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GMV Logic Controller

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ABSTRACT

The Genetic Algorithm Multi Valued Logic introduced here to optimize and even minimizing a combinatory analog and digital circuits. This paper focuses on evolving a multi valued controller genetically and examining whether they are better able to handle modeling uncertainties. The study is conducted by utilizing a multi valued logic controller, evolved by a genetic algorithm (GA), to control the speed of a fan.

Keywords:genetic algorithms, Multi valued logic, GMVL controllers

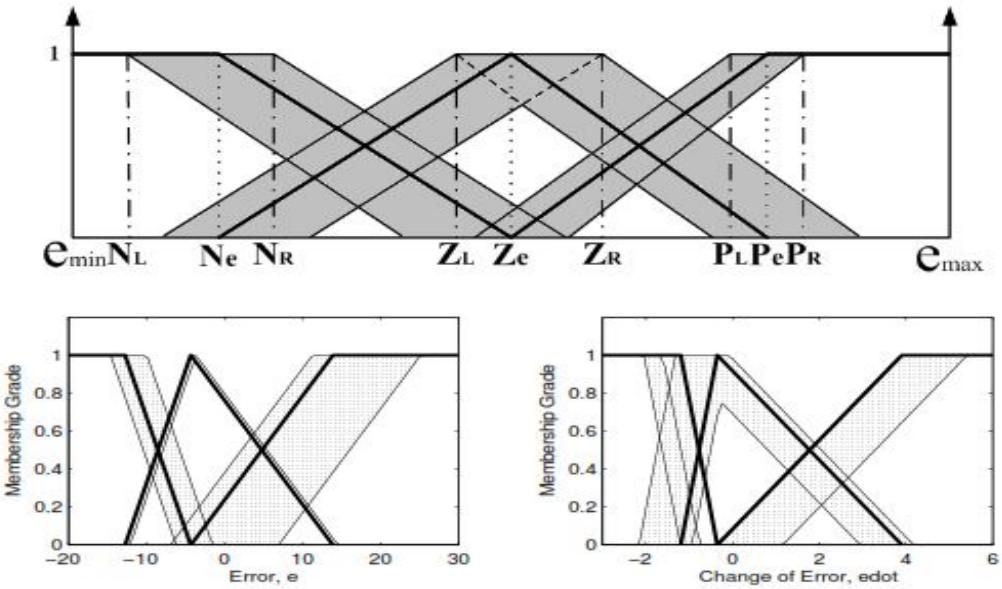
I. INTRODUCTION

In this paper multi-valued (many-valued) logics were first studied and a brief introduction on how the structure of the GMVLC is codified as a chromosome using genetic algorithm, is given. The experimental prototype used to test the generated FC is presented in Section 3. This prototype was selected because of its relevance to the majority of industrial processes [1, 2]. GMV performs a mapping between n inputs and single output. The following correction rule for learning of the GMV has been proposed [3, 4, 5, 6 and 7]:

II. GMVL Model

This accounts for the increment of binary mutation as the iterations proceeded. A technique is applied as it helps the convergence of the GA without much loss of solution optimality as reported in [8, 9, and 10], such that the consistency of obtaining the final solution is always maintained.
The proposed tuning of the NGMVL involved 100 chromosomes which are all initially randomized. The Gray–Code transformation method is applied as it can enhance the GA searching engine [11, and12]. Apart from that, the elitist strategy is employed to the selection scheme, which means the fittest chromosome has one copy directly in the new generation.

Fig. 1: Input boundary which applied to GMVL controller



A two-point crossover is applied in exchanging the gene information.

The proposed NGMVL tuned by GA is tested on three different plants: a no minimum and open loop unstable

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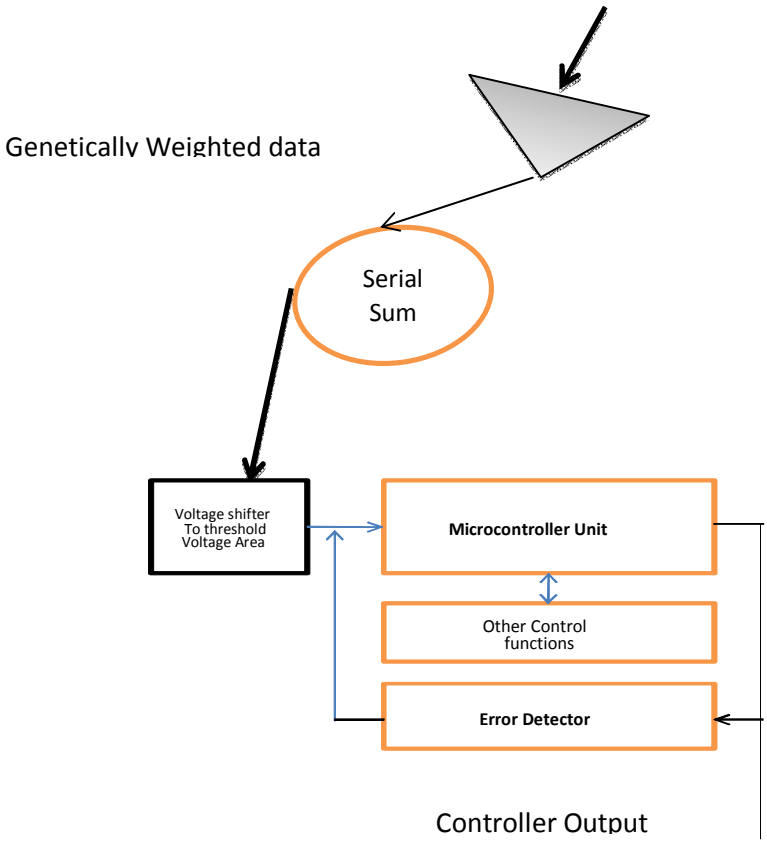
plant, a nonlinear plant, and a car parking mechanism. Each of the experiments used different GA objective functions or performance indices. The performance index is related to fitness using the following relationship.
Where the fitness for the parameter set is, is the performance index, and is the constant that affects the performance
We will next stack these neurons together to produce layers. Finally, we will cascade the layers together to form the network.

