

System Design on VTI for High-Speed Rolling Stock

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Abstract. Entry to neutral point activates the chopper, burning energy through resistance. Switching the location of resistance and chopper solves many aspects, but it does not solve fundamental problems. As a result, this study solves the fundamental problem of VTI(Ventilation by installing DC/DC converter that receives input of DC Link 2800[V] and converts it into 670[V] when entry to neutral point occurs, enabling stable power supply.

Keywords: Chopper, Switching, VTI, DC/DC converter, DC link

1 Introduction

The world is paying more and more attention to the high-speed railroad industry. Despite many disputes on intellectual properties, debt ratio, etc., high-speed railroad industry stands out due to its connection to increased national competitiveness through faster transportation of passengers and goods, construction of eco-friendly transportation infrastructure, and sustainable keynotes for green growth.

Also, entry to neutral point activates the chopper, burning energy through resistance. Switching the location of resistance and chopper solves many aspects, but it does not solve fundamental problems. As a result, this study solves fundamental problem of VTI by installing DC/DC converter that receives input of DC Link

¹ Please note that the LNCS Editorial assumes that all authors have used the western naming convention, with given names preceding surnames. This determines the structure of the names in the running heads and the author index.

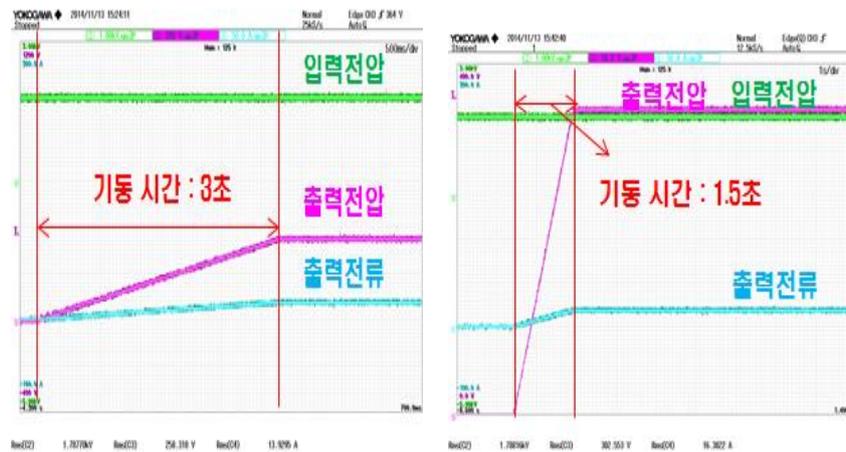
2800[V] and converts it into 670[V] when entry to neutral point occurs, enabling stable power supply.

2 Inverter Main Circuit

Ventilation inverter device is a DC/DC converter that uses IGBT(Insulated Gate Bipolar Transistor), the latest semiconductor device for power supply. This device stores history of malfunctioning and various data for convenience in maintenance, facilitating the work of repairer. Its composition makes it convenient for an engineer to repair the device, and it is separated into the main body of the converter and the output transformer. The DC/DC converter, which is loaded inside the main power conversion device, receives input of rating DC 2,850 [V] that is supplied at rheostatic brake on main power conversion device, and supplies power of DC 670 [V] to ventilation inverter.

3 DC/DC Converter Control

Figure 1 shows waveform of normal start test when start time is (a) 3 seconds and (b) 1.5 seconds at direct current input voltage of 1800[V]. Figure 2 shows output property test at load change after normal start. Also, Figure 3 shows waveform when starting 2 convertors simultaneously and applying load change. This shows that output voltage at load change is equivalent with single operation.



(a) Start time: 3 seconds (b) Start time: 1.5 seconds

Fig. 1. Waveform of normal start test at direct current input voltage of 1800[V]

Ground fault and ventilation fan/inverter malfunction are the major consistent malfunctions that occur in main power conversion device for high-speed railroad to this day. Their cause is that the circuits are supplied with input voltage (DC 670[V])

from brake resistor at dynamic braking as shown in figure 5. Therefore, stray voltage due to Turn On/Off motion of chopper IGBT is supplied.

(a) Start time: 3 seconds (b) Start time: 1.5 seconds

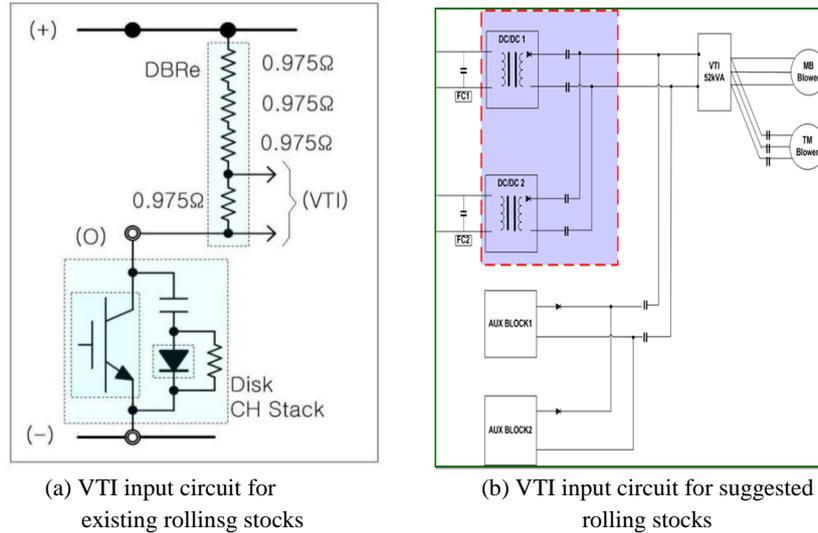


Fig. 2. Comparison of VTI input circuit for existing rolling stocks and suggested rolling stocks

3 Result

This paper suggested a method of ensuring stable power supply for the ventilation inverter (VTI) of high-speed rolling stocks by installing the DC/DC convertor.

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