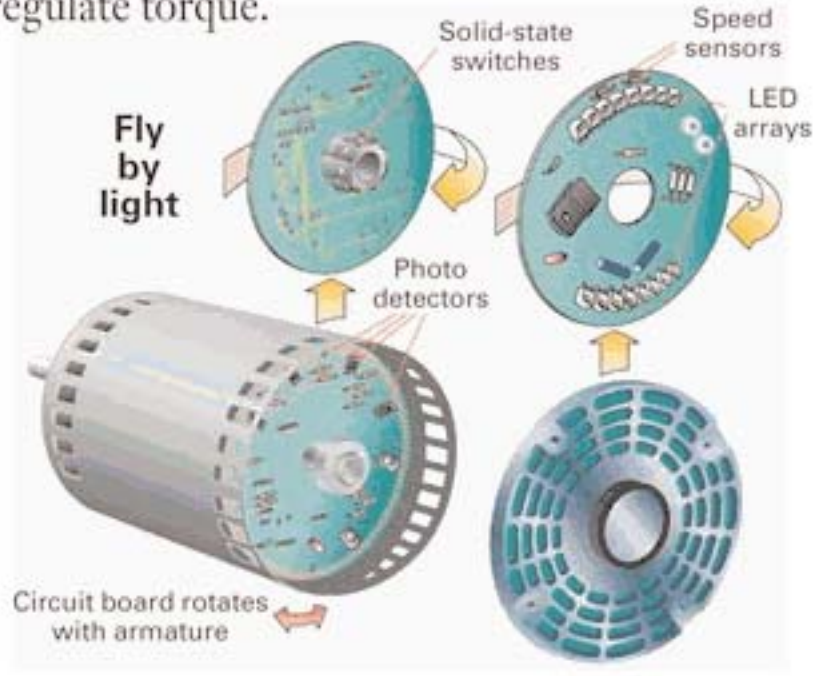
Lights, switches, action

New motor uses optical switches to control rotor flux and regulate torque.



The optical switching mechanism that controls motor torque is contained on two circuit boards, one of which mounts in the end-bell, the other, on the motor shaft. The stationary board incorporates LEDs that are strobed to activate photodetectors, which, in turn, actuate current switches on the rotating armature.

Electromagnetic motors have one thing in common: They're all driven by magnetic fields. How the fields are produced and how they couple the rotor and stator is limited only by the imagination of the designer, which is where the story begins for a novel motor developed by engineers at DynaMotors Inc., Cleveland, Ohio.

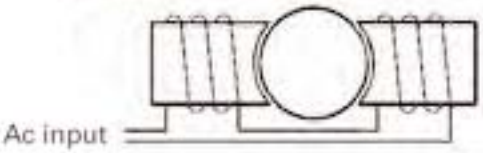
The new motor consists of a wound stator and a slotted armature (rotor) wrapped with multiple coils. Energizing the stator induces voltage in the armature coils that's subsequently employed to create a reactive magnetic field. How the induced voltage is converted to magnetic flux is what sets the motor apart.

Embedded in the armature coils are current-control switches. When actuated, the switches short the coils, creating a low-resistance path that allows the flux-producing current to flow. The resulting field repels that of the stator, thus generating torque.

According to the motor's developers, the switches are photoelectric devices that turn on and off in response to light. Light-emitting diodes (LEDs) incorporated in the motor's end-bell provide the actuation signals. By manipulating magnetic interactions, the optical switching technique controls torque right where it's produced.

One advantage of the new design

Wound like a dc motor

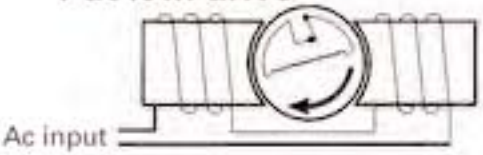


The new motor developed by DynaMotors Inc. runs on ac power, but is wired more like a dc motor found in many cordless tools. Each stator winding forms a pair of salient poles, connecting directly to the legs of a single or three-phase line.

Playing the slots

Slotted steel laminations stacked on a rotating shaft form an armature like those used in the new motor. Copper coils wound on opposite slots are electrically connected through a solid-state switch. In contrast, the coils in standard dc motors connect through copper bars over a path completed by carbon brushes.

Put it in drive



A stator field that varies with ac line current induces voltage in the armature coil. Closing the switch allows current to circulate in the armature, producing flux and hence torque. The longer the switch remains closed over a given angle of rotation, the faster the armature turns and the more torque it generates.

The commercial version of a new type of motor developed by DynaMotors Inc. is a self-contained variable-speed drive that produces high torque at low speeds. All control circuits are incorporated within the motor housing, meeting CE standards.

is that it's inherently noise-free. Even at high speeds, the armature fields switch at a relatively low frequency. This reduces line, EMI, and RFI noise by up to 99% compared to high-frequency PWM, the control method typically used in most adjustable-speed drives. It also eliminates the need for filters, isolation transformers, special cables, and grounding brushes, and extends the life of bearings and electrical insulation.

Another advantage is the amount of torque the motors produce at low speeds. Their speed-torque curves are, in fact, similar to those of dc or universal motors, characterized by high torque that increases with diminishing speed. In many cases, the motors can simplify, if not eliminate, mechanical drives. They can also run in torque mode, producing a set torque regardless of speed. **MSD**