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A CLASSIFICATION APPROACH FOR MODEL BASED FAULT DIAGNOSIS IN POWER SYSTEMS BY USING SOLID OXIDE FUEL CELLS

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Abstract: In this paper, the authors present an overview for modeling of solid oxide fuel cells. Even though, a large amount of literature of sofc's has been published in the last decade, most of them has focused on electro chemical characteristics.

To determine the fault diagnosis in power generation systems by using solid oxide fuel cells. We propose the use of quantitative model for such a plant with a support vector machine(SVM) to detect and to classify possible faults. Solid oxide fuel cells(SOFC's) are the future of the energy .In addition, the relative importance of the easy to measure residuals which are used as feature in the SVM classificationprocess,are discussed based on an advanced feature selection technique.

Index terms: Fault Detection and Isolation(FDI) and Solid oxide fuel cells (SOFC) and feature selection Support Vector machine(SVM).

INTRODUCTION: Engineers and environmentalists have long dreamed of being able to obtain the benefits of clean electric power without pollution –producing engines or heavy batteries.Their application are somewhat limited due to lack of portability; a wind mill is not much help to the power plant of a diesel truck ,a solar panel cannot provide power at night.

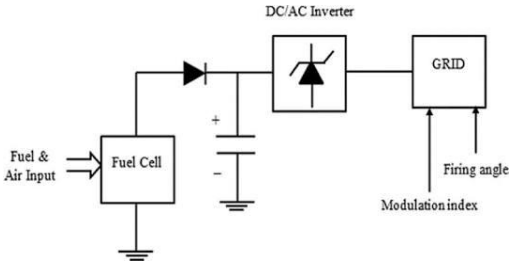
In 1962 a revolution in energy research occurred.Scientists at Westinghouse electric corporation demonstrated for the first time the feasibility of extracting electricity from a device they called a "solid electrolyte fuel cell".

The electro chemical and mechanical properties of anode, cathode and electrolyte oxides for sofc' s are primordially determined by the chemical synthesis route. Solid oxide fuel cells are a promising technology for the electric power generation, because they are featuring high energy efficiency and fuel flexibility. A wide experimentally campaign has been carried out on sofc cells, through the determination of polarization curves. One of the most advanced technologies of fuel cell now is solid oxide fuel cell. It is a high temperature fuel cell.

A fuel cell is an electro chemical reactor that converts the chemical energy of a fuel into electricity through a reaction with oxygen.Now, about fuel cells are characterized by their electrolyte material.SOFC has a solid oxide or ceramic electrolyte .In power generation plant,we are using solid oxide fuel cells,that means chemical energy,it is generated from fuel cells and batteries .so by using so SOFC's we can generate the power and it has option to detect the isolation and faults in power generation plants.

BLOCK DIAGRAM:

Model of fuel cell:



Fuel is a material such as cool gas,or oil that is burned to produce heat or power.Inorder,a fuel is any material that can be made to react with other substances .So that it releases chemical or nuclear energy as heat or to be used for work.Air input is a tiny application to turn device remote control your computer anywhere.

A diode is an electrical device allowing current to move through it in one direction with far greater case than in the other.the most common kind of diode in modern circuit design is the semi-conductordiode.Although,other diode technologies exist. Capacitor is an electronic device that stores electric charge .when voltage is applied to the capacitor, it stores electric charge.This charge is a fixed capacitor .fixed capacitor is a type of capacitor which provides fixed amount of capacitance.

A thyristoris a solid- state semi-conductor device with four layers of alternating N and P type materials. In acts exclusively as a bi-stable switch conducting when the gate receives a current trigger and continuing to conduct while voltage access the device is not reversed. An electrical grid is anointer connected network for delivering electricity from suppliers to consumers. It consists of generating stations that produce electrical power, high-voltage transmission lines that carry power from distant sources to demand centres and distribution lines that connect individual customers.

The modulation index of a modulation scheme by how much the modulated variable of the carrier signal varies around its unmodulated level. It is defined differently each modulation scheme.The rising angle is the point at which one wishes the thyristor to turn on. The firing angle

is normally done either by an analog digital or microprocessor controlled circuit which sends the desired pulse to the thyristor gate drive circuit which will produce the actual gate drive pulse.

