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Improvement of Power Quality in Fourteen-Bus System with Three and Five Level IPFC

G.Hemavathi, S.Sherine, K.Dwarakesh

Abstract*: The power fluctuation is a major problem faced by the consumers in power system,to resolve thisInterline Power Flow Controlleris used. This article proposes three and five-level Interline Power Flow Controller for power quality enhancement of fourteen bus structure. The main objective of this article is to diminish the THDcreated by IPFC. Simulations carried out and it results indicate that there is an improvement in the output of IPFC in terms of THD, real power, and reactive power. The simulation results indicate that THD of Five Level Based IPFC (FLBIPFC) is less than that of the Three-Level Based IPFC (TLBIPFC) for fourteen bussystem.

Index Terms*: IPFC-InterlinePower Flow Controller FLBIPFC -Five-Level Based IPFC TLBIPFC -Three-Level BasedIPSC NRLF-Newton Raphson Load Flow THD-Total Harmonic Distortion

I. INTRODUCTION

UPFC & IPFC are the most adaptable and dominant FACTS.Power is progressively being considered and utilized as a product. Consequently transmission frameworks are being pushed nearer to their strength and warm points of confinement with the emphasis on the nature of intensity conveyed. The goal of Interline Power Flow Controller is to provide a wide power flow control arrangement for a multi-line transmission system, in which at least two lines utilize a SSSC for series compensation. Based on the energy function Mihalic presented the control strategy for an IPFC process. Legitimate control techniques must be connected to these gadgets. The reason for the make use of such a technique, to the point that is projected in this work, is to know the vitality capacity of a powerful framework that incorporates Interline Power Flow Controllers [1]. On account of the normal DC connect, any inverter inside the IPFC can exchange genuine energy to some other and consequently encourage genuine power exchange among the lines of the transmission framework[2]. The impact of IPFC for damping low down recurrence motions has suggested in a few papers. For this reason, single machine limitless transport demonstrates coordinated with IPFC is utilized, and the linearize show is built up. The cause of Interline Power Flow Controller on Damping Inter- territory of the Oscillations in the Interconnected Power Systems is recommended by Kazemi[4].

In Power System, for damping low-repeat movements IPFC is utilized. Elamwazuthi presented that Institute of Electrical and Electronics Engineers international conference on suitable energy [5]. Some contextual investigations are introduced to delineate the examination and the likelihood of utilizing enhanced control methodologies is talked about. Valencia [10] mentioned the Steady-State operation of IPFC. A dispatch system is anticipated for an IPFC working at evaluated constrain, in which the power course between the two stratagem converters is utilized as the parameter to upgrade the voltage profile and power exchange. Voltage constancy twists for dual test structures are seemed to depictampleness of this anticipated framework. Chow gave the dispatch methodology for IPFC working at appraised capacity [11]-[12]. Numerical outcomes in light of the IEEE 30 bus,118 bus & 300bus systems are exhibited to show the execution of Newton Control stream calculation with the use of IPFC and GUPFC [13]-[15]. Analysis of IPFC location in power transmission systems is suggested by Amir [16]. The grouping of the FLC and GA algorithm are anticipated. A numerical system that investigates simple information esteems regarding legitimate factors. The reason for the fluffy system is to decide the limit of IPFC as far as voltage deviation [17].

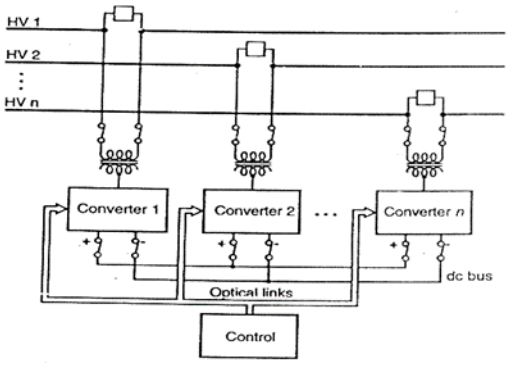

Fig: 1.1. General schematic diagram of the IPFC

II. SIMULATIONRESULTS

14 bus system without IPFC is revealed in Fig 2.1. The voltage at Bus-3 is revealed in Fig 2.2 and the peak value is 1*104 V. Fig 2.3 revealed the Bus-3 output current and the value is 200 V. The real power at Bus-3 is revealed in Fig 2.4 and the value is 28*106 watts. Bus-3 reactive power isrevealed in Fig 2.5 and value is 4*105 watts.

