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Transmission Loss Allocation Methodology are Considered in ESI

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Abstract:- The re-engineering of ELECTRICITY SUPPLY INDUSTRY (ESI) started in 20th century introduced non-interference and succeeding open access policy in electricity. And this restructured system brought competition in energy market. This modification incorporates of two characteristics that are coupled with each other; re-engineering and denationalization. due to this change, some difficulties and provocation have dropped up.

Among all the problems, the issue of power losses distribution assumes significance. Distribution of distribution loss has become a controversial matter among the electricity builder and Clint. When electrical energy is communicated through a meshwork, it will cause energy losses. And generating unit produce more energy to repay these losses. And cause of deregulation and competition, no generating unit would like to generate more power to repay losses. Logically, both generators and consumers are expected to pay for losses. It is identified technique to shank this difficulty, then there is a possibility that the Independent System Operator (ISO) which is a profitless operation will be responsible for these power losses. It should be the operating units who should cover up these losses. This dissertation work focuses on presenting a strategy for loss allocation among the generating units. A distribution loss doesn't exist due to reality that distribution loss is extremely down result of network states and it is a unbreakable quantity.

Keywords:- *Transmission Loss Allocation, ESI ,ISO.*

I. INTRODUCTION

Electricity is one of the most extensively used form of energy, has been located more than a hundred years back. After the breakthrough of Edison's electric bulb, electricity has been merchantly manufactured and promoted in USA. Thomas Alva Edison, evaluated colonist of electric power system, first intiated "The Pearl Street Power Station" in New York, USA in 1882 [2]. Posterior more agencies were started. In early days there was no command in electric power productions. Small agencies handled small alternator in district areas and advertised power to agencies and other users in that area. These agencies were a little bit effective and useless facilities they provided. Separate agencies contingent on electric power for disparate needs such as street light , industrial power, residential lighting etc.

Now for very small service complex, electrical benefit have expanded one thousand million times bigger. Now, electric power systems became prevalent and composite in the environment. From its birth to present, power system complex and services have gone through disparate phases of development. For the last one hundred years ago electric power systems controlled as supervised holdings. In supervised oligopoly, an electric power system can be bisected into four main uncluttered zones; generating, transmission, distribution sub-station and electricity retailing.

a) **Generating sub-station** – Where generating is step-up from 11kv to 66kv,132kv,220kv or 400kv for primary transmission line (3-phare 3-wire)
b) **Transmission** – Where, the transmission voltage is step - down to high voltage (33kv or 66k or 11kv) for bulk consumers.
c) **Distribution** – Where, voltage in further step-down to distribution voltage (400v-3- phase 4-wire) consumer feeding.
d) **Retailing** – Electricity retailing is the final sale of electricity from generation to the end-use consumer.

Fig. 1

Contrariety to conservative perpendicularly consolidated energy system, oligopoly is disconnected from generation and distribution district in a non-interference energy structure. As a result, generation and distribution are merciless, with non-identified agencies contending for those profession. On the other hand, few ministries and governor registered that it is best to have only one transference structure. Therefore, in few cases transference region abided synchronized.

Transference loss in electric power system is a environmental circumstance. Electric energy has be progressed from triggering location to clint location through 3 or 4 wires for depletion. All wires have different loads, which absorb different energy. The energy absorbed in this way is mentioned to as "loss". Most of this loss(i2R) is unsettled to the warming of the power lines by the electrical current flowing through them. Transmission loss constitutes about 5% to 10% of total production, an amount benefit millions of dollar per year.

Energy loss in a Transmission and Distribution grid is infected by a number of ingredient such as:

- Orientation of generating plant.
- Loads & network configuration.
- Balanced & un-balanced potential difference.
- Power factor, harmonics and apparent power.
- Electric current in a line is a square law interconnection repeating the phase current would tetrad the line loss.
- Size based on material, types of transformer and type of cables.

The objective for this work is :

a) To model a small scale power system network using MATLAB in order to simulate transmission losses.
b) To develop experimental algorithm that can be implemented for small scale deregulated power system network in allocating the transmission losses using already available method.
c) To implement the algorithm for a standard IEEE test bus system.
d) To determine the losses in each line responsible for every generator.

