

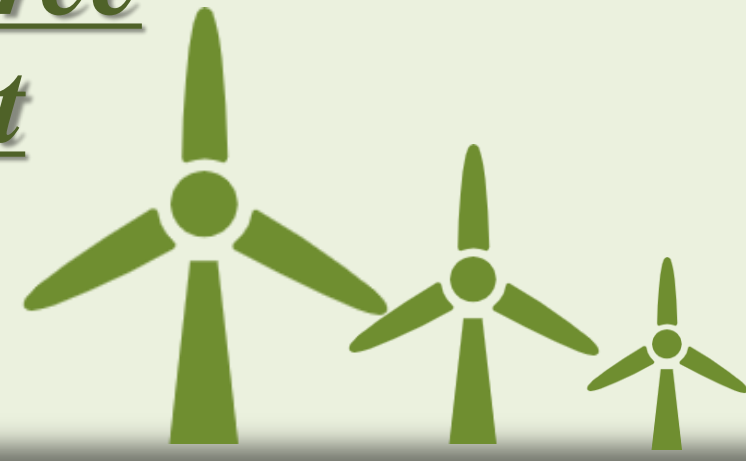
The Virtual Admittance Control of Sending End Converter for Offshore Wind Farm Integration

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INTRODUCTION

- To integrate and transfer bulk offshore wind power to the onshore grid, the voltage source converter-based high voltage direct current (VSC-HVDC) transmission system is becoming a promising scheme.



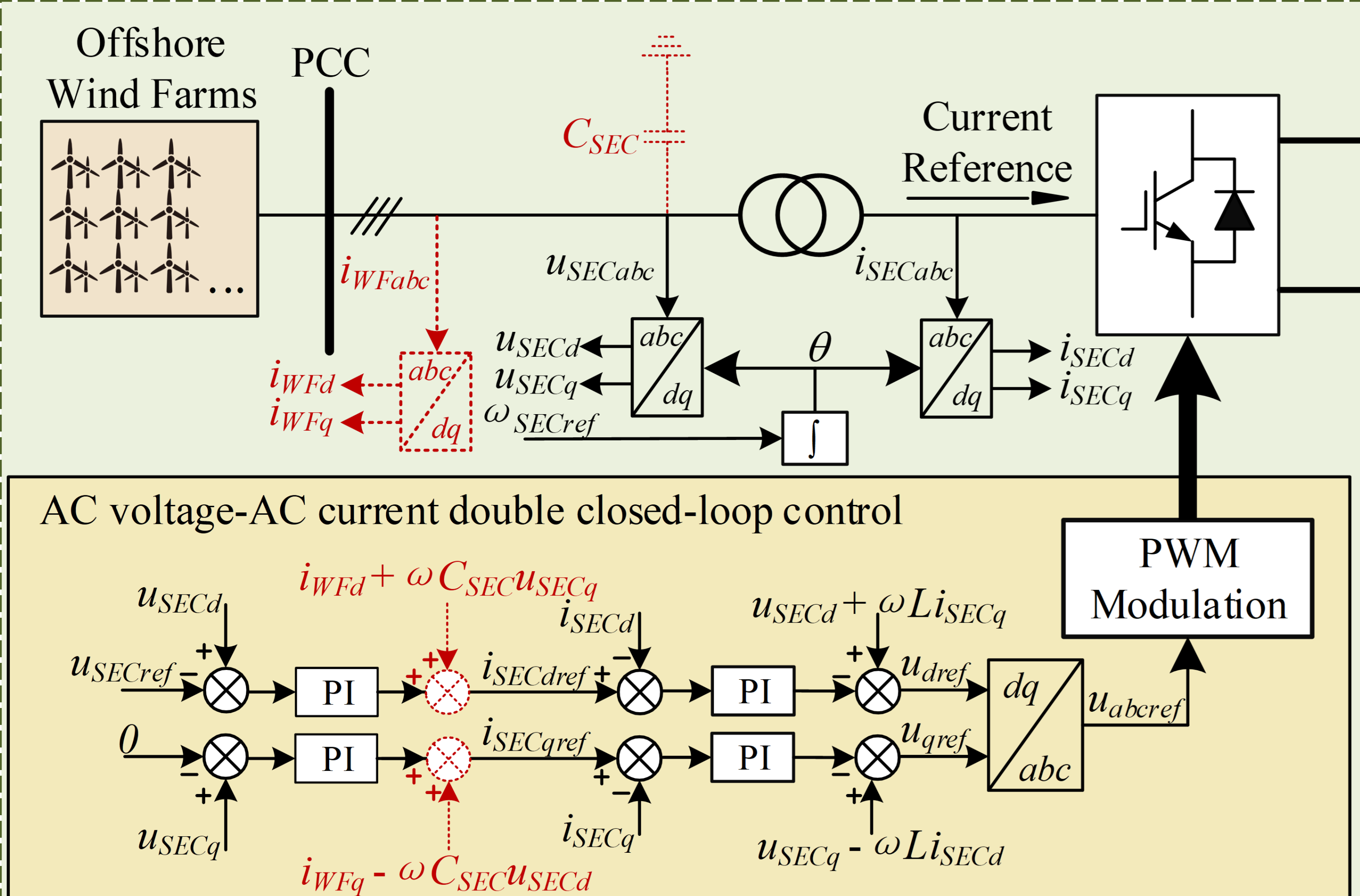
Isolated Island Operation Low Overcurrent Capability

