Allied Motion

Motion Solutions That Change the Game

Patented DPFlex Drive: Sensorless, Brushless Motor Control Done Right

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Brushless motors have become the first choice for many motor applications because of their increased efficiency and reduced operating costs. But one aspect of a brushless motor that is sometimes less appealing is the need for controlling motor commutation.

Traditionally, commutation is initiated with the help of Hall sensors. In other cases where an encoder is available, the encoder is used for commutation. These sensors increase motor cost, and they sometimes prohibit the use of a brushless motor because Hall sensors typically cannot handle the same extreme temperatures the rest of the motor can.

A sensorless, brushless motor would be ideal; however, with traditional sensorless motor control, there is a significant challenge getting the motor started. Allied Motion's DPFlex Drive is a sensorless, brushless motor drive that starts brushless motors with ease.

Let's compare the DPFlex drive with some alternative design options:

Automated Control

While there are a large number of "canned" sensorless chips available for automated control, these application-specific integrated circuits (ASICs) are only adequate for simple applications that do not have severe loads on startup or when torque-to-inertia ratios are large. With larger system inertias, ASIC-based sensorless drives often start roughly or simply fail to start.

The vast majority of the ASICs try to solve this startup problem by applying current to the stator, getting the rotor to line up with the stator field, and then slowly increasing frequency. Once the speed is past a given threshold level, the sensorless commutation routine can be engaged.

These single-chip solutions are not applicable to higher power applications either. For higher power applications, you generally need to design and build your own amplifier stage and install a processor to control everything. And, the addition of a processor necessitates developing firmware code for the product.

Determining Zero-Speed Position

In general, ASIC-based motor controls can be divided into two main "camps". One method uses induced-voltage sensing technology, sometimes referred to as back EMF (back electromotive force, or BEMF) sensing to measure the induced voltage caused by the time-varying rotor magnetic field.

The other method is essentially observer-based. It predicts or observes the rotor position from phase current measurements (and perhaps others such as bus voltage) and estimates of circuit model values for the motor. Both schemes possess challenges at zero or low speed—the induced voltage signal is very small or zero, and low signal-to-noise ratio issues come into play.

Allied Motion's ***DPFlex drive*** is superior to these other design approaches because it uses saturation to determine rotor position at zero-speed. Alternative saliency-based methods for position detection exist but give erroneous results in many cases.

The DPFlex II reliably starts sensorless motors under load, and can drive suitable motors to speeds as high as 150,000 RPM.

The DPFlex system generates position estimates with greater resolution than just simple "Hall states," setting it apart from other methods. By knowing the rotor's position within a Hall state the DPFlex will start the motor reliably and robustly. The rotor will rotate in the desired direction and can accelerate to its full capability upon startup.

Measuring Rotor-Induced Voltage

Another shortcoming of many standard ASIC-based designs, especially those that use back EMF sensing, is that of rotor saliency induced BEMF voltage affects measured on the high impedance motor phase (the "off phase"). Because virtually all brushless motors exhibit saliency, this becomes yet another issue for ASIC-based drive designs. As a result, the measurements taken during the off state include a voltage contribution due to the di/dt (time rate of change of current) in the two active driving phases (the "on phases"). Other products that may seem comparable to the DPFlex measure signal samples at one point in a pulse-width modulation (PWM) switching cycle; taking them at only one point means the sign of the rate of change of the current would always be the same. This can produce false BEMF zero crossing information.

Allied Motion's DPFlex Drive has improved upon this standard feature by conditioning the analog signal measured during the off phase and by taking samples of di/dt in both directions. This bipolar approach results in a much better and more reliable measurement of the rotor-induced voltage, enabling a smooth and robust automated startup.

By incorporating fine-tuned sensorless motor startup, Allied Motion's patented DPFlex Drive provides the expected brushless motor benefits with the faultless startup that is desired. DPFlex is sensorless, brushless control done right.

Related Materials

>> Click here for brushless motor specifications >>

>> Choosing Between Brush and Brushless DC Motors — What are the Trade-Offs? >>

About Allied Motion Technologies Inc.

Allied Motion (NASDAQ: AMOT) designs, manufactures and sells precision and specialty motion control components and systems used in a broad range of industries within our major served markets, which include Vehicle, Medical, Aerospace & Defense, and Industrial/Electronics. The Company is headquartered in Amherst, NY, has global operations and sells into markets across the United States, Canada, South America, Europe and Asia.

Allied Motion is focused on motion control applications and is known worldwide for its expertise in electro-magnetic, mechanical and electronic motion technology. Its products include brush and brushless DC motors, brushless servo and torque motors, coreless DC motors, integrated brushless motor-drives, gear motors, gearing, modular digital servo drives, motion controllers, incremental and absolute optical encoders, and other associated motion control-related products.

Allied Motion Solution Centers

Allied Motion
Motion Solutions That Change the Game

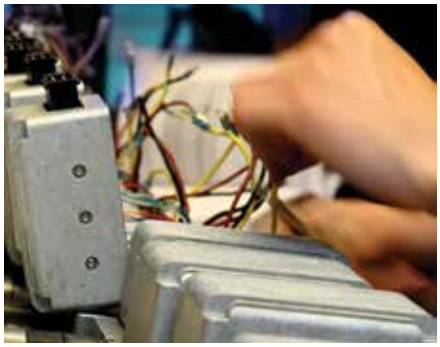
Allied Motion maintains Solution Centers in three geographically strategic locations to assist our customers with all aspects of their product selection and buying decisions. These three facilities assure you of local support no matter your location around the globe.

Each Solution Center is manned by experienced application engineering and customer service teams, which are available to provide:

- Application analysis assistance
- Detailed product information and documentation
- Standard product selection
- Product customization and options guidance
- Specification development assistance for custom-design products
- Price quotations
- Ordering, order status and shipment information
- Logistics assistance

For assistance with all of your motion applications, contact us at one of our continental Allied Motion Solution Centers.

Allied Motion also has a global network of factory trained selling partners to serve you. Call us; we'll put you in touch with an Allied Motion sales partner near you.



Allied Motion Solution Center NA

North America	+1 (716) 242-7535
Europe	+46 (8) 546 11 100
Asia	+852 2607 4038

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www.alliedmotion.com

Advanced Electric Traction & Steering Solutions

North America

Allied Motion's North America Solution Center assists our customers in the United States, Canada, and Mexico:

Allied Motion Technologies NASC
495 Commerce Drive
Amherst, NY 14228 USA

+1 (716) 242-7535
inquiry@alliedmotion.com

Europe

Allied Motion's Europe Solution Center assists our customers in the UK, Ireland, continental Europe, Eastern Europe, Scandinavia and Israel:

Allied Motion Technologies EUSC
Ekbacksvägen 26, PO Box 11198
S-161 11 Bromma, Sweden

+46 (8) 546 111 00
inquiry@alliedmotion.com

Asia

Allied Motion's Asia Solution Center assists our customers in China, Taiwan, Japan, S. Korea, and other Far East countries:

Allied Motion Technologies ASC
58 Leshan Road
Xinbei District, Changzhou 213022 China

+852 2607 4038 + 86 519 85113625
inquiry@alliedmotion.com