Research Internship / Master Thesis

GaN-based Motor Drive for Humanoid Robots

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Description

Humanoid robots incorporate multiple subsystems, including servo control systems, battery management systems (BMS), sensor systems, AI control, and more. Integrating these components within a human-sized form while ensuring smooth operation presents significant challenges, particularly in terms of size and heat dissipation. Among these subsystems, the servo control system is the most space-constrained. To achieve a human-like range of motion, humanoid robots typically use around 40 permanent magnet synchronous motors (PMSMs) and their corresponding control systems. These motors are distributed across various body parts, including the neck, torso, arms, legs, toes, and others.

Compared to traditional drive systems, those used in humanoid robots require higher control accuracy and must meet stricter size and heat dissipation constraints. For the same power output, Gallium Nitride (GaN)-based motor drive systems offer faster control, lower switching losses, and a more compact design, making them a promising solution to the challenges faced by humanoid robot drive systems.

Source: EPC Corporation

Tasks

- Get familiar with TI C2000 real-time microcontrollers;
- Implement field-oriented control (FOC) for a PMSM driven by a three-phase GaN inverter;
- Implement sensorless control for PMSM systems.

Prerequisites

- Great interest in power electronics and electrical drives;
- Good academic performance;
- Experience with C programming;
- Experience with MATLAB or PLECS;
- Knowledge in motor control, e.g., field-oriented control (FOC).

Contact and further information

- Please attach your CV and the latest study transcript to the application

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