II. RESULTS AND DISCUSSION

The "Loss Function Decomposition" based method has been tested for three different test system and tested against standard IEEE-3,IEEE-4 and IEEE 6-bus network with the help of Matlab. Matlab 7.8 is used to accomplish work and then the final results have been verified against [24] for 4-bus network and [38] for 6-bus network. For calculation of loss allocation a Mfile is framed according to algorithm.

- *IEEE-3 Bus Network:-*

Here is the standard IEEE 4 bus network is shown in Figure 1. with it's power flow. And all the input data for the calculation of loss calculation is given in Table 1, 2.

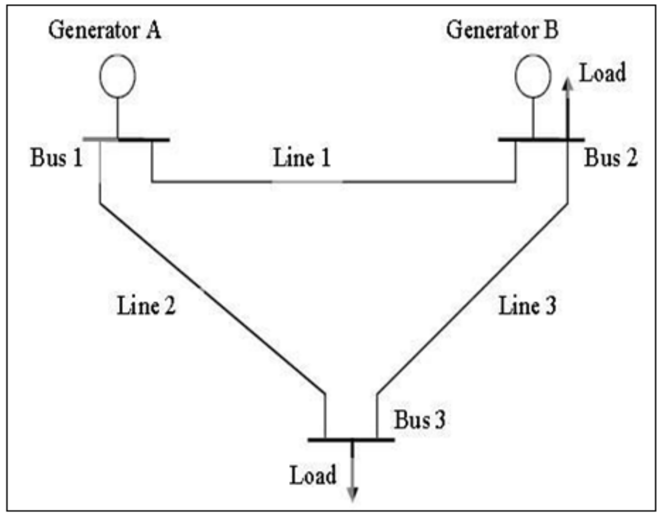

Fig. 1:- IEEE-3 bus system

- *Results for 3-Bus Network:-*

Line	G1(p.u.)
1-2	119.19287+34.26967j
	-29.26398-119.30376j
1-3	156.44413-6.40367j
	-141.39436-56.34078j
2-3	-66.65407+57.06369j
	-19.84719+83.79749j

Table 1:- Branch Power Flow Decomposition for Generators for 3-bus system.

Line	G1(p.u.)
1-2	279.02678
1-3	222.36528
2-3	88.97733

Table 2:- Branch Active Distribution loss to Generators for 3-bus system

In Fig. 1 there are two generating station whereas result allocate the loss for generator, which is located at 1 bus. The reason behind this is that the difference between generated power and consumed power at bus 2 is negative. Which means the all power generated by generator 2 is supplied to the load on the same bus itself and hence plays no role transmission loss allocation.

➢ *IEEE-4 Bus Network:-*

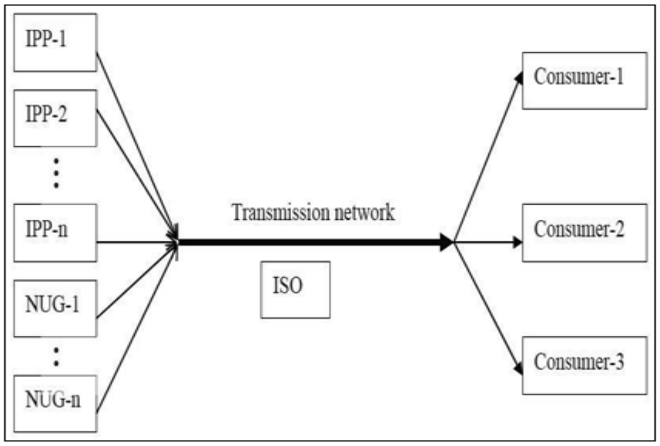

Fig. 2:- CKT diagram for periodic 4-Bus power flow solution.

