power an electric motor, generally using oxygen from the air and compressed hydrogen. This thesis aims to design and simulate a power drive train of a FCEV, by using Multisim software package. The goal is to investigate the usage of a FC stack at a conventional vehicle and the overall performance of the vehicle. The results will be presented and will provide useful data for FCEV technology.

**Implementation & Means:**

- Theoretical analysis of various types of fuel cells, specifically for FCEVs
- Design and simulation of the full power drive train in Multisim
- The effect of load variation to the performance of power drive system
- Calculation of the overall power factor of a DC/DC boost converter

**References:**

- [1] N. Mohan, T. M. Undeland, and W. P. Robbins, Power electronics : converters, applications, and design, 3rd ed. ed. Hoboken, N.J. ; [Chichester]: Wiley, 2003.
- [2] S. J. Chapman, Electric machinery fundamentals, 4th ed. ed. Maidenhead: McGraw-Hill Education, 2003.
- [3] C. Spiegel, PEM fuel cell modeling and simulation using Matlab. London: Academic, 2008.
- [4] J. Larminie and A. Dicks, Fuel cell systems explained, 2nd ed. ed. Chichester: Wiley, 2003.

**Requirements:** *theoretical knowledge of fuel cells, Multisim software package*