



FUZZY COGNITIVE MAP USED IN IC ENGINES

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ABSTRACT

Cognitive Map has shown promising tools for modeling and simulation of computer and simulation of knowledge in computer and representation of real object, concept, perception or event and their relations. This paper examines the application of fuzzy theory to the expression of these relation, the development of frame works to better manage the operation of these relations. The experiments conducted in this thesis show that the proposed framework is effective and useful for deriving inferences from input data, solving certain classification problems, and for prediction and decision-making.

Keywords: - Fuzzy cognitive maps, I.C Engines, B.H.P.,

I. INTRODUCTION

Knowledge representation (KR) may be thought of as a surrogate [1] that is a substitute of real object, concept or event. As it is not possible to represent everything in the world .KR is necessarily an approximation of the real world that focuses on certain properties of an object, concept or event while ignoring others. Since the focus is only on a subset of the real world, it is necessary that this subset be relevant to form a useful view of the world to be modeled. KR is therefore a medium for expressing our perception of objects, ideas, imaginations and events within certain context, as well as the relation among this perception. For example, we may have certain knowledge regarding the relation between the force of braking applied to a car and its speed. We can then represent these concepts of braking force and speed, and the relation between by certain mean, for example, word expression, and symbols.

Structuring these concepts and relations in a model so that they can be consistently represented and quickly accessed and manipulated by a computer, is the goal of KR [2]. The purpose is to derive certain interpretations, predictions and or decisions from the model.

In the 1970s social scientists used the **Cognitive Map** [3] to capture the structure of arguments and claimed that it offered insights into policy practice. However, its use does not appear to be widespread in political science[4]. It is a graphical representation of concepts and relations, using arcs with symbolic labels to describe the positive or negative

causal relations, and nodes to describe the concepts. However, as will be discussed in chapter 2. Using symbols introduces imbalance to Cognitive Map.

Kosko proposed the Fuzzy Cognitive Map[5] as an extension to the Cognitive Map in order to overcome its shortcomings. Instead of using symbols to represent positive and negative causalities, FCM provides a numeric description to the causal influences. It has been used in many studies because it is a convenient vehicle for expressing causal knowledge and making inference. However, its scope is limited to representation of monotonic causality between concepts, where the causal effects increase with increasing causal influence or decrease with increasing causal influence or vice versa.

FCM expresses the causal influence of a concept on another as weights in the interval [-1, 1], and uses a step transformation function to map the causal influence from one concept to another [6]. FCM is sometimes regarding as a paradigm similar to that of artificial neural network (ANN).

II INTRODUCTION OF IC ENGINE

A heat engine is a device which transforms the chemical energy of a fuel into thermal energy and uses this energy to produce mechanical work.

In an internal combustion engine the products of combustion are directly the motive fluid. Petrol, gas and diesel,



Wrankel engine, and open cycle gas turbines are examples of internal combustion engine

III. WORKING OF IC ENGINE

Suction stroke: - suction stroke 0-1 starts when the piston is at top dead centre and about to move downwards. The inlet valve is open at this time and the exhaust valve is closed. Due to the suction created by the motion of the piston towards bottom dead centre, the charge consisting of fresh air mixed with the fuel is drawn into the cylinder. At the end of the suction stroke the inlet valve closes.

Compression stroke: - the fresh charge taken into the cylinder during the suction stroke is compressed by the return stroke of the piston 1-2. During this stroke both inlet and exhaust valves remain closed. The air which occupied the whole cylinder volume is now compressed into clearance volume. Just before the end of the compression stroke the mixture is ignited with the help of an electric spark plug between of the electrode of spark plug located in combustion chamber wall. Burning takes place when the piston is almost at top dead centre. During the burning process the chemical energy of the fuel is converted into sensible energy, producing a temperature rise of about 2000°C and the pressure is also considerably increased.

Expansion and power stroke: - due to high pressure the burnt gases force the piston towards bottom dead centre, stroke 3-4 both inlet and exhaust valve remaining closed. Thus power is obtained during this stroke. Both pressure and temperature decrease during expansion.

Exhaust stroke: - at the end of the expansion stroke the valve opens, the inlet valve remaining closed, and the piston is moving from bottom dead centre to top dead centre sweeps out the burnt gases from the cylinder, stroke 4-0 the exhaust valve closed at the end of the exhaust stroke and some residual gases remain in the cylinder.