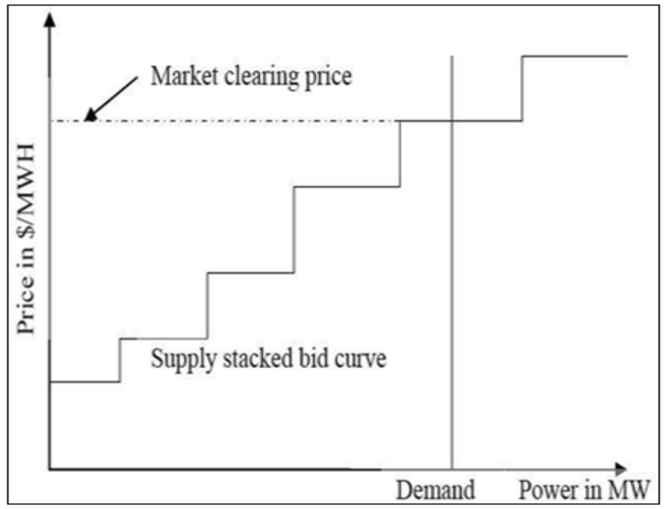

Fig. 3:- Converged load flow solution of IEEE-4 bus network

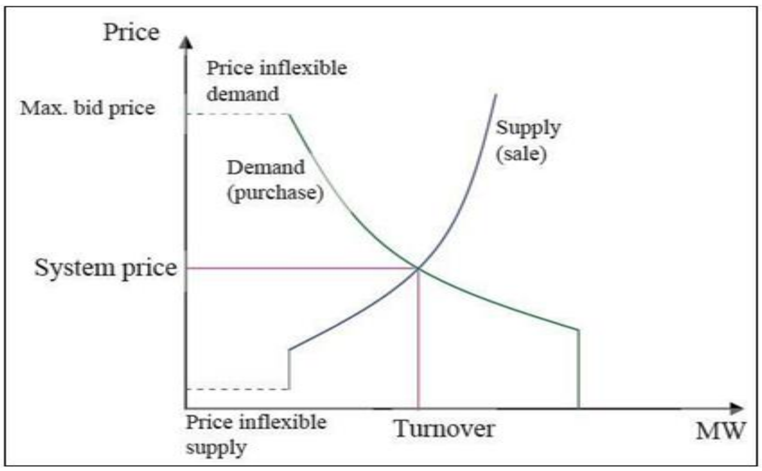

Fig. 4:- Line Parameter for 4-bus system

➢ *Results :- 4-Bus Network*

LINE	G1(P.U)	G4(P.U)
1-2	.30879+.05245j	0.20460+0.04273j
	0.03161+0.00945j	0.03097+0.00647j
1-3	0.15389+0.05023j	0.15182+0.04065j
	-0.03142-0.01025j	-0.03099-0.00830j
3-2	0.01569+0.00117j	0.01552+0.00068j
	0.06998+0.00523j	0.06926+0.00303j
4-2	0.00698+0.00274j	0.00680+0.00190j
	0.23538+0.09251j	0.22928+0.06395j
4-3	-0.00387-0.00289j	0.00387-0.00248j
	0.26150+0.19518j	0.26180+0.16767j

Table 3:- Branch Power Flow Decomposition for Generators for 4-bus system

Line	G1(p.u.)	G4(p.u.)
1-2	.00397	.00060
1-3	.00227	-0.00046
3-2	.00013	.00058
4-2	.00017	.00575
4-3	.00000	.00000

Table 4:- Branch Active Distribution Loss to Generators for 4-bus system

In branch 3-2, the power flow provided by G4 is mightier thanG1.G4 should be distributed extra losses than G1 according to interconnection between the dynamic losses and power losses. For these technique, it is compatible with the expected distribution loss. In branch 4-3,its dynamic loss is zero due to its zero resistance, so any distributed loss section should be zero.

➢ *IEEE-6 Bus Network*

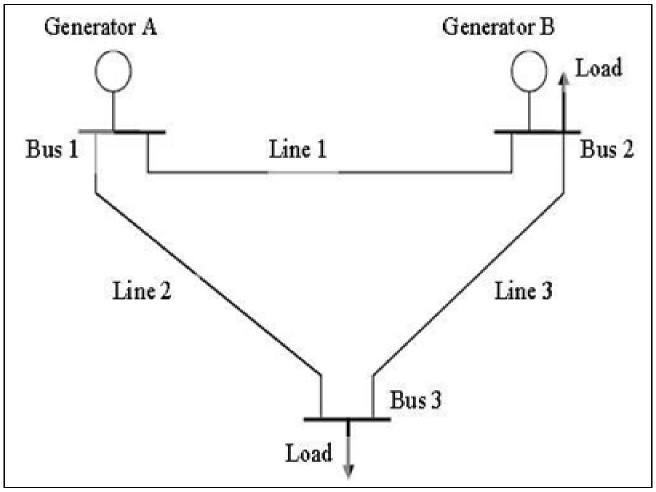

Fig. 5:- Bus network

From Bus	To Bus	R(ohm)	X(ohm)
1	3	0.034200	0.18000
2	4	0.114000	0.60000
1	2	0.091200	0.48000
3	4	0.22800	0.12000
3	5	0.22800	0.12000
1	3	0.034200	0.18000
2	4	0.114000	0.60000
4	5	0.022800	0.12000
5	6	0.000000	0.12000

