Study of dynamic characteristic change by control method of electric generator

Hibiki Yamada[1], Akihiro Tsusaka[1], Takuya Goto[1], Kazuto Yukita[1] , Toshiya Nanahara[1]
[1]Aichi Institute of Technology,
v25729vv@aitech.ac.jp

Introduction

In recent years, renewable energy sources (renewable energy) have been introduced worldwide to achieve carbon neutrality. However, renewable energy has no inertia, and as the share of renewable energy in the grid power composition increases, the inertia of the grid will decrease. To address this issue, a method has been proposed to add inertia to renewable energy by connecting it to the grid via an electric generator. An electric generator is a device in which an electric motor and a generator are connected coaxially, as shown in Figure 1. This paper reports on an experimental investigation into differences in motor control methods for electric generators.

Experimental circuit

Figure 2 shows the experimental circuit used in this paper. The set of the Induction Motor and Synchronous Generator shown in the same figure constitutes an electric generator, which is operated by an inverter. An automatic voltage regulator (AVR) is installed on the generator. The motor is controlled by a governor (GOV). Figure 3 shows the AVR configuration diagram. In this paper, the block diagram in Figure 3 was constructed using MATLAB/Simulink and implemented using a DSP device.

Experimental Results

This study examined the operation of an inverter using V/F control and speed control. The model shown in Figure 2 was used to simulate a single-line open fault occurring on the transmission line between the motor-generator and the LOAD. Figure 4 shows the transmission line current when operated under V/F control, and Figure 5 shows the transmission line current when operated under speed control. Comparing the two figures reveals that under V/F control, the transmission line current increases after the fault occurs. However, under speed control, the transmission line current returns to its steady-state value.

Acknowledgement

This research was conducted using the facilities and equipment of the "Aichi Institute of Technology Eco-Electric Research Center". The authors would like to express their gratitude to all parties involved.

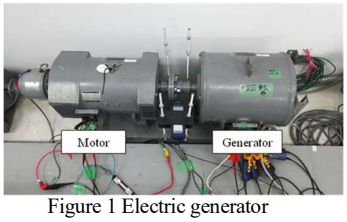

Figure 1 Electric generator

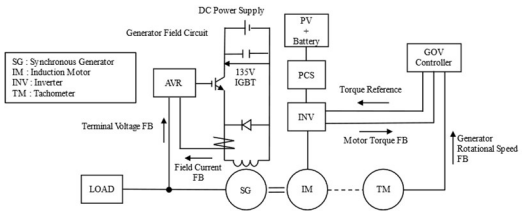

Figure 2 Model system

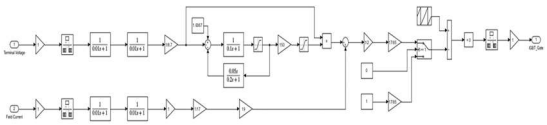
Figure 3 AVR block diagram

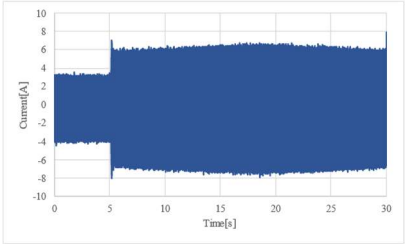

Figure 4 Current at V/F drive

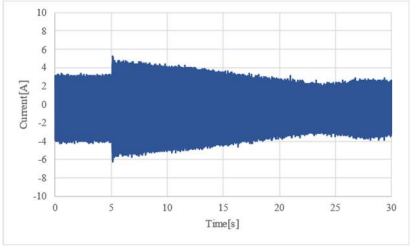

Figure 5 Current at speed control

References

[1] NEDO : ”STREAM Project”, 2022. https://www.nedo.go.jp/news/press/AA5_101550.html