

# Fuzzy System Methodology for Restoration of Distribution System by Distributed Generation

More Kranthi Kumar, R.Hariharan

*Abstract Blackout is the severe thing in the whole power system. Restore the power system is a complex thing for the system operators. In Power system restoration process pick up the critical load is the important task in the restoration process. In this distributed generated using to pick up the critical load. DG placements are done by fuzzy logic system using Virtual instrumentation. In this paper this methodology was tested in two load locations with two distributed generation system. DG placement depends upon severity of the damage of power system which restore with less restoration time.*

## I. INTRODUCTION

Power system restoration is a complex process due to multi objective and multi constraints are should satisfied during restoration process. In recent times due to complex power system network islanding capability of power system it raise 44% of distribution system. Restoration processes are improvised generation capability, transmission path optimization and distribution system optimization. In that critical load recovers the first priority of the restoration process. Pick up the critical load depends upon the severity of the system.

In recent times micro grids explored by integrating the distributed generation in to the conventional distribution system. But the integration of DG will create many technical issues and irregular integration may reduce the performance of system. Optimal DG placement is very efficient to restore the system with short period of time.

ODGP permit new constraints and objectives by consideration of natural disaster state. There objective is to increase number of critical load and decrease restoration time for this we need to rank or prioritize loads. In literature these selection of DG location is done by checking the operational constraints.

Finding location constraints and prioritizing damaged regions usually depends upon multiple criteria. In this paper Fuzzy Multi Criterion Decision Making is used for solving ranking problem. A Fuzzy rule base system has developed for estimation of proper DG location by their simulation values.

## II. PROPOSED SYSTEM

The proposed system to recover the critical load by quick manner using intelligence system. Depends upon the crew load location 1 and location 2 it selects the DG1 and DG2

depend upon the load severity with a short period of time. The proposed block diagram is shown in figure 1.

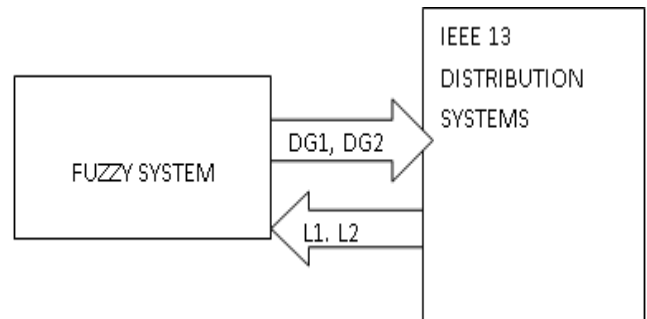


Figure 1 : Block diagram

## III. FUZZY SYSTEM

Fuzzy system progress as an important three stages, stage 1: Fuzzification - it is the process of allotting the numerical input values of load crisp values to fuzzy sets. Fuzzy sets come under the membership values. Two load locations are considered as fuzzy input values. Each load location 4 fuzzy sets. Fuzzy sets input variable membership functions are NA (0 0 0), low(0 .3 .5) , medium(.2 .5 .8) , high (.5 .8 1). Fuzzy input variables and input variable membership functions are shown in the figure.

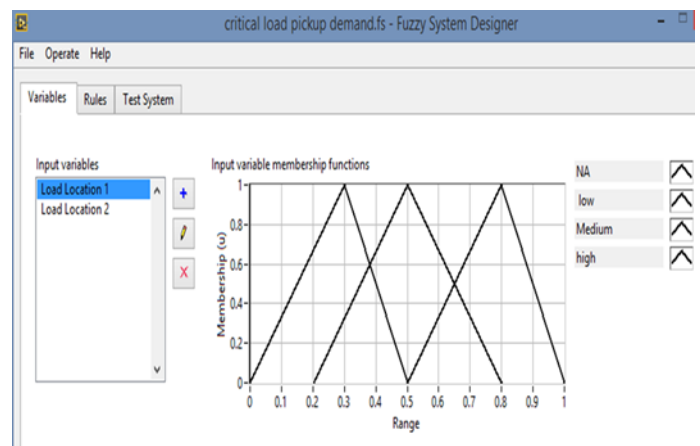


Figure 2: Fuzzy Input variable and membership function -Virtual instrumentation

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**More Kranthi Kumar**, U.G. Scholar, Department of Electrical and Electronics Engineering, Saveetha School of Engineering, Saveetha Institute of Medical And Technical Science, Chennai , Tamilnadu, India.

