



模块 12

简介：直流电机



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教学目标：

理解 直流电机的电磁和机械模型

接口 驱动直流电机电源所需的电路

扩展 PWM 软件提供电机的软件控制

测量 电机速度与占空比

需要预先学习的模块： 模块 2, 5 和 9

- 电压、电流和功率（模块 2）
- 电阻、电容（模块 2）
- 电池和电压调节（模块 5）
- SysTick 计时器（模块 9）

推荐阅读材料：

- Volume 1 Sections 8.1, 8.6, and 8.7
- **Embedded Systems: Introduction to the MSP432 Microcontroller, ISBN: 978-1512185676, Jonathan Valvano, copyright (c) 2017**
- Volume 2 Sections 1.4 and 6.5
- **Embedded Systems: Real-Time Interfacing to the MSP432 Microcontroller, ISBN: 978-1514676585, Jonathan Valvano, copyright (c) 2017**

该模块与下一个（模块 13）一起开发机器人，使其移动，参见图 1。在模块 9 中，您使用脉冲宽度调制来创建软件，使 LED 变暗。您现在将使用该 PWM 软件调整传送到机器人上的直流电机的功率。

本实验的重点是使用**两个 H 桥（two H-bridges）**的电机的机械和电气方面。这是转动电机的常见电路构造。您还将了解用于将两个直流电机连接到微控制器的电机驱动器 IC TI-DRV8838。模块 13 将专注于使用计时器来创建灵活高效的软件，以生成两个 PWM 输出，为您的直流电机供电。

在本实验中，您将用眼睛和秒表测量电机速度。但是，在模块 16 中，您将连接转速计，以便软件可以直接测量电机速度。然后，您将组合模块 12, 13, 16 和 17, 以创建一个**闭环控制系统（closed-loop control system）**，允许您设置每个电机的期望速度。

输送到电机的**电功率（power）**（P 瓦特）是电压（V 伏特），电流（I 安培）和占空比的乘积（作为无量纲分数 0 到 1 的占空比，在模块 9 中研究）。电机可以向前或向后转动，因为电压和电流具有方向或极性。

$$P = V * I * \text{Duty}$$

在这个机器人上，电压将固定在大约 7V，电流将取决于机械负载（摩擦）。但是，软件将设置占空比。电机将电能转换为机械功率。这种机械动力为车轮提供**扭矩（torque）**（扭矩=力*距离），使车轮转动并使机器人移动。



图 1. 在本实验中，您将**为机器人添加电机和轮子。**

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