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The Output voltage at Bus-4 is revealed in Fig 2.6 and the value is 2*104 V. The output current at Bus-4 is revealed in Fig 2.7 and its peak value is 1800 A.

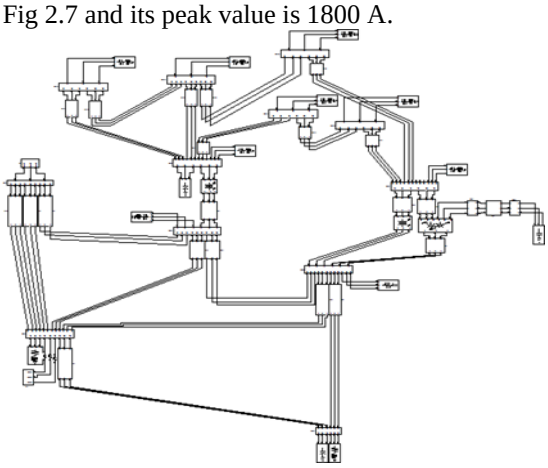

Fig 2.1 14-Bus system without IPFC

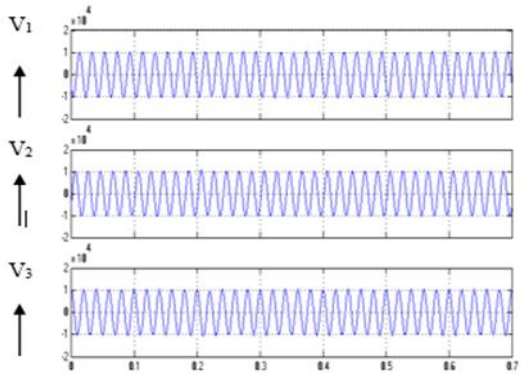

Fig 2.2 Output voltage at Bus-3

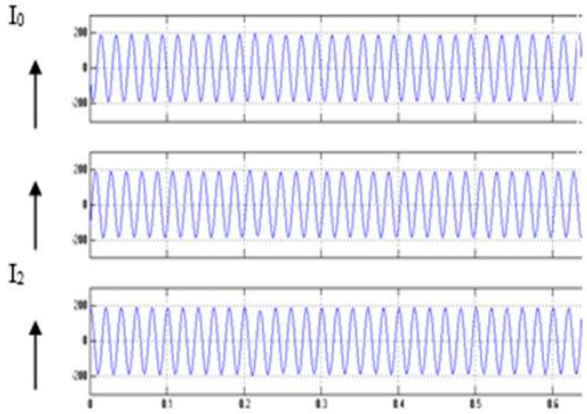

Fig 2.3 Bus3- Output current

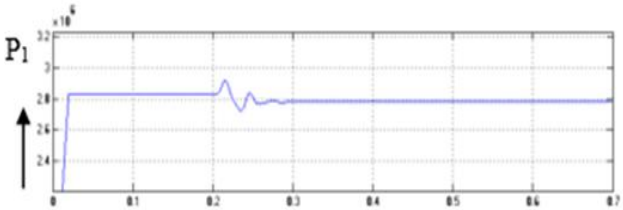

Fig 2.4 Real power at Bus-3

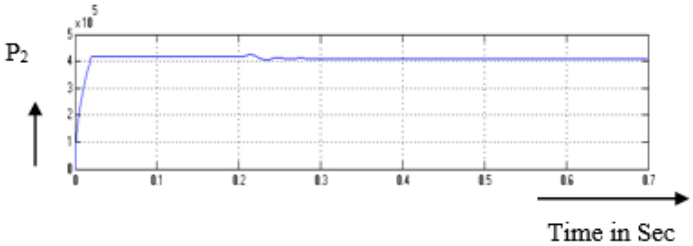

Fig 2.5 Reactive power at Bus-3

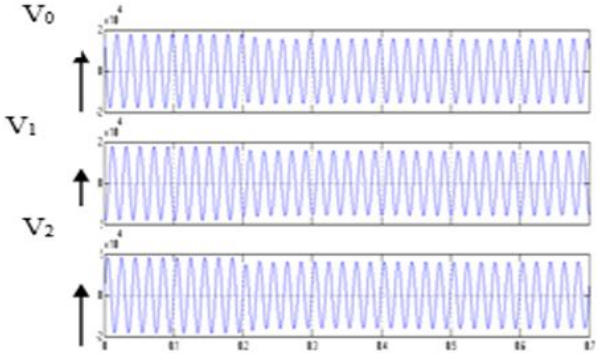

Fig 2.6 Output voltage at Bus-4

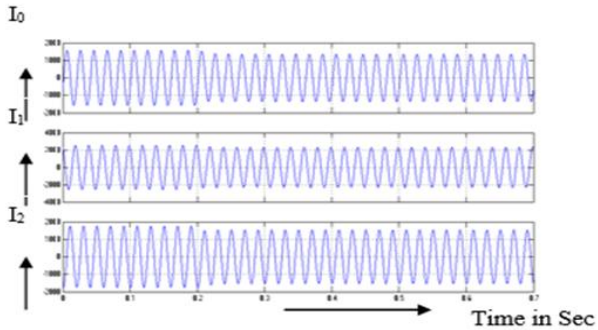

Fig 2.7 Output current atBus-4

The Real power at Bus-4 is revealed in Fig 2.8 and its value3.4*107 watts. The Reactive power at Bus-4 is revealed in Fig 2.9andvalue is 2.5*107 watts.