We know that,

$$IHP = BHP + FHP$$

$$BHP = IHP - FHP$$

$$FHP = IHP - BHP$$

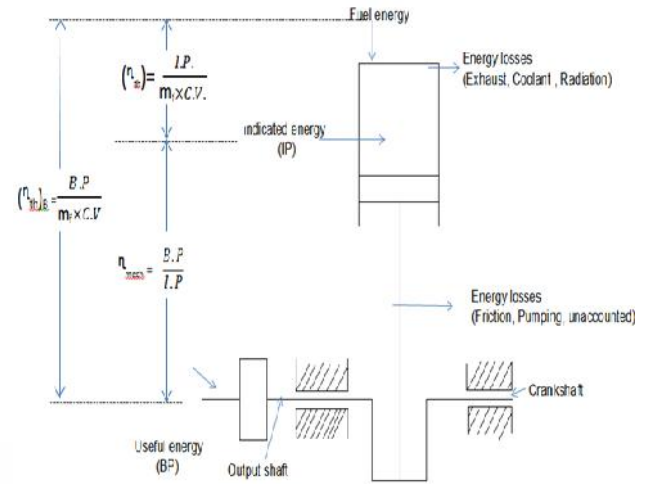


Fig 1. Basic IC engine energies

IV. HOW COGNITIVE MAP USED IN IC ENGINE

In case of the I.C Engine put all the values of the variable effect the IHP in the circles and mention the circle no. and node intensity. This intensity value decided by the past results and mentions the arc with the weights. This weight shows the impact of one circle node to the other circle node. If it is positive means the effect will be positive and negative the effect will be negative. The positive effect increases the effect and the negative weight decrease the effect. The fig 2 show the Cognitive map of the IC engine which show the circle and node affect the results outcome on the BHP [4]

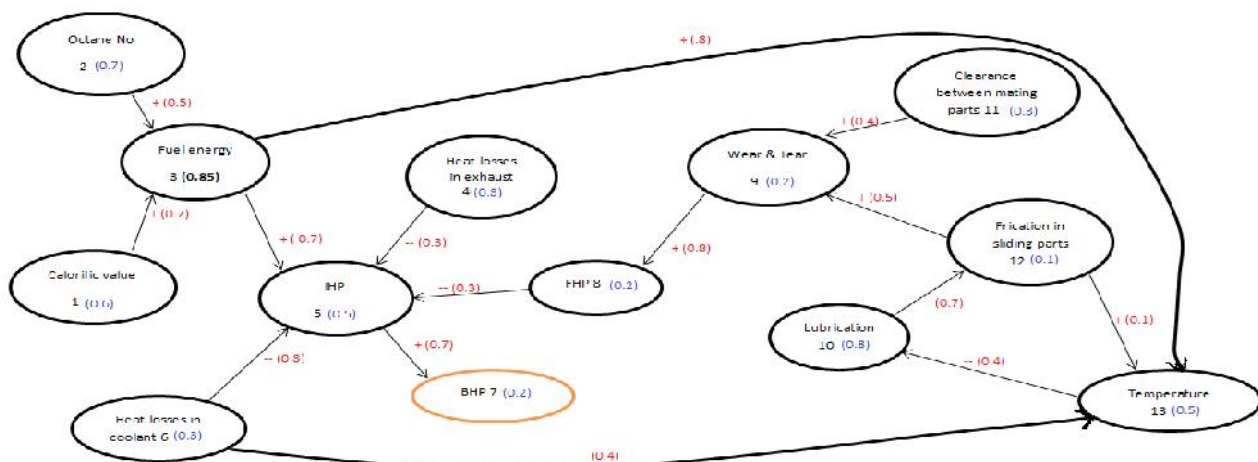


Fig 2. IC engine Cognitive map

Here this cognitive map shows the effect of all the variable on the BHP what effect when the IHP increase and what effect when the FHP increase how they are depend on each other, in this cognitive map show that the octane no. and calorific value effect the fuel energy. The fuel energy effect the engine temperature and the IHP or the IHP effect by the heat losses in the exhaust and the heat transfer in the coolant or the FHP all these variable effect he IHP in negative manner. This decrease the value of IHP and it is directly effect the BHP. When it will increase the BHP increase and when it will decrease the BHP decrease and the FHP effect by the lubricant and the wear and tear between the mating parts or the temperature [1].

At last we make the intensity matrix of all the node and name this matrix is C and make the other matrix E in which show that how the nodes are create positive and negative effect on each other shown in fig 3 and 4.