Table 5:- Line Parameter Data for 6-Bus network

Bus No.	P(pu)	Q(pu)	V(pu)	Θ(rad)
1	1.2000	0.3820	1.050	0.101
2	0.2636	0.2370	1.050	0.000
3	0.8500	0.4000	1.002	0.025
4	0.4000	0.2000	0.996	-0.001
5	0.2000	0.1000	0.988	-0.001
6	0.2000	0.1000	0.978	-0.015

Table 6:- Converged load flow solution of 6 bus network

➢ *Results for 6-Bus Network:*

Line	G1(p.u.)	G2(p.u.)
1-3	.03917	.00571
2-4	.00818	.00707
2-1	0.00085	0.00058
3-4	0.00769	-0.00079
3-5	0.01299	0.00093
1-3	0.03917	0.00571
2-4	0.00818	0.00707
4-5	0.00033	0.00028
5-6	0.00000	0.00000

Table 7:- Branch Power Flow Decomposition for Generators for 6-bus system

Line	G1 (P.U)	G2 (P.U)
1-3	0.98416+0.36543j	0.96294+0.27641j
	0.14336+0.05323j	0.14027+0.04026j
2-4	0.17809+0.10364j	0.16903+0.09814j
	0.15392+0.08957j	0.14609+0.08482j
2-1	-0.10618+0.06795j	0.11249+0.05690j
	0.03776-0.02417j	0.04000-0.02023j
3-4	0.19081+0.03641 j	0.19054+0.03125j
	0.01950-0.00372j	-0.01947-0.00319j
3-5	0.23058+0.01332j	0.22762+0.00722j
	0.01658+0.00096j	0.01637+0.00052j
1-3	0.98416+0.36543j	0.96294+0.27641j
	0.14336+0.05323j	0.14027+0.04026j
2-4	0.17809+0.10364j	0.16903+0.09814j
	0.15392+0.08957j	0.14609+0.08482j
4-5	0.07164+0.05272j	0.07107+0.05230j
	0.06016+0.04428j	0.05968+0.04392j
5-6	0.15319+0.03816j	0.15215+0.03565j
	0.03857+0.00961j	0.03831+0.00898j

Table 8:- Branch Active Distribution Loss to Generators for 6-bus network

The result for 6-bus system is verified against [38]. To branch 5–6, its dynamic loss is zero due to its zero resistance, so any distributed loss section should be zero.

III. CONCLUSION

A technique of circuit for branch loss equilateral extrapolation concept. Conceptual interpretation and arithmetical reaction show that the projected technique has the succeeding properties:

- It integrates the network assumption and the abstraction of quadratic expectation to demand the distribution loss of limbs.
- The secure distribution losing has the similar declaration as distribution concept in[24,38]. Balanced the technique in [24,38], the advanced technique offers subconscious clarification of the secure arm distribution loss.
- The secure portion of the networks on the currents and power flows through limbs award with general corporal concepts are liberated to the solution of the voltage reference network.

FUTURE SCOPE

The presented Loss Function Decomposition to allocate the transmission loss was designed in such a way that it could account the power flow along with the topology of network. Changes in topology of network or may say the different arrangement of network will always give you different results for loss allocation. A electric power system organization may also be revised 76 Although a new generating sub-station is appended, a new transference line is added to the existing system, and therefore due to change in network conditions results will be different.

More advanced exploration can carried out to design and develop a Technique to handle future expansions to merge this method with an intelligent unit to make it a universal structure. We can develop a hardware based on this intelligent unit. Exploiting this appliances a loss meter is parallel to an algorithmic energy meter can be elaborated agglomeration losses for generators in a period of time.

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