

Basic Study of Motor Drive System with Mechanical Winding Changeover

Akeshi Takahashi¹⁾ Shinji Sugimoto¹⁾ Kazuo Nishihama¹⁾ Katsuhiro Hoshino²⁾ Noriyuki Maekawa²⁾
Takatoshi Kushida³⁾ Hirotatsu Otsuki³⁾

¹⁾ Hitachi, Ltd. Research & Development Group.

7-1-1, Omika-cho, Hitachi-shi 319-1292, Japan (email: akeshi.takahashi.hc@hitachi.com)

²⁾ Hitachi Astemo, Ltd. 2520 Takaba, Hitachinaka-shi 312-8503, Japan

³⁾ Hitachi Industrial Products, Ltd. 1-1-1 Shirogane-cho Hitachi-shi, 317-0056, Japan

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This report presents a mechanical winding-changeover system to reduce motor size and satisfies the wide-range rotation-torque (NT) characteristics required for heavy-duty trucks as shown in Fig. 1. The motor winding connections are changed during motor-drive operation: 1Y connection at low-speed and high-torque operation, whereas 2Y connection at high-speed and low-torque operation. To change the winding connections, we adopted multi contacts shown in Fig. 2 instead of conventional mechanical relays, which enabled to downsize the winding-changeover device.

FEA results showed that a 220 kW PM motor with the proposed winding-changeover system could satisfy the required NT curve with minimal motor-core-stuck length of 200 mm while the conventional motor could not satisfy it even with the length of 300 mm as shown in Figs 3 and 4.

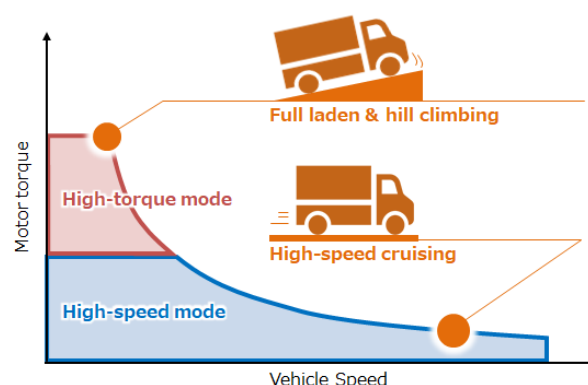


Fig. 1. Torque characteristics of heavy-duty trucks.

Switching method	(a) Mechanical (conventional)	(b) Mechanical (proposed)	(c) Electronic type
Cost	○ Cheap	○ Cheap	× Expensive
Size	× Large	○ Small	× Large
Lifetime	× Short	○ Long	○ Long

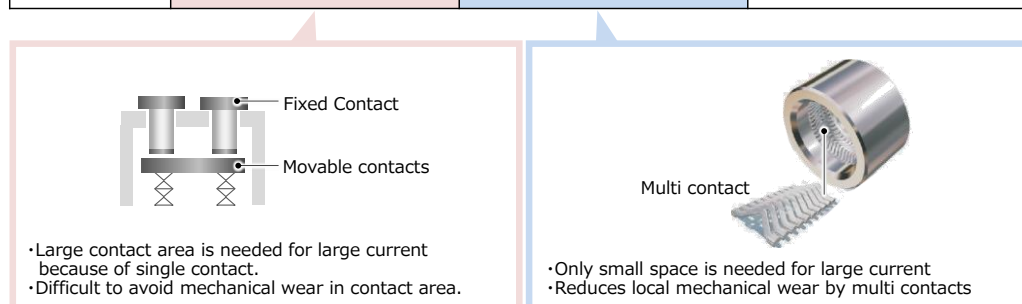


Fig. 2. Comparison of Overview of conventional and propose structures

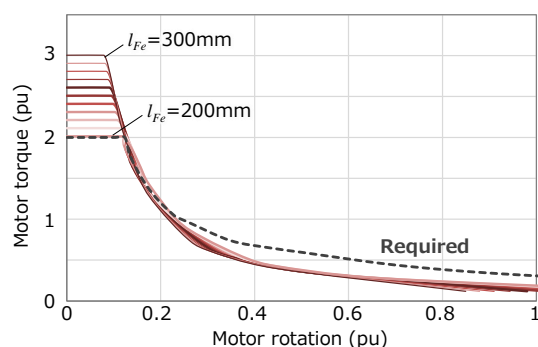


Fig. 3. FEA results of NT characteristics with conventional motors.

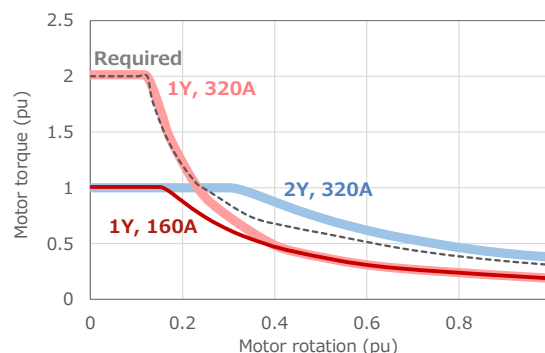


Fig. 4. FEA results of proposed motor with winding changeover (l_{Fe} : 200mm).