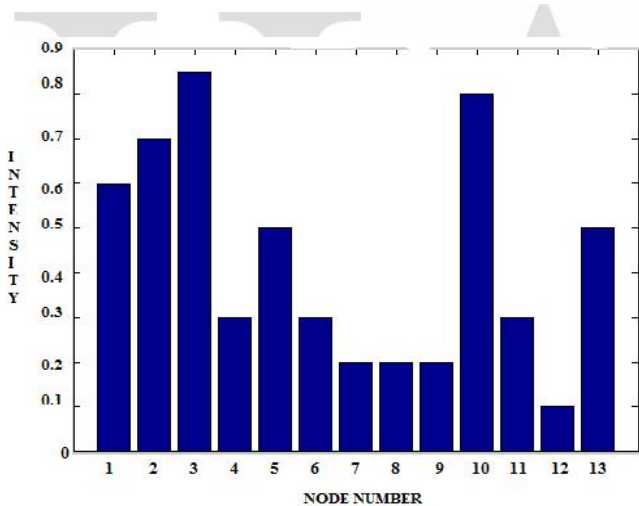


Fig 3. Variable intensity matrix

Here we use mat lab software to find out the value of the matrix C and matrix E results. So make a program in the matlab by using the formula given below:

Threshold function:-

$$= \frac{e^2+1}{e^2+1} \times \frac{e^x-e^{-x}}{e^x-e^{-x}}$$

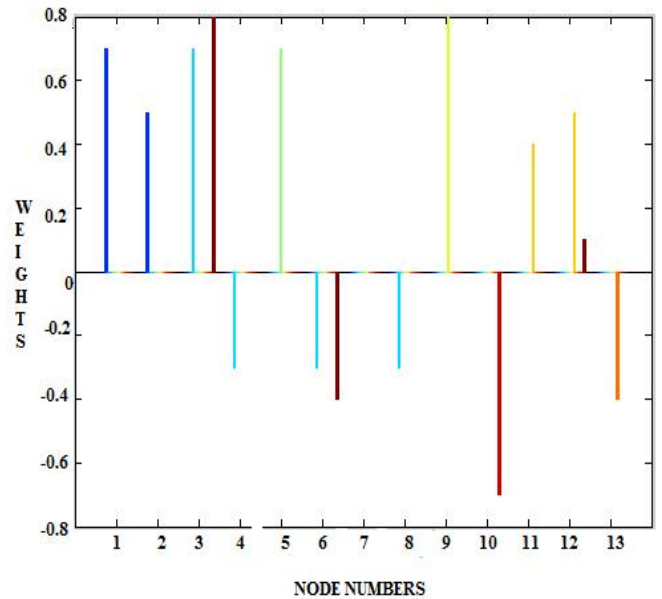


Fig 4. Variables Weight matrix

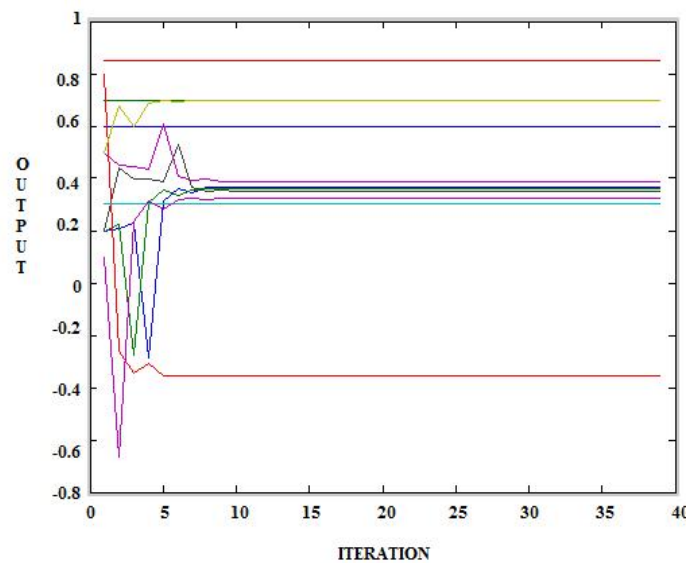


Fig.5 Results of I.C engine Cognitive map

V. SUMMARY

As per the paper presentation it is prove we can find out the results of IC engine through the fuzzy cognitive map with little variation in the variable inputs and can show how output is affected by this valued, each and every variable effect on the output variable. We can check the worst condition of fuel

effect on the BHP and the good condition of fuel effect on the BHP.

understand any technology very easily and without confusion and get result is very approximately.

So we can check how all the variable affect the output BHP and can see in the fig 5. The fuzzy cognitive map help to

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