WORKING PRINCIPLE

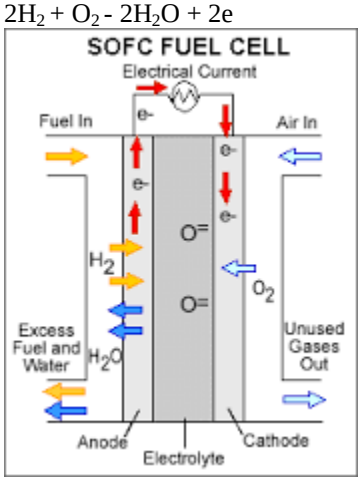
SOFC generates power using oxygen (O2) in the air and to reform city gas is obtained from the heat generated city gas. In SOFC, oxygen ions react with hydrogen and carbon monoxide to generate electricity and heat.How a solid oxide fuel cell works. The cell is constructed with two porous electrodes which sandwich an electrolyte.The fuel cell needs to run at high temperatures in order to achieve sufficiently high current densities and power output;

Operation at upto1000c is possible using the most common electrolyte-material,yttria-stabilized zirconia (YSZ)

Now we have diagram explanation about solid oxide fuel cells shown in below:

Basic equation

$2H_2 + O_2 - 2H_2O + 2e$



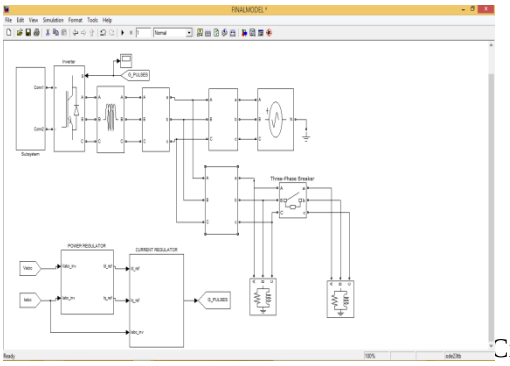
Air electrode (cathode) oxygen in the air supplied to the cathode,becomes oxygen ions.Electrolyte has oxygen ions electrode to the fuel through electrolyte. In the anode hydrogen and carbonmonoxide react with oxide ions to produce water and carbondioxide.The electrons emitted during this reaction generate electricity. Electricity is generated using electrons emitted by oxide ions.

FEATURES OF THE SOFC:

As a result of operating at a high temperature,the heat necessary for the reaction to reform city gas is obtained from the heat generated during power generation ,this results in a high power generation efficiency.

CIRCUIT DIAGRAM:

The fig. shows Circuit, that how the solid oxide fuel cell detects faults. The circuit consists or subsystem, inverter, three phase circuit breaker and current and voltage regulators, to regulates the power, and not to occur faults.


Circuit diagram.

SIMULATION:

The Overall accuracy does quantify the fault detection performance,as it represents estimation.

We have the wave forms of constant current that is shown in figure in the below:

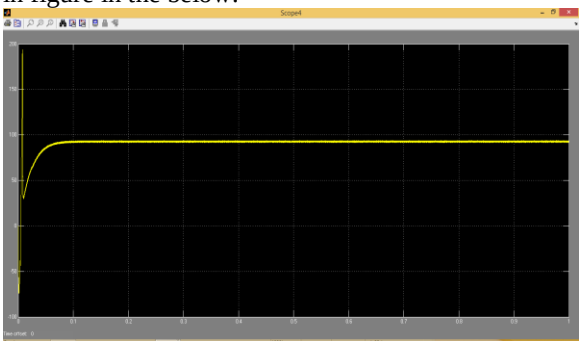


Fig.1

In this fig1, we have 0 to 0.05 the active power increases after that from 0.1 to 1 it will be constant.

In fig2, we have 0 to 0.01 the active power increases and after that, from 0.02to 1, the active power will be constant.

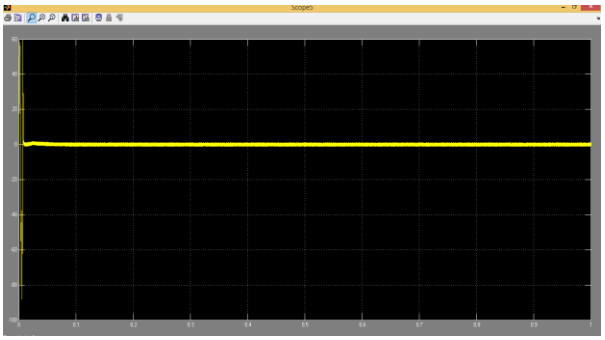


Fig.2

Here in fig.3 shows that, volatage and current.

In current, active power will increases from 0 to 0.1 .and then from 0.15 to 1,the active power will be constant .Here, we have less losses .

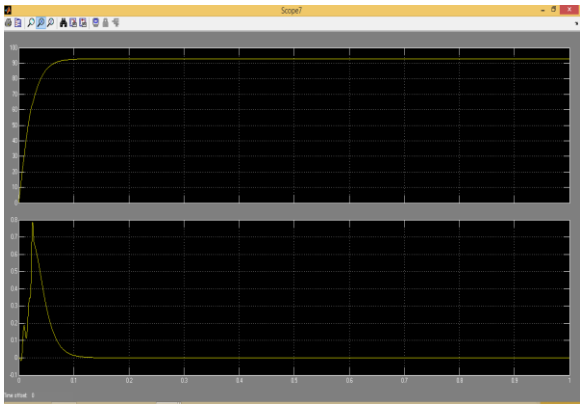


fig.3

In fig.3, In Voltage,Active Power will increases from 0to 0.02 and from 0.03 to 1 the active power will be constant.

