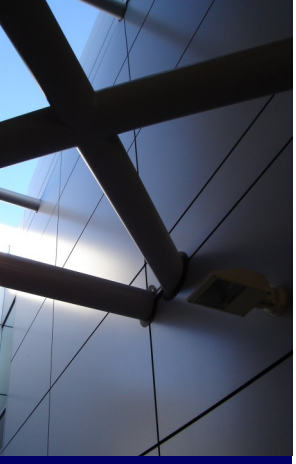

MECHANICAL ENGINEERING
THESIS DEFENSE

*The Department of Mechanical Engineering presents:*

# *The Master's Thesis Defense of*

# Sandeep Sebastian

## Tuesday, April 2, 2019,
## 3-5PM in Bourns Hall A265

Master of Science, Graduate Program in Mechanical Engineering
University of California, Riverside, April 2019
Dr. Cengiz Ozkan, Chairperson

**Title: Adaptive fast charging algorithm to extend the cycle life of commercial lithium-ion batteries**

**Abstract:** Fast charging methods have been widely adopted for many applications, especially in electric vehicles to make them competitive with combustion engine vehicles. However, the lack of understanding about the degradation effects occurring with existing fast charging approaches has led to a large amount of safety and capacity issues. It is thus of paramount importance that electric vehicle and portable device manufactures quantify the effect of fast charging on thermal stability, usable capacity and cycle life of the battery. In this study, a novel fast charging technique has been proposed by analyzing the internal resistance of the battery and a charging current was applied accordingly. Compared with the existing industrial fast charging approach, the battery cycled with the internal resistance (IR) based fast charging lasted an average of 11 cycles longer. Meanwhile, the battery cycled under the industry based fast charging showed higher internal resistance over 120 cycles, whereas the battery cycled under the IR based fast charging showed a lower increase. Besides, the temperature of the battery cycled under the IR based fast charging was not significantly higher ($\pm$ 2$^{o}$ C), hence similar thermal solutions could be used for battery packs cycled under the IR based charging. As a result, the proposed novel fast charging technique has shown great potential to be used as an adaptive fast charging algorithm.