

ECE5730

PHYSICS-BASED BATTERY MANAGEMENT SYSTEMS ALGORITHMS

Fall 2026

Considers battery-management-system algorithms using physics-based models of Li-ion cells. Develops lumped-parameter and impedance models, system-ID techniques, time-based simulations. Application to state and health estimation, fast charge, power-limits calculations. Prer., ECE5710, ECE5720.

Instructor: Dr. Gregory Plett **Office:** EN-224 **Phone:** 255-3468 **email:** gplett@uccs.edu

Office Hours: By appointment.

Text: Plett, G.L. and Trimboli, M.S., *Battery Management Systems: Volume III, Physics-Based Battery Management*, Artech House, 2024.

Software: ECE5730 will utilize MATLAB for computational investigations and data analysis. COM-SOL may also be used, and is available via virtual machine.

Evaluation: Seven graded homework assignments/mini-projects;
 Unequal weighting (based on individual requirements), 100% total.

Grading: 90–100= A^- to A ; 80–89= B^- to B^+ ; 70–79= C^- to C^+ ;
 60–69= D^- to D^+ ; 0–59= F .

Topics	Est. Weeks
1. Redundant parameter elimination.	1.0
2. Modeling electrochemical impedance.	2.0
3. Model parameter estimation.	3.0
4. Efficient time-domain simulation.	2.0
5. Electrochemical internal variables estimation.	2.0
6. Diagnostics and prognostics of degradation.	2.0
7. Optimal fast charge.	2.0
8. Computing dynamic power limits.	1.0

Work Load: This is an aggressive course requiring weekly homework assignments. Expect to spend six to nine hours per week outside of class reading the textbook and completing homework assignments. This is in accord with UCCS policy relating credit hours for a lecture course to student workload. Some students will find that more time is required, while others will find that less time is required.

Homework Policy #1: Homework will be collected at the beginning of class on the assigned date. Homework turned in after the class period will be penalized 10%. Homework turned in after the due date will be penalized an additional 25% per day unless previous arrangements have been made with the instructor. Examinations will be based on the homework problems and the material covered in class. It is to your advantage to understand the fundamental concepts that are demonstrated in the homework problems. It will be difficult to earn higher than a "C" without performing well on the homework assignments.

Homework Policy #2: Your homework is expected to be a bona-fide individual effort. Copying homework from another student or other source is CHEATING and will not be tolerated. You may (and are encouraged to) discuss homework problems with other students, but only to the extent that you would discuss them with the instructor. Don't ask another student a question that you would not expect the instructor to answer. Most of us know when we are compromising our integrity. If you are in doubt, ask first.

Homework Policy #3: Part of your engineering education involves learning how to communicate technical information to others. Basic standards of neatness and clarity are essential to this process of communication. Your process of solving a problem must be presented in a logical sequence. Consider your assignments to represent your performance as an engineer. Do not submit scrap paper, and do not submit paper containing scratched out notes. Graphs are to be titled and axes are to be labeled (with correct units). The above standards of clarity and neatness also apply to your work on exams.

Attendance: Attendance is your responsibility. Class lectures will cover a significant amount of material. Some will not be in the text or may be explained differently. It is to your advantage to take notes, ask questions, and to fully participate in the classroom experience.

Missed Exams: Missed exams will count as ZERO without a physician's documentation of an illness, or other appropriate documentation of an emergency beyond your control and requiring your absence.

Drop Date: This course complies with the UCCS campus rules for drop date.

Disability Services: If you are a student with a disability and believe you will need accommodations for this class, it is your responsibility to register with Disability Services and provide them with documentation of your disability. They will work with you to determine what accommodations are appropriate for your situation. To avoid any delay, you should contact Disability Services as soon as possible. Please note that accommodations are not retroactive and disability accommodations cannot be provided until a Faculty Accommodation Letter has been given to me. Please contact Disability Services for more information about receiving accommodations at Main Hall room 105, 719-255-3354 or dservice@uccs.edu.

Military Students: If you are a military student with the potential of being called to military service or training during the course of the semester, you are encouraged to contact your UCCS course instructor no later than the first week of class to discuss the class attendance policy. Please see the Veteran and Military Affairs website for more information.

Student Wellbeing: As a college student, there may be times when stressors interfere with your academic performance or negatively impact your daily life. If you or someone you know is experiencing mental health challenges at UCCS, please contact the Wellness Center about their confidential services. The Wellness Center is located inside the Gallogly Recreation and Wellness Center. Phone 719-255-4444. Hours: Monday – Friday 8 a.m. – 5 p.m.

Other resources include:

- National Suicide Prevention Lifeline at 800-273-8255 or text HELLO to 741741
- Colorado Crisis Services at 844-493-8255, or text TALK to 38255
- For emergencies contact UCCS Public Safety at 719-255-3111 or call 988 or 911

Responsible Reporting: Institutional Equity / Title IX Statement: The Office of Institutional Equity (OIE), administers the University of Colorado (CU) Sexual Misconduct policy (including Title IX), the UCCS Discrimination and Harassment Policy, and the CU Conflict of Interest in Cases of Amorous Relationships Policy. All UCCS faculty and staff, including student employees, are considered “responsible employees” and must report any suspected or known conduct that may be in violation of these policies (“prohibited conduct”) directly to the OIE. This reporting requirement exists to support the safety of our campus community, and there is no statute of limitations. Prohibited conduct includes unwanted verbal or physical conduct that is sexual in nature, or based on a protected class (such as, gender, race, veteran status, disability, etc.). You may review the Applicable Policies and OIE’s Resolution Procedures at <https://equity.uccs.edu>. While reporting prohibited conduct to the OIE is required by UCCS employees, participation in an OIE resolution process though the OIE is voluntary. Confidential reporting, and access to medical and mental health services, are available to students through the UCCS Wellness Center at 719-255-4444.