Dual closed-loop control is widely utilized in the SEC

Designed for the 2-level converter with the filter capacitor

Commonly used Modular Multilevel Converter (MMC)

CONVENTIONAL DUAL CLOSED-LOOP CONTROL SCHEME



MMC without AC capacitor

The feedforward of the load current

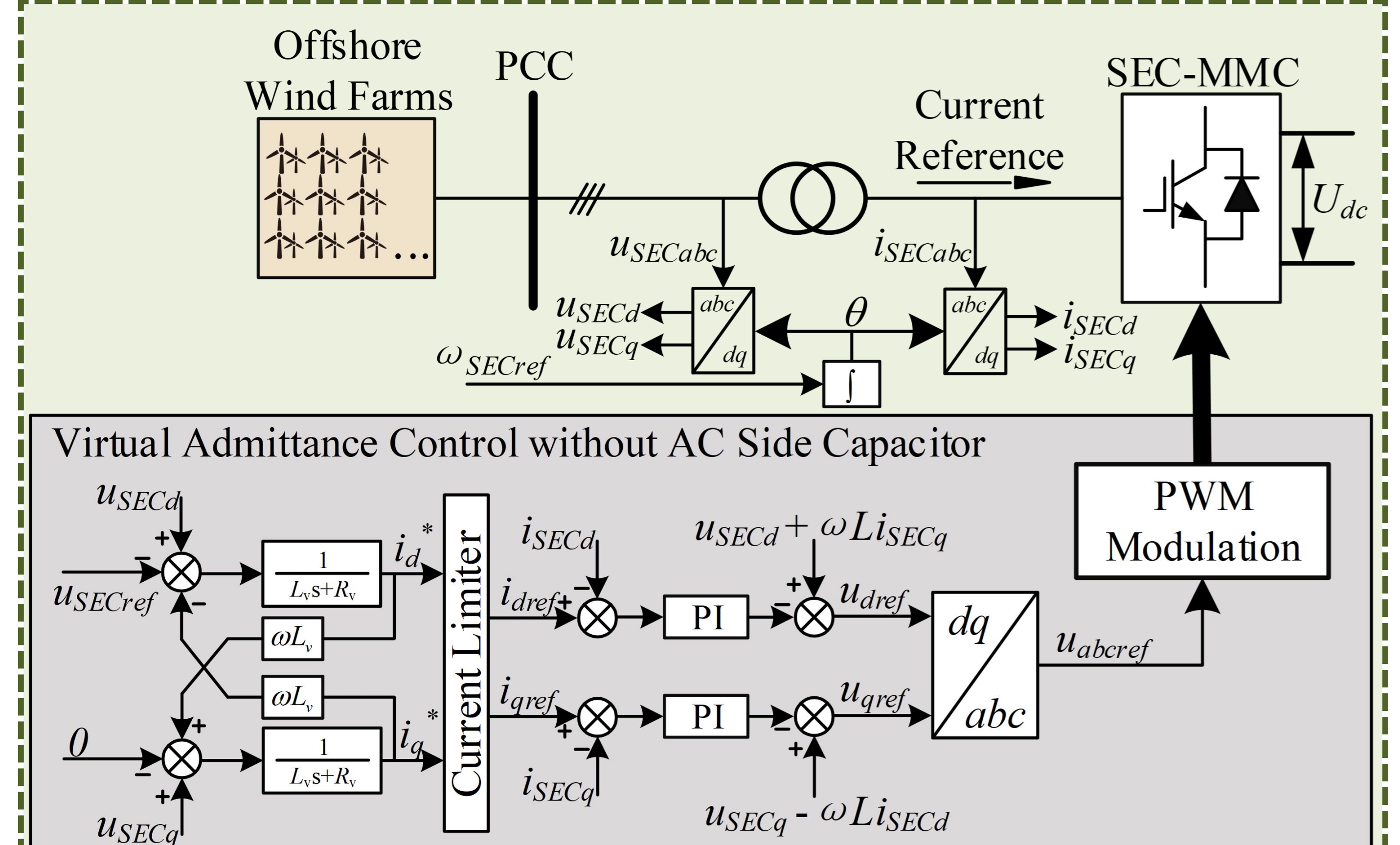
The decoupling terms