Fig. 2: The GMVL controller



III. Genetic algorithms for Control

This transfer function takes the input (which may have any value between plus and minus infinity) and squashes the output into the range 0 to 1, according to the expression.
Typically, a neuron has more than one input. A neuron with inputs is shown in Figure 4. The individual inputs are each weighted by corresponding elements of the weight matrix.

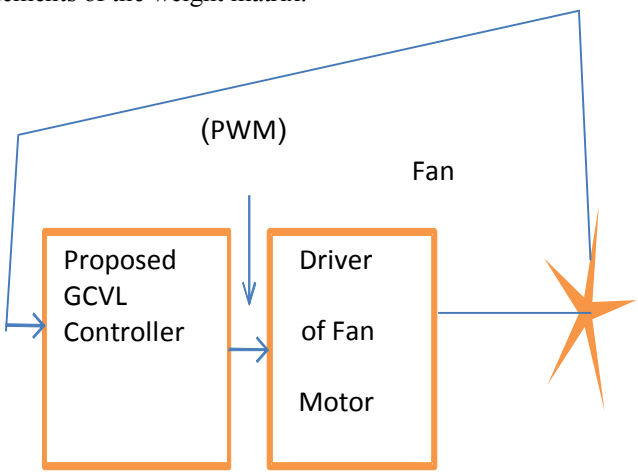


Fig.3. Genetic Multi-valued Logic

Note that the number of inputs to a network is set by the external specifications of the problem. If, for instance, you want to design a genetic algorithm that is to predict kite-flying conditions and the inputs are air temperature, wind velocity and humidity, then there would be three inputs to the network.

IV. Using Multi-Valued Logic in Control Processes

Two very different approaches may be used to select the parameters of a Multi valued logic system [12]. One is a partially dependent approach, where a best possible Multi valued logic system is designed arts, and then used to initialize the parameters of a singleton Multi valued logic system. The other method is a totally independent approach, where all of the parameters of the GMVL are tuned from scratch without the aid of an existing design. In this paper, the partially dependent approach is adopted because it has the following advantage: 1) smart initialization of the parameters of the GMVL; and 2) a baseline design whose performance can be compared with that of the GMVL [12]. Another advantage is the number of parameters that need to be tuned is usually fewer with this approach, thus the GA can converge at a faster speed.

As illustrated in figures 4, the overall appearance of speed looks pretty continual as in analog and the input current absolutely stress free. The position of input which specifies a level of voltage leads the output to generate appropriate pulse width and can be the meaning of multi valued logic that is comparable to the concept of group setting by MVL logic.

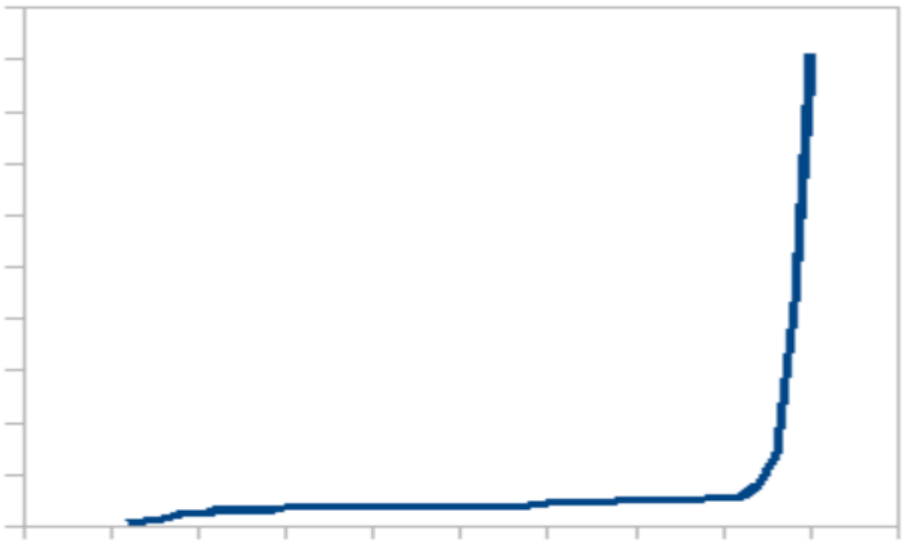


Fig.4: RPM graph of the Fan Motor in figure 3

V. Conclusion

The basis of genetic algorithm Multi valued logic (GMVL) relies on the output of a simple neuron followed by unstable generated oscillator which applied to a system in order to control it via the length of generated pulse. Proposed structure of the speed control loop with additional adaptation mechanism included is rather simple and does not require advanced computational effort, which is especially important for practical realization of the control structure using microprocessor techniques.

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