

**ECE SENIOR DESIGN PROJECT 2002-2003 FINAL REPORT**

**5kW/10kW Power Converter for Fuel Cell Energy  
Conversion**

Submitted to Dr. Chika Nwankpa and the Senior Design Project Committee  
of the  
Electrical and Computer Engineering Department

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## **Executive Summary**

Our industrialized world has an ever-increasing need for reliable electrical power. The steady decline of natural resources, growing tension with countries that provide petroleum, and ecological concerns have forced researchers to seek out more efficient and cleaner methods for producing power. The fuel cell has been given a lot of attention in recent years by advocates of alternative energy due its high efficiency and low emissions. One of the problems with incorporating the fuel cell directly into today's market is that it outputs DC power, while most loads require an AC source. The IEEE has sponsored the "2003 Future Energy Challenge", a nationwide competition between many major universities, in which the goal is to build a 10 KW, 120/240 volt DC to AC inverter. The major requirements are low cost, efficient operation, and minimal size/weight of the actual device. The cost evaluation of the inverter in mass production will be calculated in the competition. The device constructed is a multistage switching type power inverter. The DC signal will be inverted with a square wave chopper at high frequency to reduce transformer size and cost. The square wave signal will be amplified with a transformer and then rectified to a DC voltage at the appropriate level. The rectified DC voltage will be regulated and controlled at 200 volts while the fuel cell input voltage can vary from 22 – 41 volts. The inversion process requires a feedback controlled pulse width modulation inverter. The modulated sine wave will then be filtered to output a pure 60 Hz, 120 volt rms sine wave. Two isolated branches are constructed out of phase to each other, which, when bridged, will produce a 240 volt AC output.