In fig4.In three phase voltage input,we are detecting the possible faults by using solid oxide fuel cells .constant current and constant voltage strategies are investigated .in both cases ,an adequately trained SVM classifier is used to provide a high probability.

In fig.4from -50 to 0.5 we have faults,by using solid oxide fuel cells we have detecting the faults.

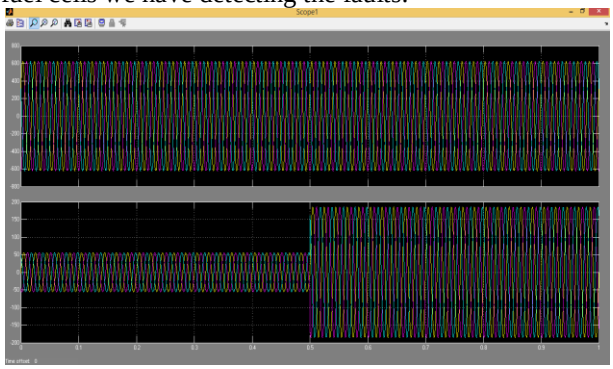


Fig.4

Advantages:

SOFC's have a number of advantages due to their solid materials and high operating temperature.

Since all the components are solid , as a result, there is no need for electrolyte loss maintenance and also electrolyte corrosion is eliminated.

Since SOFC's are operated at high temperature, expensive catalysts such as platinum (or) ruthenium are totally avoided. Also because of high temperature operation, the sofc has a better ability to tolerate the presence of impurities as a result of life increasing.

Costs are reduced for internal reforming of natural gas. Due to high-quality waste heat for cogeneration applications and low activation losses, the efficiency for electricity production is greater. Releasing negligible pollution is also a commendable reason why sofc s are popular today.

DISADVANTAGES:

However, there are also some disadvantages in existence for determining the performance of sofcs.Sofcs operate high temperature , so the materials used as components are thermally challenged. The relatively high cost and complex fabrication are also significant problems that need to be solved.

APPLICATIONS:

Due to the advantages mentioned above, SOFC's are being considered for a wide range of applications, such as working as power systems for trains, ships and vehicles , supplying electrical power for residential (or) industrial utility.

CONCULSION:

We have addressed the model-based FDI process in SOFC power generation plants and searched for a solution that functions correctly in typical working conditions when several types of faults can occur with random sizes under several operating conditions.

REFERENCES:

(1)S.Srinivasan,Fuel Cells from Fundamentals Applications .New York,NY,USA:Springer,2006.

(2) N .Behling ,Fuel Cells Current Technology Challenges Future Research Need.New York,NY,USA:Elesier,2012.

(3) D .Marra,M.Sorrentino ,C.Pianese ,and B.Iwaanschitz,"A neutral network estimator of solid oxide fuel cell performance for on –fieddiagnosis and prognostics applications ",J.Hydrogen energy ,vol .38.pp.7077-7091,2013.

(4) A .Sorce, A .GRECO .L .Magistri, and P. Costamagna. "FDI oriented modeling of an experimental SOFC system ,modelvadilation and simulation of faulty states"Appl.Energy,vol.136.pp.894-908-2014.

(5) R.Isermann ,"Supervision,fault-detection methods-An Introduction ."Control Eng.Practice .vol.5. pp 639-652.1997.

(6) R Isermann "Model-based fault detection and diagnosis-Status and applications Annu Rev. Control ,vol 29no.1.pp 71-85,2005

(7) L.A.M. Riasocs M.G. Simoes and P.E. Miyagai ",A Bayesian network fault diagonostic system for proton exchange membrane fuel cells ,"J.PowerSources,vol 165.pp. 267-278.2007.

(8)J.Chio and B.Zhou , "Diagnosis of PEM fuel cell stack dynamic behaviours". J. Power Sources ,vol 177, pp.83-95-2008.

(9) A.M. Niroumand ,W Merida and M.Saif , "PEM fuel cell low flow FDI", J.Process .Control vol. 21, pp. 602-612-2009.

(10)T.Esocert ,D, Feroldi, S.DeLiraV.Puig, J. Quevedo,JRiera and M.Serra, "Model-based fault diagnosis in PEM fuel cell systems". J. power sources, vol.192 pp. 216-223,2009.

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