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Comparison of resonant current regulators for DFIG during grid voltage distortion

应用于谐波电网下DFIG控制的谐振器比较研究

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Key words: Doubly fed induction generator, Harmonically distorted grid voltage, Resonant current regulator, Vector PI current regulator, Discretization method

关键词： 双馈风力发电机；谐波电网电压；谐振器；矢量比例积分调节器；离散化方法

Focus

The proportional integral resonant (PIR) regulator with traditional resonant part and the vector proportional integral (VPI) regulator with VPI resonant part are compared, with the transfer function and frequency response characteristics of these two current regulators analyzed and compared.

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Bode diagram of the open- or closed-loop transfer function using PIR and VPI regulators

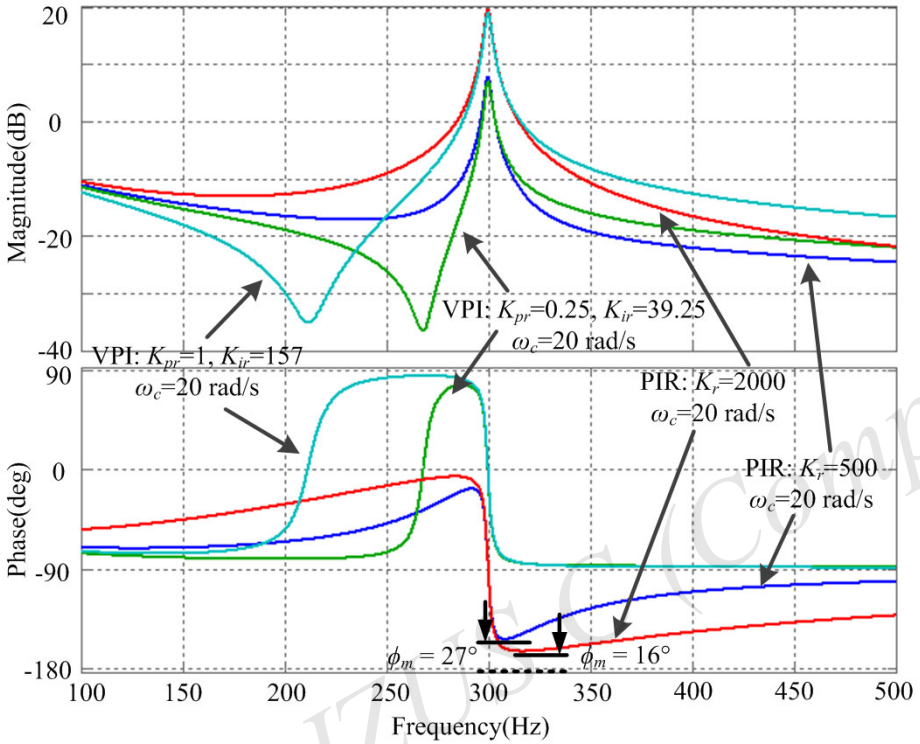


Fig. 4 Bode diagram of the open-loop transfer function using both PIR and VPI regulators (K_p=1, K_i=1, ω_c=20 rad/s, ω_1=100π rad/s, K_r=500 or 2000, K_{pr}=0.25 and K_{ir}=39.25 or K_{pr}=1 and K_{ir}=157, R_r=0.88 Ω, σ=0.06, L_r=0.093 H)

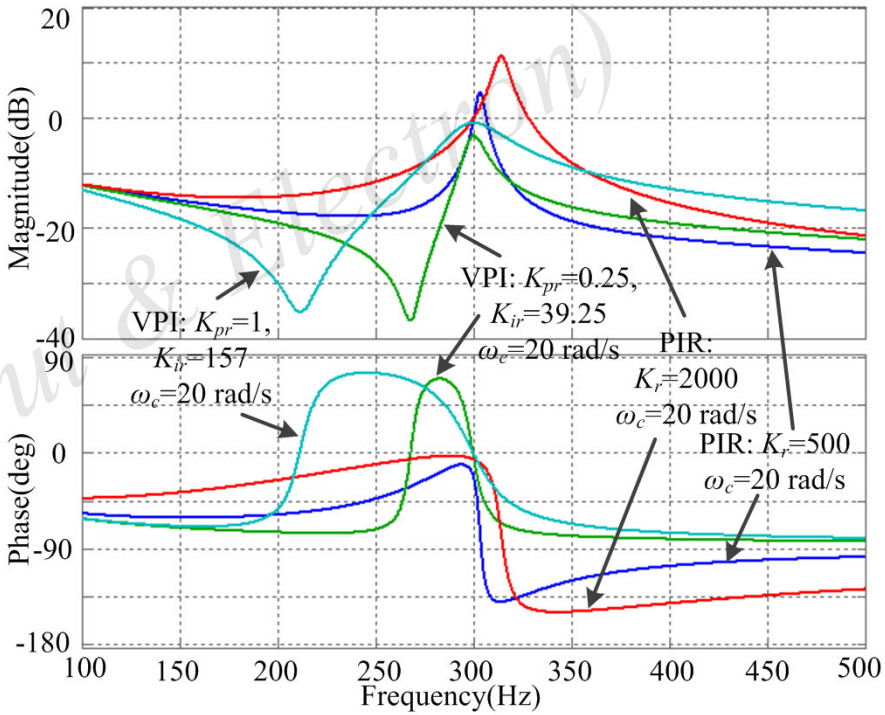


Fig. 5 Bode diagram of closed-loop current control with both PIR and VPI regulators (K_p=1, K_i=1, ω_c=20 rad/s, ω_1=100π rad/s, K_r=500 or 2000, K_{pr}=0.25 and K_{ir}=39.25 or K_{pr}=1 and K_{ir}=157, R_r=0.88 Ω, σ=0.06, L_r=0.093 H)

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Conclusions

- Aimed at DFIG operation with harmonic grid voltage, the VPI regulator has a much larger phase margin than the PIR regulator, which is beneficial for stable closed-loop operation of DFIG.
- The VPI regulator exhibits an accurate steady state closed-loop operation with 0 dB magnitude response and 0° phase response, while the PIR regulator fails to achieve 0° phase response at the resonant frequency.

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