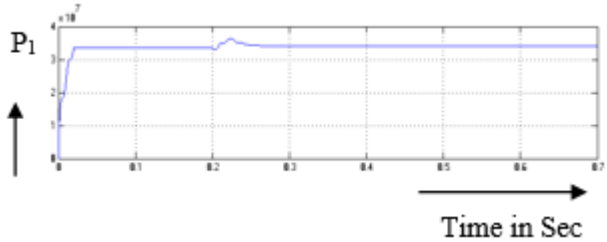

Fig 2.8 Real power at Bus-4

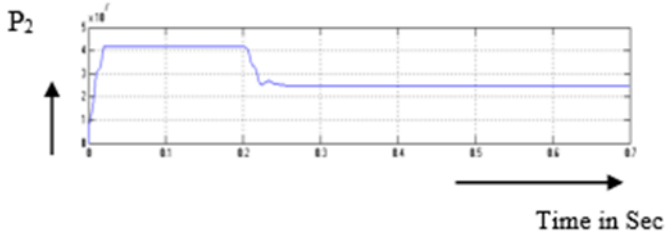

Fig 2.9 Reactive power at Bus-4

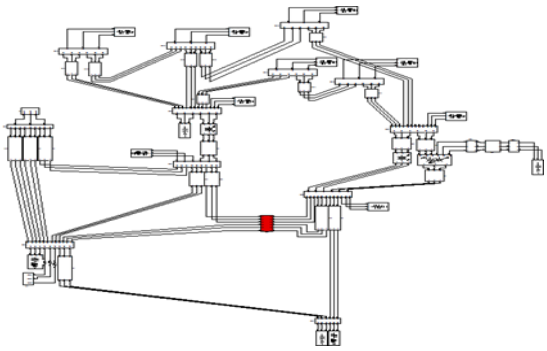

Fig 2.10 Three-level 14-bus system with IPFC

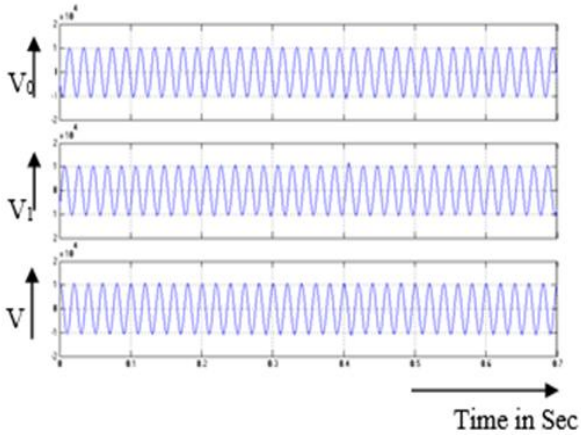

Fig 2.11 Output voltage at Bus-3

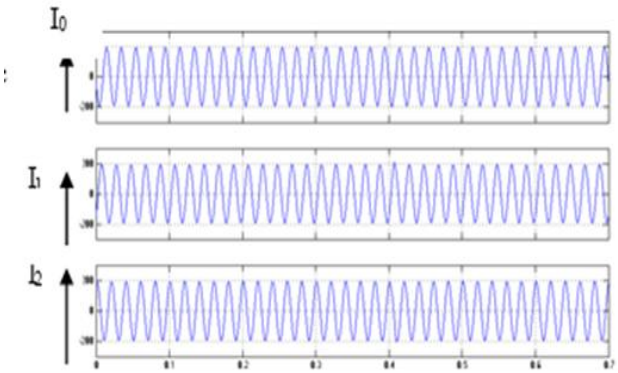

Fig 2.12 Output current at Bus-3

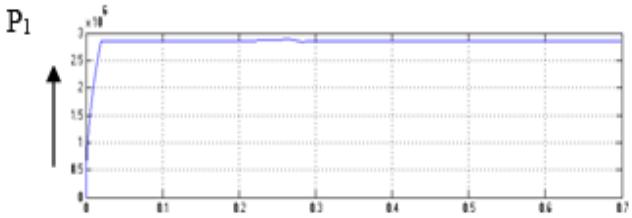

Fig 2.13 Real power at Bus-3

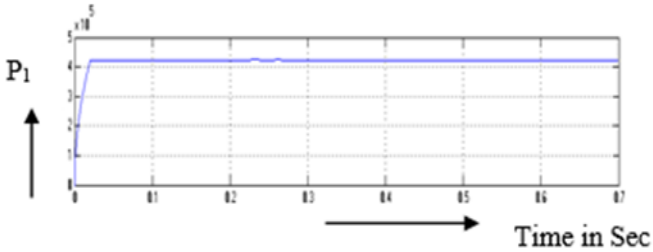

Fig 2.14 Reactive power at Bus-3

The circuit diagram of the IPFC modelis revealed in Fig 2.15 The voltage of the three-level inverter is revealed in 2.16 and its peak to peak value is2*104 V.

The voltage at Bus-4 is revealed in Fig 2.17 and the value is 1.5*104V. Fig 2.18 revealed the output current &value is 2000 A. Fig 2.19 revealed the Bus-4 real power and the value is 3.5*107 watts. The Reactive power is revealed in Fig 2.20 and its value is 3.5*107 W. The frequency band of the voltage is revealed in Fig2.21.

