



# 模块 2

简介：电压、电流和功率



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## 教学目标：

**回顾** 包含电阻、电容和电感的电路

**理解** 电压、电流和功率

**探索** 电阻、电容和 LED 的特性

**学习** 如何使用示波器

**测量** 电阻、电容和 LED 的电压和电流特性

## 需要预先学习的模块（模块 1）

- 使用 CCS 在 LaunchPad 上进行编程（模块 1）

## 推荐阅读材料：

- Volume 1 Section 1.1,  
**Embedded Systems: Introduction to the MSP432 Microcontroller**  
ISBN: 978-1512185676, Jonathan Valvano, copyright (c) 2017

或

- Volume 2 Sections 8.1, 8.3.1, and 9.1  
**Embedded Systems: Real-Time Interfacing to the MSP432 Microcontroller**, ISBN: 978-1514676585, Jonathan Valvano, copyright (c) 2017

本模块会介绍电子工程专业中设计的电路基础理论。在学习本模块之前，我们期望您已经掌握了电阻、电容和电感的基本特性。机器人系统中所用到的电路并不复杂，所以本课程中不会涉及到电路设计。然而，您需要理解电路中的电压、电流和功率。本模块中会给出电压、电流和功率的定义。本模块的实验中会介绍如何测量流过电阻、电容和 LED 的电压、电流和功率。

**电流 (I)** 是电子的移动。电流是具有一定方向的，它的大小由每秒流过某一点的电荷数量来衡量。电流具有大小和方向。因为电子带有负电荷，所以如果电子向左移动，则电流方向向右。

**电压 (V)** 是两点之间的电势差。电压的单位是伏特 (V)，它永远代表的是一个差值。这个电势差可以产生电流。

当一个导体中有电流流过时，另一个重要的参数是**功率**。一个导体中消耗的功率（单位瓦特）可以由电压 (V，单位伏特) 和电流 (I，单位安培) 的乘积来计算。有趣的是，尽管电压有极性 (+和-)，同时电流也有方向，但功率并没有极性或方向。电阻、电容、LED 以及电机均以不同的方式消耗功率。

电池中所储存的**能量 (E)**，单位焦耳) 可以通过电压 (V，单位伏特)、电流 (I，单位安培) 和时间来计算。能量也不存在极性 or 方向。

**示波器**是一种可以通过图形来显示电路中的信息的仪器，它显示的是电压与时间的关系波形。示波器可能有一个或者多个通道，并且有多种方式来触发或者捕捉波形。在研究机器人系统的传感器或执行机构时，示波器是一种及其有效的仪器。

**信号发生器**是一种可以产生随时间变化的电压信号的仪器。常用的波形包括方波、脉冲波形和正弦波。某些信号发生器允许用户设置波形的频率和电压幅度。

在本模块对应的实验环节中，您将使用电阻、电容和 LED 搭建一些简单电路。利用电压表和电流表，您可以研究电阻和 LED 的稳态响应，或称直流 (DC) 响应。通过这种方式，您可以观察到电压、电流和功率。利用信号发生器和示波器，您可以研究电阻和电容的暂态响应，或称交流 (AC) 响应。

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