Using Neural Network-based Approximation to improve HPC Application

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*Abstract*—Our project is about replacing the time-consuming part of the OpenFuelCell which is the simulation software for the SOFC (Solid Oxide Fuel Cell) by using a neural network. For that we produced the datapoints with the help of OpenFuelCell and used them as the labeled datapoints to train our neural network to predict. The model we trained in this project gives the 87% accurate result in predicting the output current and voltage.

Keywords—component, formatting, style, styling, insert (key words)

# Introduction (*Heading 1*)

Fuel cell is the electrochemical conversion device that changes the chemical energy of fuel and oxidizing agent into electrical energy. Unlike the normal batteries, the fuel cell doesn’t require recharging. They will produce electricity if they will get a continuous supply of fuel to keep working. A fuel cell consists of three main parts cathode, anode and electrolyte. Fuel cells are generally classified based on electrolyte type. This classification determines the kind of electro-chemical reactions that take place in the cell, the kind of catalysts required, the temperature range in which the cell operates, the fuel required, and other factors. There are several types of fuel cells currently under development, each with its own advantages, limitations, and potential applications.

Fuel cells are better compared to traditional power sources like batteries and engines because of their high efficiency and they eliminate the pollution caused by engines using fossil fuels. Hydrogen fuel cells emit only water, so they produce no pollutant like carbon dioxide or carbon monoxide. The fuel cells are quite during operation as there are fewer moving parts that makes them suitable to be used at noise-sensitive areas and operating time of fuel cell is more than double that of traditional batteries. As fuel cell doesn’t depend on traditional fuels like oil and gas and can reduce the dependency of non-oil producing countries economical dependency on oil producing countries. Different fuel cells come in different sizes and can work at variety of temperatures, which increases the areas of application for fuel cells.

Solid oxide fuel cell, also known as SOFC for short uses a non-porous ceramic compound as electrolyte. SOFC works at very high temperature like 1000 degree Celsius and due to which it doesn’t require costly metal catalyst, which reduces the cost. When it comes to efficiency solid oxide fuel cell can provide 60% accuracy and because it works at very high temperature the utilization of that heat further increases its efficiency. But due to high temperature operation the startup is slow and thermal shielding is required to retain its heat. This also restrict the areas in which solid oxide fuel cell can be used and this will restrict the elements that can be used in this type of fuel cell.

OpenFuelCell is open source computational fluid dynamics software to model solid oxide fuel cell using Hydrogen and water as fuel and dry air as oxidant.

# Ease of Use

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* The subscript for the permeability of vacuum **0, and other common scientific constants, is zero with subscript formatting, not a lowercase letter “o”.
* In American English, commas, semicolons, periods, question and exclamation marks are located within quotation marks only when a complete thought or name is cited, such as a title or full quotation. When quotation marks are used, instead of a bold or italic typeface, to highlight a word or phrase, punctuation should appear outside of the quotation marks. A parenthetical phrase or statement at the end of a sentence is punctuated outside of the closing parenthesis (like this). (A parenthetical sentence is punctuated within the parentheses.)
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##### References

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