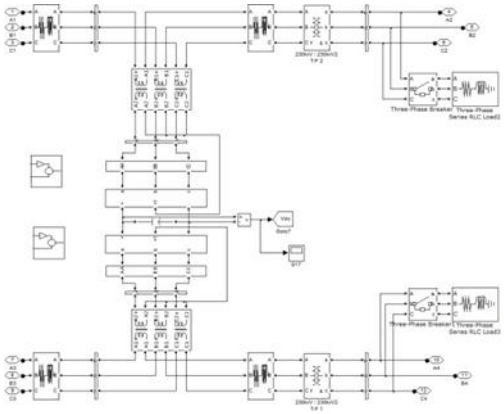

Fig 2.15 Circuit diagram of the IPFC

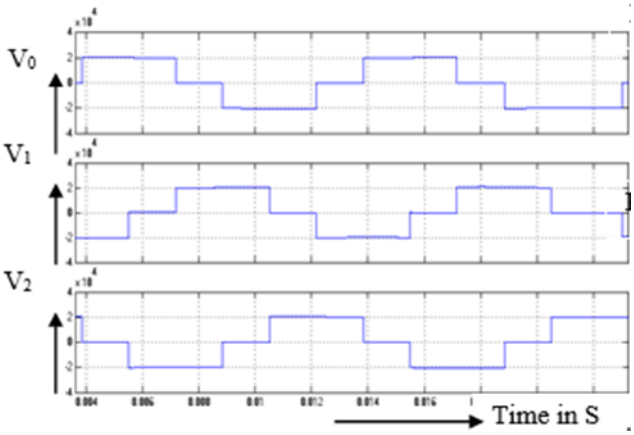

Fig 2.16 Output voltage of the three-level inverter

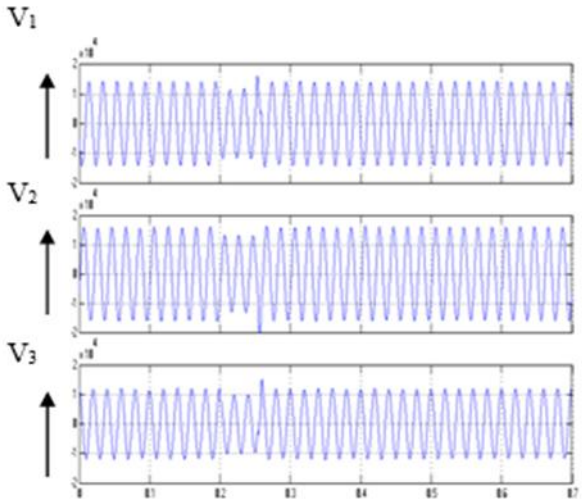

Fig 2.17 Output voltage at Bus-4

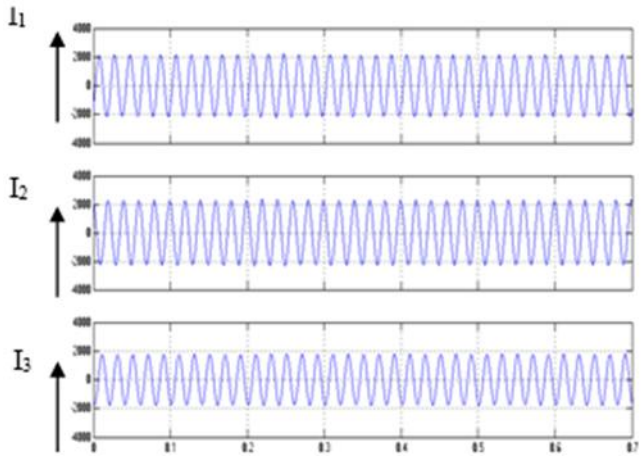

Fig 2.18 Output current at Bus-4

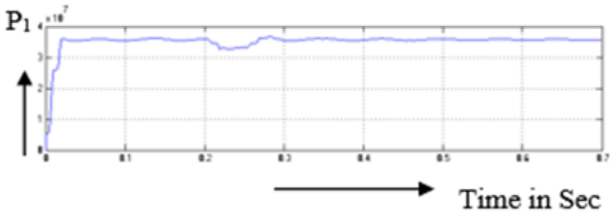

Fig 2.19 Real power at Bus-4

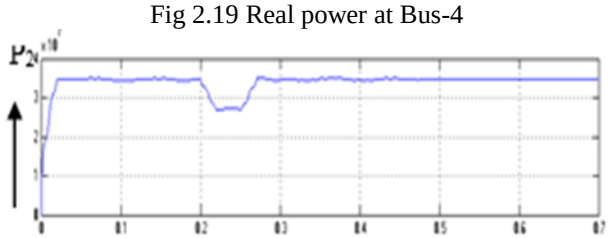

