

Collaborative unbalance compensation method for high-speed railway traction power supply system considering energy feedback

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Abstract— The unbalance current issue of the high-speed railway is the most prominent power quality of the traction power supply systems. Bullet trains can generate energy feedback when they brake, which should not be neglected. In this study, the effects of energy feedback on the unbalance issue are analysed, under different operating conditions of the trains. A collaborative unbalance compensation method (CUCM) for the high-speed railway is proposed in this work to lower the compensation capacity of the expensive power electronics compensation devices. To ensure that the CUCM works well, a further analysis of the two compensation principles, the railway power conditioner principle and Steinmetz principle, was carried out. The analysis results showed that the two compensation principles have different implementation methods and compensation current expressions, but the compensation essences were the same. According to the principle analysis results, a collaborative strategy was used. A capacity analysis of the CUCM, based on the actual operating situations of the bullet trains, was also completely done in this study. The simulation and experimental results showed that the proposed CUCM could adequately compensate the unbalance current of the high-speed railway power systems well with a low cost, in both traction and energy feedback situations.

For the published version of record document, go to:

<http://dx.doi.org/10.1049/iet-pel.2018.5736>