Absence

Worsened Control Performance

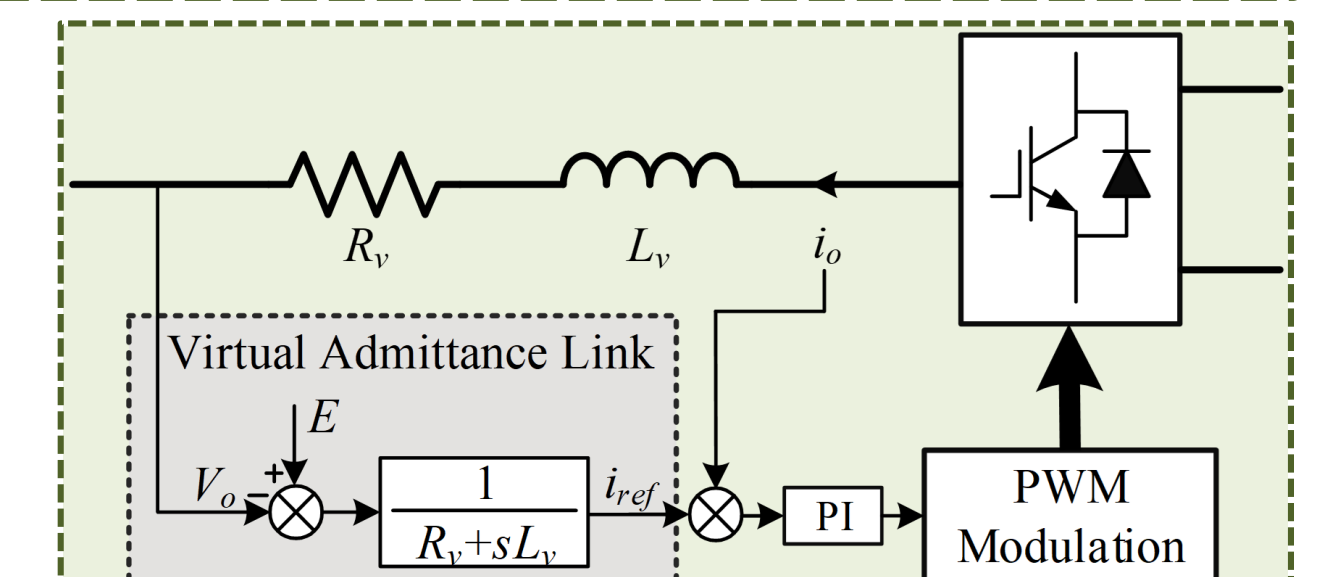
The transient overcurrent capacity is poor

VIRTUAL ADMITTANCE CONTROL OF SEC



$$i_{dref} = \begin{cases} i_d^* & \sqrt{i_d^{*2} + i_q^{*2}} < i_{lim} \\ \frac{i_{lim}}{\sqrt{i_d^{*2} + i_q^{*2}}} i_d^* & \sqrt{i_d^{*2} + i_q^{*2}} \geq i_{lim} \end{cases}$$