Fig 2.20 Reactive power at Bus-4

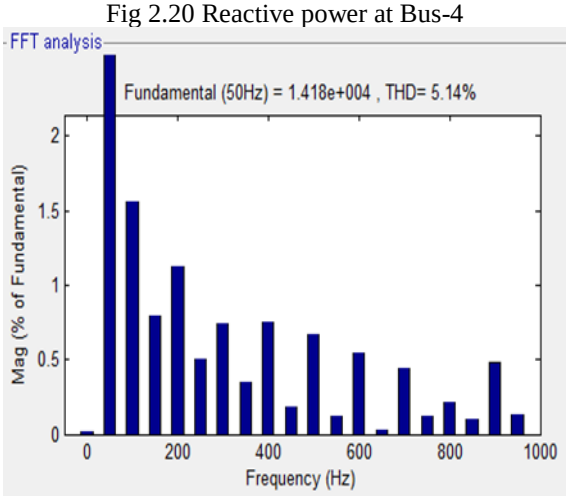

Fig 2.21 output voltage-Frequency band

A five-level 14-bus system is revealed in Fig 3.1.The Output voltage at Bus-3 is revealed in Fig 3.2 and the value is 1*104 V. The Output ampere is revealed in Fig 3.3 and its value is 200 A. Fig 3.4 revealed the Bus-3 real power and the value is 3*106 watts. The Reactive power at Bus-3 is revealed in Fig 3.5 and its value is 4.5*105watts.

