

## **Benefits of Inerters for Multi-Car Trains**

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### **Abstract**

This paper applies the inerter to multi-car trains, and discusses its benefits in improving system stability and performance. An inerter is a genuine two-terminal passive mechanical element, whose reacting force is proportional to the relative acceleration of its terminals. In this paper, we build the model of multi-car trains, and discuss the advantages of applying inerters in the suspensions. The study is carried out by three steps. First, we construct a thirty-one degree-of-freedom fulltrain model. Second, we show that inerters can significantly improve the system's stability and performance. Last, we link multi cars, and discuss the impacts of connecting cars on system stability and performance. Based on the results, the inerters are deemed effective in improving the performance and stability of multi-car trains. Furthermore, connecting cars tends to decrease the critical speed and increase the settling time, but has no influence on the passenger comfort.