**R.Hariharan**, Associate Professor, Department of Electrical and Electronics Engineering, Saveetha School of Engineering, Saveetha Institute of Medical And Technical Science, Chennai, Tamilnadu, India.  
(email: harinov22@gmail.com)

Fuzzy sets Output variable are DGL1, DGL2. Each DG 4 Fuzzy sets. Fuzzy sets output variable membership functions are NA (0 0 0), low(0 .3 .5), medium(.2 .5 .8), high (.5 .8 1). Fuzzy output variables and output variable membership functions are shown in the figure.

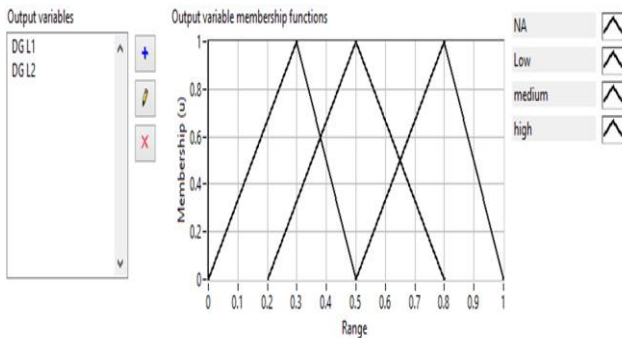


Figure 3: Fuzzy output variable and membership function - Virtual instrumentation

3.1 Rule base system

A fuzzy rule-based system is shown in figure 3. It shows depends upon the load crew values. Distributed generation location and crew dispatch value will be selected by a fuzzy system. It is done by if-then rule. Defuzzification methods are used in the center of the area. It tested in IEEE 13 distribution bus system. Two severe damaged critical loads are considered. Depends upon the load crew severity DG1 and DG2 value will be optimized by the fuzzy system. If-then 14 rules are shown in the table 1.

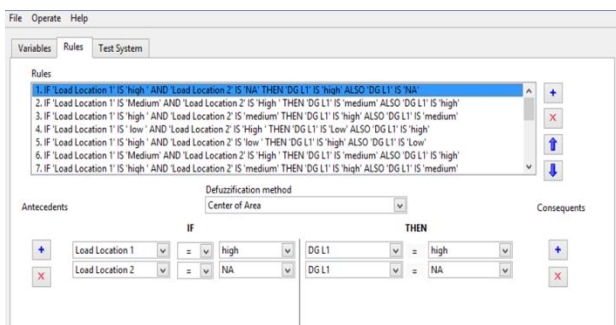


Figure 4: Fuzzy rules window - virtual instrumentation

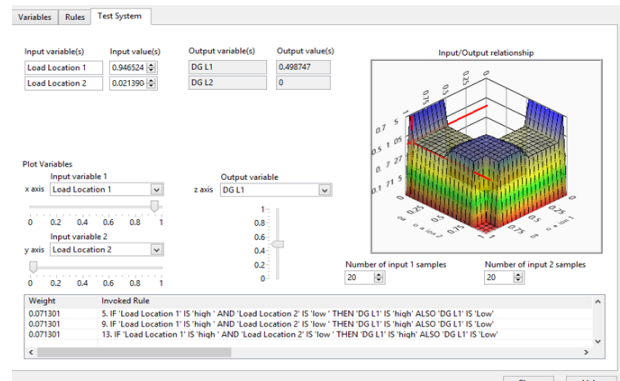
N.A	LOW	Medium	High	DG1	DG2
L1	L1	L1	L1	H	N.A
L1	L1	L1	L2	M	H
L1	L1	L2	L1	H	M
L1	L1	L2	L2	L	H
L1	L2	L1	L1	H	L
L1	L2	L1	L2	M	H
L1	L2	L2	L1	H	M
L1	L2	L2	L2	L	H
L2	L1	L1	L1	H	L
L2	L1	L1	L2	M	H
L2	L1	L2	L1	H	M
L2	L1	L2	L2	L	H
L2	L2	L1	L1	H	L
L2	L2	L1	L2	M	H
L2	L2	L2	L1	H	M
L2	L2	L2	L2	N.A	H