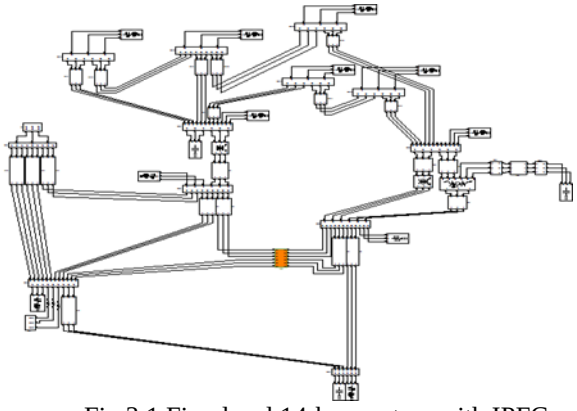

Fig 3.1 Five-level 14-bus system with IPFC

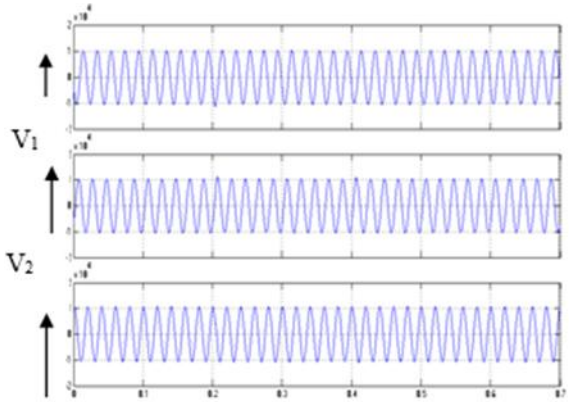

Fig 3.2 Output voltage at Bus-3

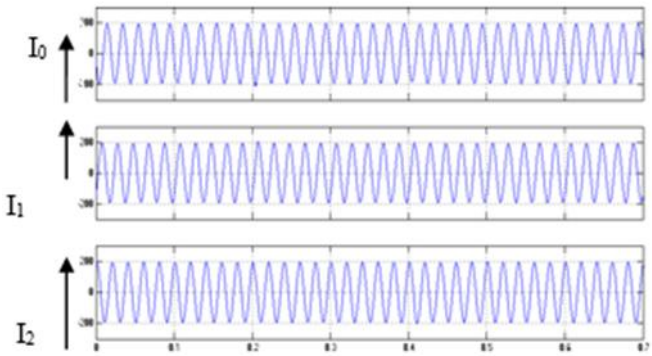

Fig 3.3 Output current at Bus-3

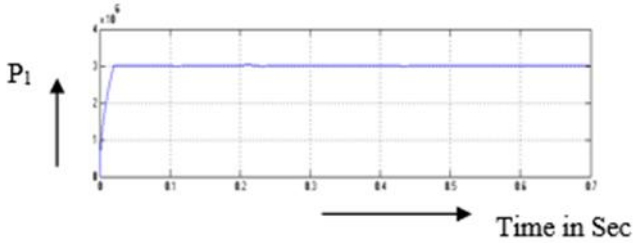

Fig 3.4 Real power at Bus-3

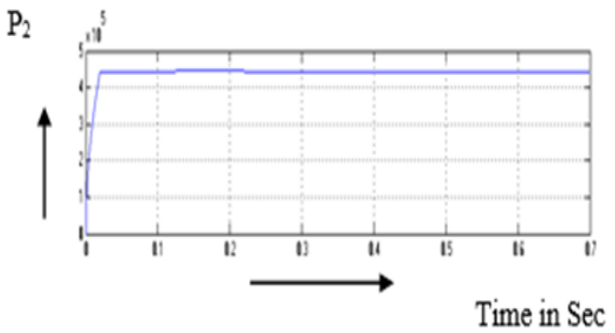

Fig 3.5 Bus3 -Reactive power

The IPFC model is revealed in Fig 3.6 the Output voltage of the five-level inverter is revealed in Fig 3.7 and its peak to peak value is 1.5*104 V. The output voltage at Bus-4 is revealed in Fig 3.8 and value is 2*104 V. The current output at Bus-4 revealed in Fig 3.9 and value is 3500 A. The Real power at Bus-4 is revealed in Fig3.10 and its charge is 4*107 watts. The Reactive power at Bus-3 revealed inFig3.11 and its value is 4*107 watts. The frequency band (output voltage) is revealed in Fig 3.12. The comparison of real & reactive power is given in Table-1. The Comparison of THD in the voltage is given inTable-2.

