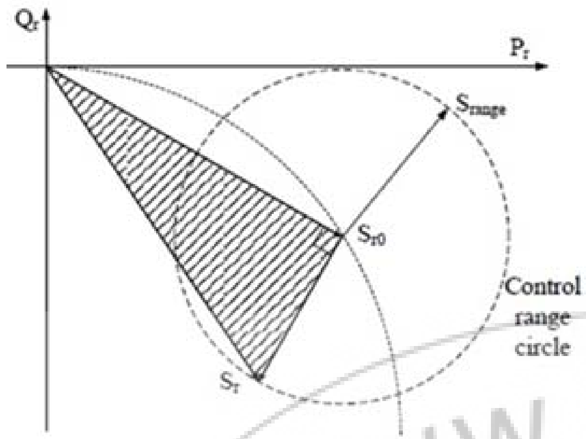

Figure 8: The maximum P_{se} of the control range S_{range}

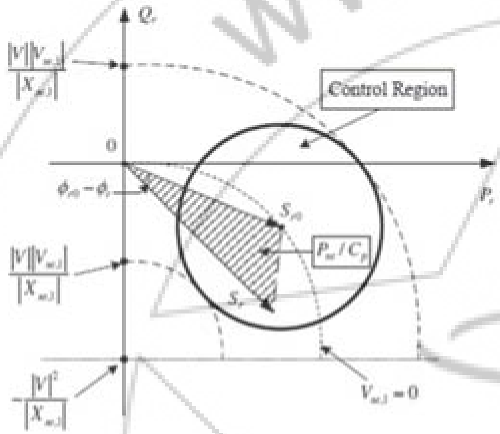

Figure 7: The relationship between P_{se} and the receiving end power

Therefore the relationship between the control range and maximum active power transmission can be represented by:

$$P_{se} = C_p A_{(\sigma r0, r)} = \frac{|X_{se,1}|}{|V_r|^2}|S_{r0}||S_{range}|$$

Where $\frac{|X_{se,1}|}{|V_r|^2}|S_{r0}|$ is the ratio of $\left(\frac{P_{se}}{S_{range}}\right)$

and it means how much maximum active power required to achieve the control range Srange. In a typical power system network, if the voltage and power are both 1pu, the impedance will be around 0.1pu; therefore the ratio is round 10%.

4. Results

The simulated values of active and reactive power flows with and without control through the transmission line for 1^0 and 90^0 transmission angles are shown in following Figures.

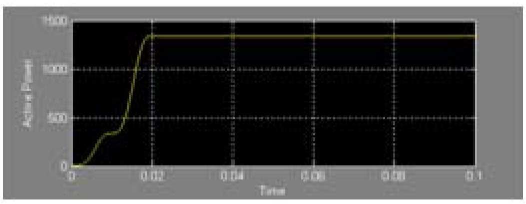

Figure 8: (a) Active Power through the line without control with 1^0 transmission angle

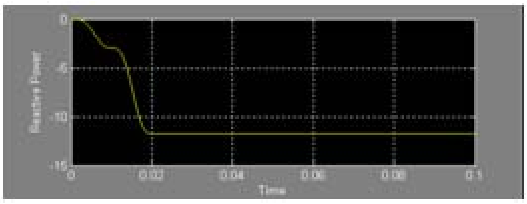

Figure 8: (b) Reactive Power through the line without control with 1^0 transmission angle

Figure9: (a) Active Power through the line without control with 90^0 transmission angle

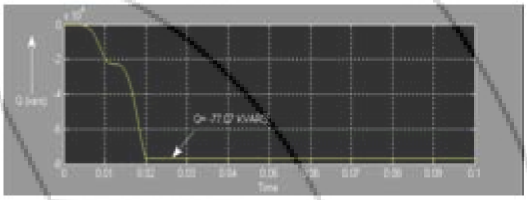

Figure 9: (b) Reactive Power through the line without control with 90^0 transmission angle

Fig.8 and Fig.9 shown above indicates power flow through the transmission line without controlling for different transmission angle. Fig.10and Fig.11 shown below indicates power flow through the transmission line with controlling for different transmission angle.

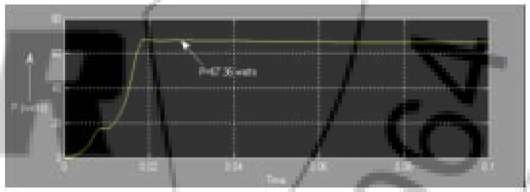

Figure 10: (a) Active Power through the line with control with 1^O transmission angle

Figure 10: (b) Reactive Power through the line with control with 1^O transmission angle

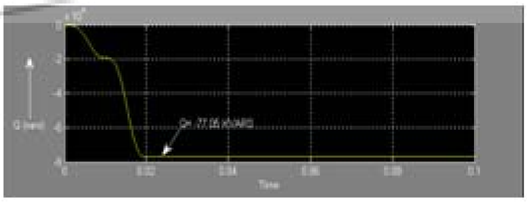

Figure 11: (a) Active Power through the line with control with 90^O transmission angle

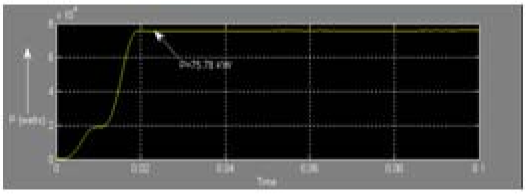

Figure 11: (b) Reactive Power through the line with control with 90^{O} transmission angle

5. Conclusion

This paper presents the new concept of DPFC system and the method of transmitting active power through the same line at different frequency. The distributed converters bring the following benefits: reduce cost for both equipment and maintenance; increase the reliability of the whole system, even when the shunt converter breaks, series converters can also work as variable conductor; break the location constrain, the converters are physical separated without losing control capability. Since the exchange active power is through the same line which transmits the fundamental power, the transmission capability of the line will be reduced. The level of reduction depends on the control range of DPFC, and it is around 10% or less of the range related to the transmission line parameters.

References

[1] K.R.Padiyar*FACTS controllers in power transmission and distribution*

[2] Allen J Wood, Bruce F. Wollenberg*Power Generation, Operation, & Control*

[3] Zhihui Yuan, Sjoerd W.H de Haan, Braham Frreira and DaliborCevoric *"A FACTS Device: Distributed Power Flow Controller (DPFC)" IEEE Transaction on Power Electronics, vol.25, no.10, October 2010. page no 2564-2572*

[4] Mohammad MoradiGhahderijani ECE Department, University of Sistan and Baluchestan, Iran *"Power Quality Improvement and Mitigation Case Study Using Distributed Power Flow Controller" 2012 IEEE page no 464-468*

[5] Zhihui Yuan Sjoerd W.H. de Haan Braham Ferreira *"A New FACTS Component — Distributed Power Flow Controller (DPFC)"*

[6] Narain G.ingorani and Laszlo Gyugyi *Understanding FACTS concept and technology of flexible AC transmission systems*

[7] R.H.Miller&J.H.Malinowski*Power System Operation*Zhihui Yuan Sjoerd W.H. de Haan Braham Ferreira *"A New FACTS Component — Distributed Power Flow Controller (DPFC)"*