Table 1 : Fuzzy rules

IV. SIMULATION RESULT

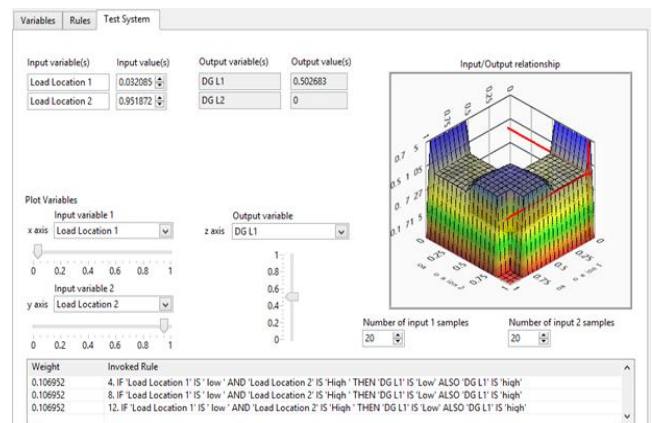
Case 1:

Input variables load location linguistic values L1 0.946 and L2 .021390 depends upon the load variables three rules are invoked. Invoked rule no 5, 9 and 13 weight is .0713. Defuzzification output variable are DG1 linguistic variables are .498747 and DG2 linguistic variables is 0. So DG L1 activates to recover the load location 1.



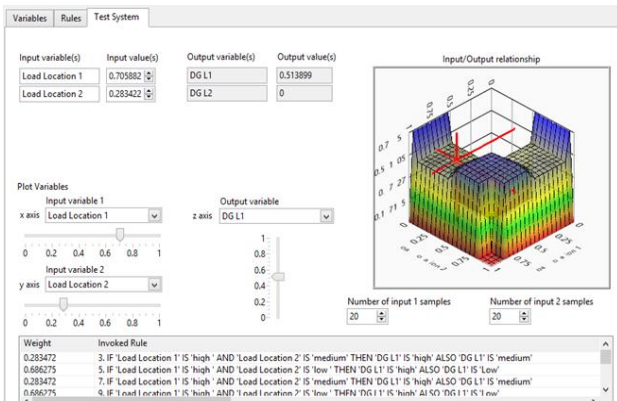
Case 2:

Input variables load location linguistic values L1 0.032 and L2 .0951872 depends upon the load variables three rules are invoked. Invoked rule no 4, 8 and 12 weight is .106. Defuzzification output variable are DG1 linguistic variables are 0 and DG2 linguistic variables is .502683. So DG L1 activates to recover the load location 2.



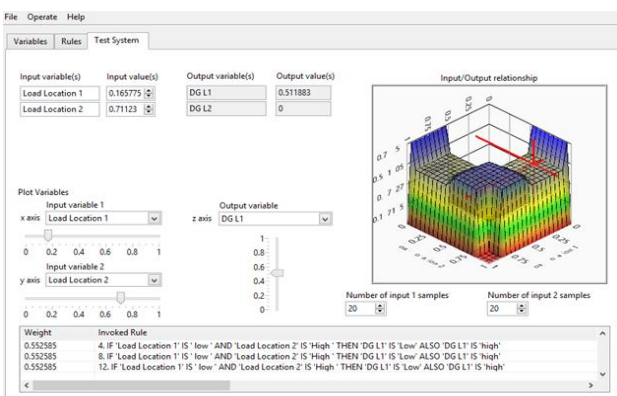
Case 3:

Input variables load location linguistic values L1 0.705882 and L2 .283422 depends upon the load variables three rules are invoked. Invoked rule no 5, 9 is .686275 and invoked rule no 3, 7 is 2834. Defuzzification output variable are DG1 linguistic variables is 0.513899 and DG2 linguistic variables are 0. So DG L1 activates to recover the load location 1.



**Case 4:**

Input variables load location linguistic values L1 0.165775 and L2 .71123 depends upon the load variables three rules are invoked. Invoked rule no 4,8,12 is .552585. Defuzzification output variable are DG1 linguistic variables are 0.513899 and DG2 linguistic variables is 0. So DG L2 activates to recover the load location 2



**V. CONCLUSION AND FUTURE ENHANCEMENT**

The proposed method of Intelligence system to recover the damaged network as priority with depends upon the critical load crew. Distributed generation allocate the load location depends upon the crew damage by fuzzy system. This system optimized by less period of time. In Future the system tested in complex networks with fuzzy system.

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