

Novel High-Efficiency Switched Reluctance Motor and its Control Method

We are looking to out-license the technology for its commercialization.

Novel structure of switched reluctance motor which realizes high efficiency and high power factor

◆Background

Permanent magnet motors(PMs) are widely employed in home appliances and electric cars, because of their high efficiency. On the other hand, PMs have disadvantages that rare earth materials in PMs are poor in production and costly, and that they are deteriorated by high temperature. Recently, switched reluctance motors (SRMs) not containing rare earth materials and having simple construction have been gathering attention, but SRMs also have problems of lower efficiency and lower power factor compared with PMs.

◆Summary and Advantages

The inventors developed a new SRM structure where rare-earth-free AlNiCo magnets are embedded (Fig. 1), and its control method which enables control of output and torque while the SRM is rotating. This helps SRM’s performance such as power factor and efficiency be optimized according to its application in wide motor operating range that requires various rotation speed or load torque.

❑ Rare-earth-free

As well as conventional SRMs, this new SRM does not contain rare earth such as neodymium, leading to low manufacturing cost.

❑ High efficiency and high power factor

Torque characteristics of the motor during rotation can be adjusted in accordance with the required load (Fig. 2), resulting in high efficiency and high power factor. This technology is applicable to various motors for various applications.

❑ Performance under high temperature

AlNiCo magnets are known for its high-temperature resistance, thus this new motor performs well even under high temperature ( $\leq 200^{\circ}\text{C}$ ) suitable for automobile applications.

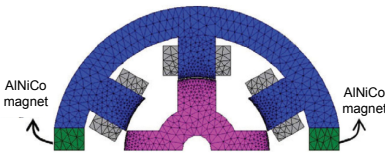


Fig. 1: Structure of the new SRM (upper half)

Table1. Comparison with prior art

|                           | PM          | Current SRM | This Invention |
|---------------------------|-------------|-------------|----------------|
| Rare Earth                | Yes         | No          | No             |
| Simplicity                | Complicated | Simple      | Simple         |
| Cost                      | High        | Low         | Low            |
| Power Factor & Efficiency | High        | Low         | High           |
| High temp. performance    | Low         | Fair        | Fair           |

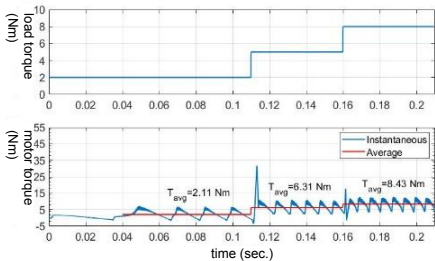


Fig.2: Motor torque and load torque (simulation result)

By following the newly established motor control method, increasing ratio of the motor torque became higher than that of the load torque. This shows that the motor efficiency has been improved by 10~20%.

◆Development Status

- Prototype SRM developed
- Efficiency\* of the new motor control method veri-fied in simulation
  - \* Adjusted torque characteristics even during motor rotation
- Seeking a partner to im-prove the output and opti-mize the SRMs according to their needs

◆Applications

- Home appliances
- Electric cars, hybrid cars

◆Offer

- License
- Option for License
- Collaborative Research

◆Contact

Yuka Tanaka  
Technology Transfer Team,  
Kyoto University Division  
TLO-KYOTO Co., Ltd.

Mail: licensing\_ku@tlo-kyoto.co.jp  
Phone: +81-75-753-9150

Level 4, International Science  
Innovation Bldg., Kyoto University,  
Yoshidahonmachi, Sakyo-ku,  
Kyoto  
606-8501, Japan

