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Electric Planetary Gear Motor

A new electric motor is designed with multiple rotors sharing a common stator and winding system and is cleverly combined with a planetary gearbox to achieve higher efficiency, higher power density, impressive material savings and a compact design.

BACKGROUND

Electric motors for industrial and automotive drives usually gain their high power density from high rotational speeds. In a separate gearbox, the speed is then reduced and the torque increased, adapted to the application. However, the increase in power density through higher speeds is limited by the strength properties of the rotor material. 100-200 m/s is typically the limit of economically viable peripheral rotor speeds.

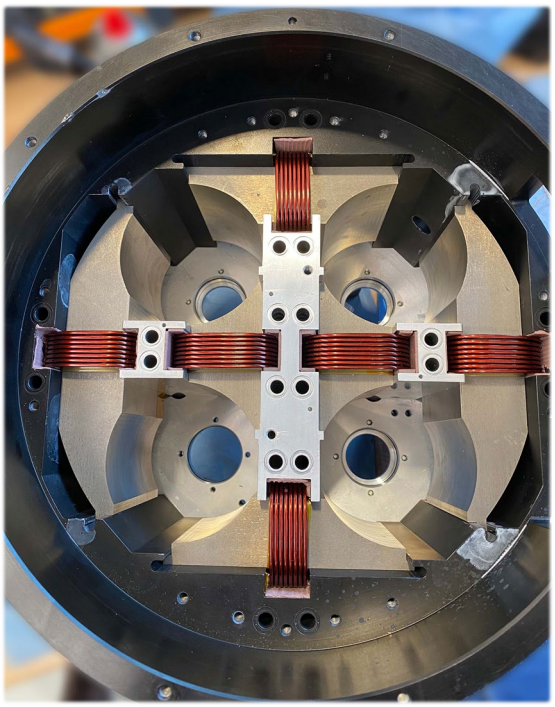
A classic electric machine has a stator and a rotor. Dividing this one rotor into several smaller rotors with the same total area and speed leads to the same power, but the rotors' peripheral velocity is now lower. This allows the speed and, thus, the power of multi-rotor machines to be increased even further before material limits are reached.

TECHNOLOGY

A variant of the newly developed gear motor contains four synchronous, pairwise counter-rotating rotors. Two co-rotating rotors power a large internally toothed ring gear, whereas the other two power a smaller externally toothed sun gear. This arrangement resembles a planetary gear with efficient power conversion. The result is an efficient, flat, and compact electric machine.

The skillful design of the common stator reduces the winding system by half, leading to significant savings in cost and material, especially copper and iron. The magnetization of the four rotors is preferably realized with permanent magnets. However, the design as a reluctance motor without rare earth metals is also possible.

In addition, the placement of the power electronics and the configuration of the coils are advantageous for automated production. Moreover, the planetary motor can be controlled without sensors using the INFORM® method, further reducing costs, volume, and assembly or maintenance errors.



ADVANTAGES

- high efficiency and power density
- compact design
- automation of production
- cost-effective due to material- and weight-reduction

REFERENCE:
M040/2019

APPLICATIONS:
Electromobility
Automotive technology
Aerospace
Construction industry
Manufacturing industry
Machine tools
Emergency units
Drum drives
Robotic drives

KEYWORDS:
Planetary motor
Power electronics
Electronic drives
Motor gear system
INFORM® method

DEVELOPMENT STATUS:
TRL 6, Prototype built

IPR:
Patents granted in EP, US, China and Korea

OPTIONS:
R&D - Cooperation
License Agreement

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