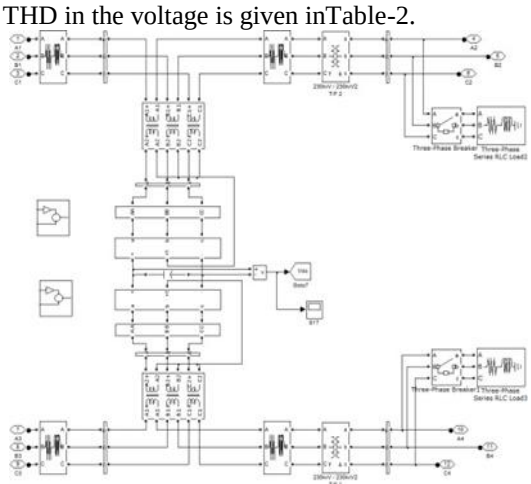

Fig 3.6 IPFC model

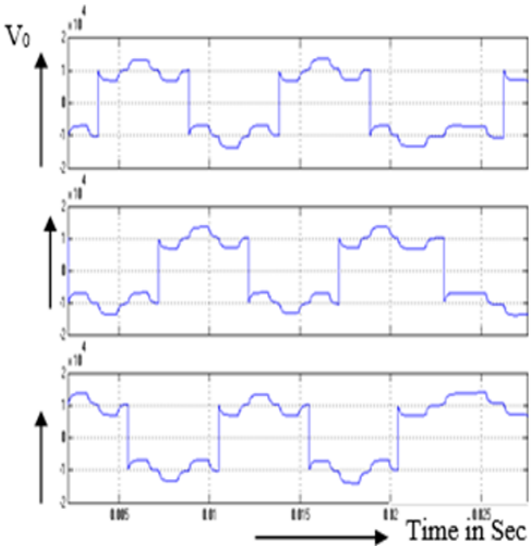

Fig 3.7 Output voltage of the five-level inverter

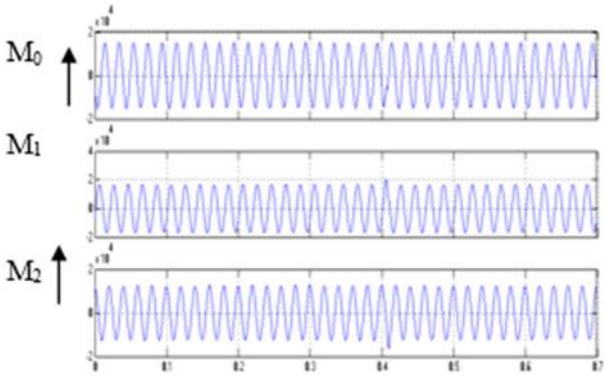

Fig 3.8 Output voltage at Bus-4

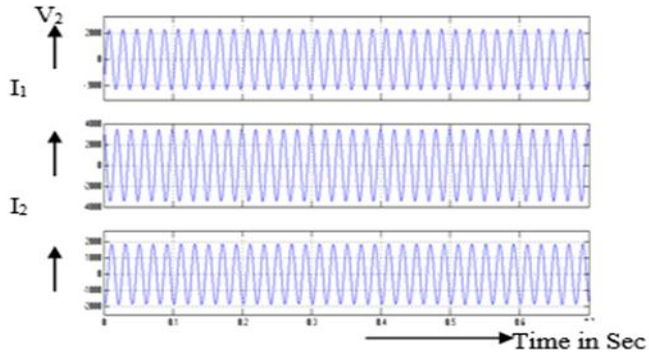

Fig 3.9 Output current at Bus-4

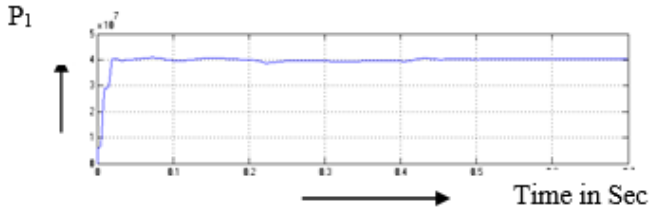

Fig 3.9 Real Power at Bus-4

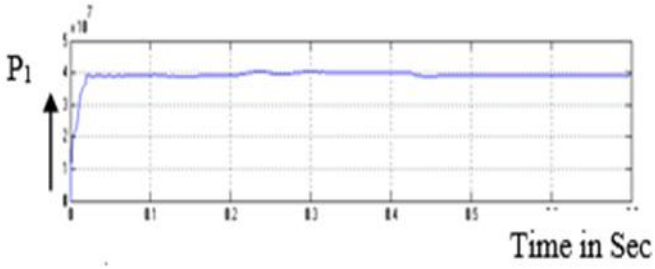

Fig 3.9 Reactive Power at Bus-4

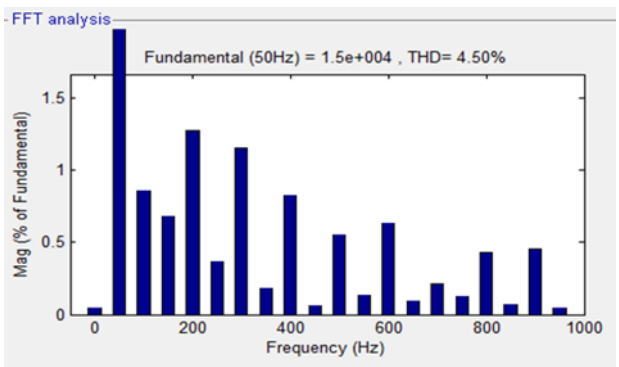

Fig 3.12 Output voltage-Frequency band

III. TABULATION

14-bus	Voltage	Real power (MW)	Reactive power(MVAR)
Without IPFC	150kv	34.12	29.05
With IPFC 3-level	161kv	37.86	35.75
With IPFC 5-level	170kv	40.56	38.89

Table 1 comparison of real & reactive power

9-bus system	Voltage THD
With IPFC Three level	5.14%
With IPFC Five level	4.50%

Table 2 Comparison of THD in the voltage

IV. CONCLUSION

The 14-bus systems with three-level and five-level IPFC's are modeled and simulated using Mat lab. The results indicate that the performance of the five-level IPFC system is superior to the three-level IPFC system. The THD is minimum with the five-level IPFC system. The simulation results indicate that the voltage stability is improved using IPFC.

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G. Hemavathi currently working as assistant professor in the department of electrical and electronics engineering, Bharath Institute of Higher Education and Research. She has an industrial experience of 2 years in OPG Thermal power plant.She completed U.G. Degree from Anna University, P.G.Degree from Anna UniversityFirst

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K. Dwarakesh completed his undergraduate in Electrical and Electronics Engineering and Post graduate in Power Electronics and Drives. Currently he is pursuing his research work in the area of power quality, he has made several publications in reputed journals.