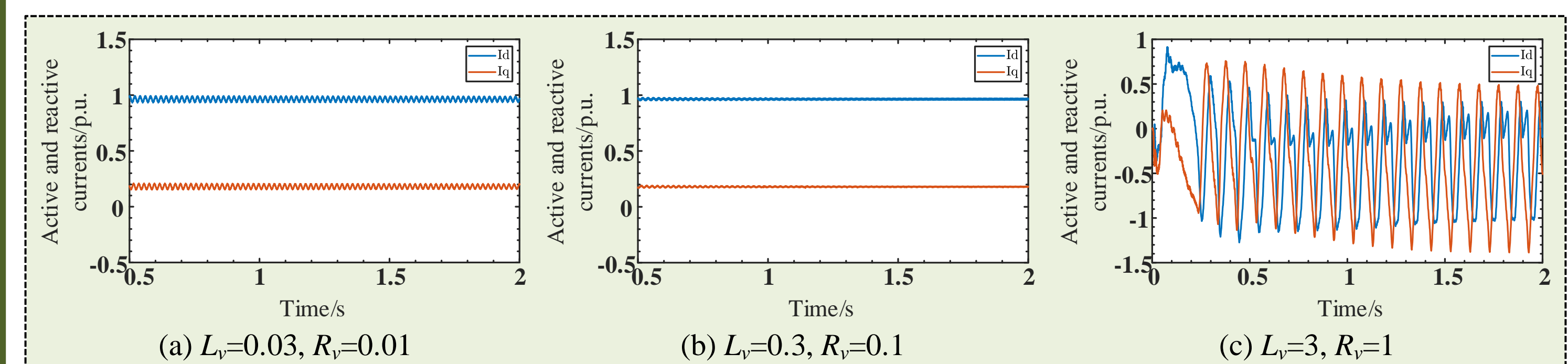
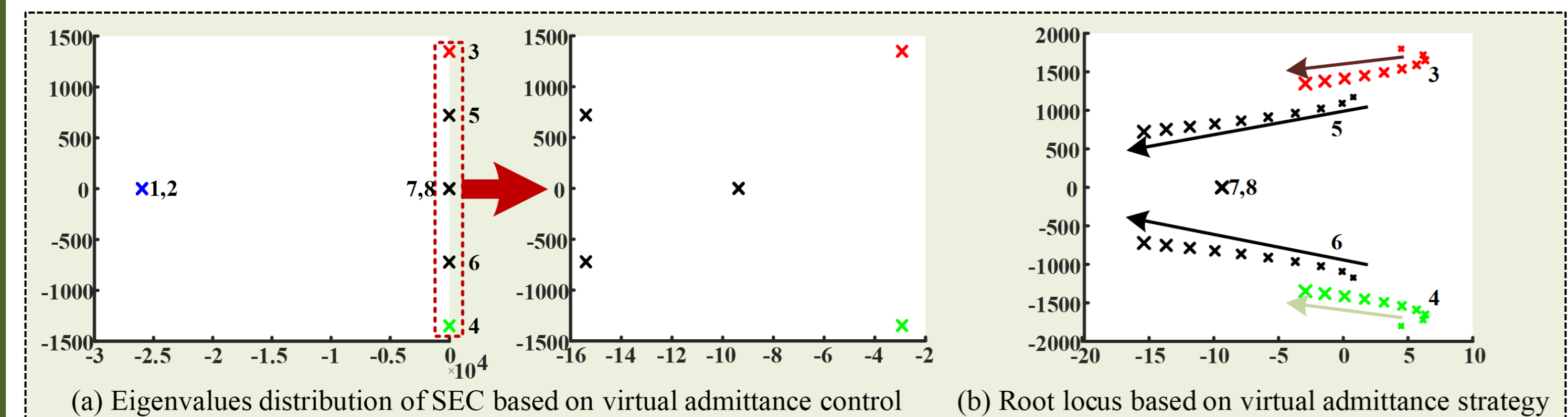
Elliptic Current limiter



Control Principle

PARAMETER DESIGN

$\Delta \dot{\mathbf{x}} = \mathbf{A} \Delta \mathbf{x} + \mathbf{B} \Delta \mathbf{u}$ State space matrix A Eigenvalues analysis



RESULT AND CONCLUSION

- The virtual admittance control strategy has better steady-state performance.
- Under the condition of a sudden drop in wind farm power: 1. More quickly without oscillation; 2. Transient voltage peak of 1.25p.u. (much smaller).
- Under the condition of active voltage drop of SEC: 1. Avoid the problems of losing feedforward and decoupling terms; 2. Saturation of the outer loop.
- Parameter design: L_v and R_v : 1. \downarrow (Unstable, RHP); 2. \uparrow (Reduces the active power transmission limit).



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