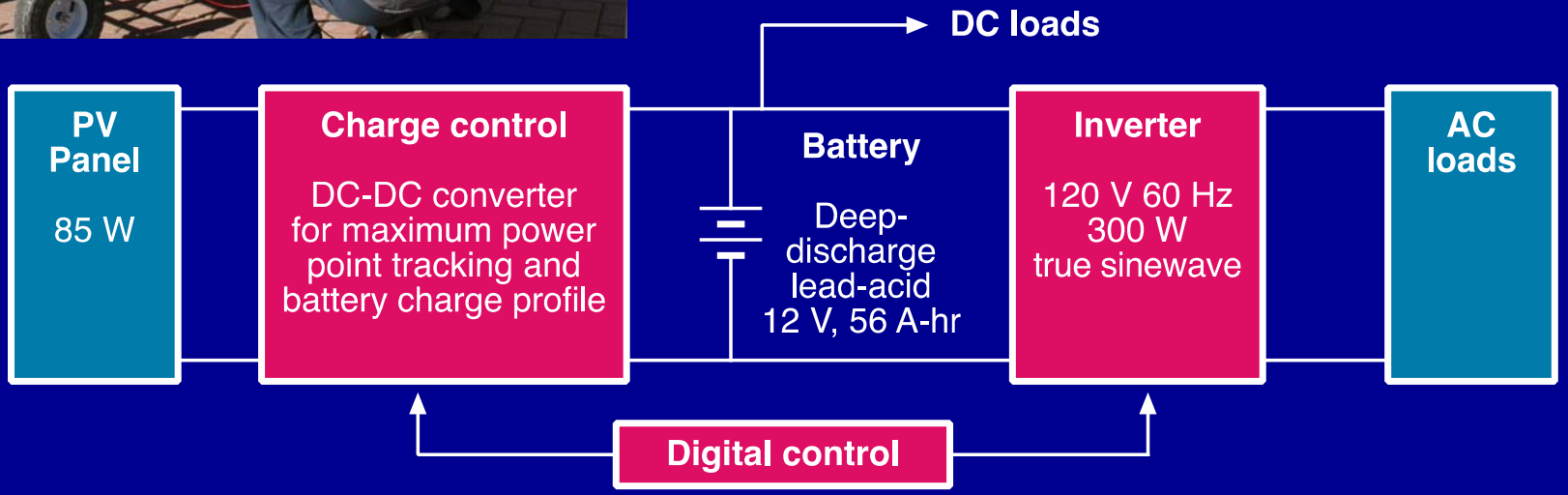
ECEN 4517
ECEN 5517

POWER ELECTRONICS AND PHOTOVOLTAIC POWER SYSTEM LABORATORY

http://ece.colorado.edu/~ecen4517

- Photovoltaic power systems
- Power conversion and control electronics

Prerequisite: ECEN 4797 or ECEN 5797



Spring 2014 Instructors

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Office hours (in addition to lab): Monday 3-4pm

Daniel Seltzer, seltzer@colorado.edu

TA's:

Jie Lv (Tue), Jie.Lv@colorado.edu

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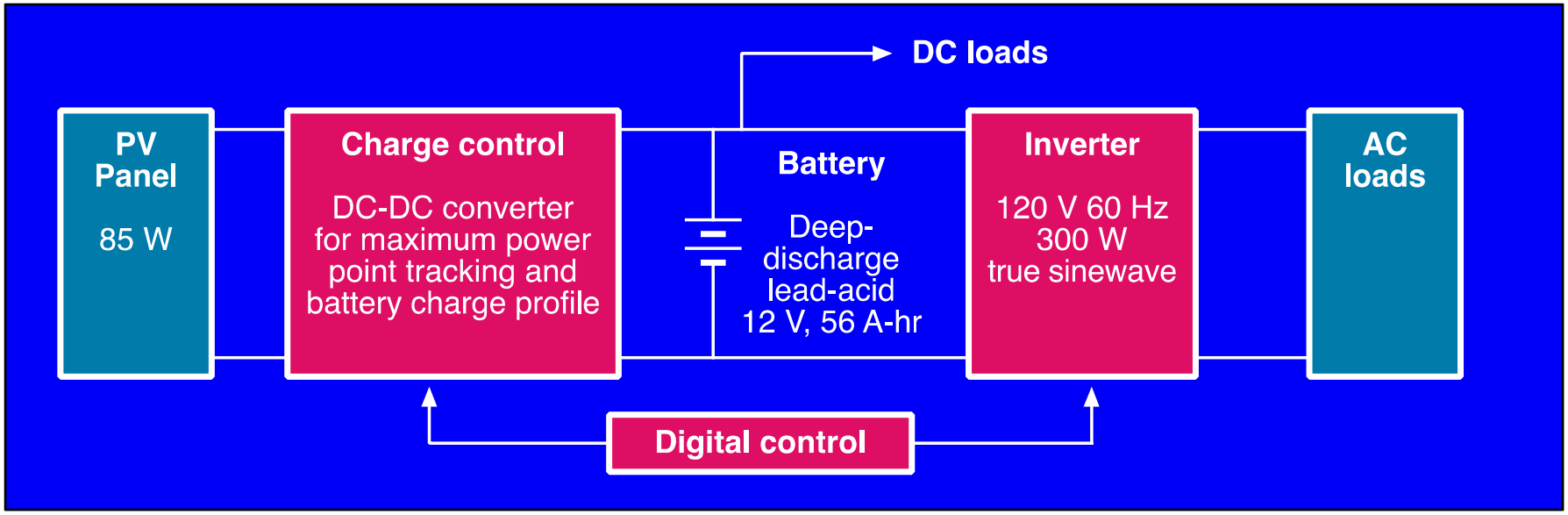
Fan Zhang, Fan.Zhang@colorado.edu

Spring 2014 Lab Sections

- 5517-011: Tuesday 12-3:50pm
- 4517-011: Wednesday 12-3:50pm
- 4517-012: cancelled, move to Tuesday or Wednesday

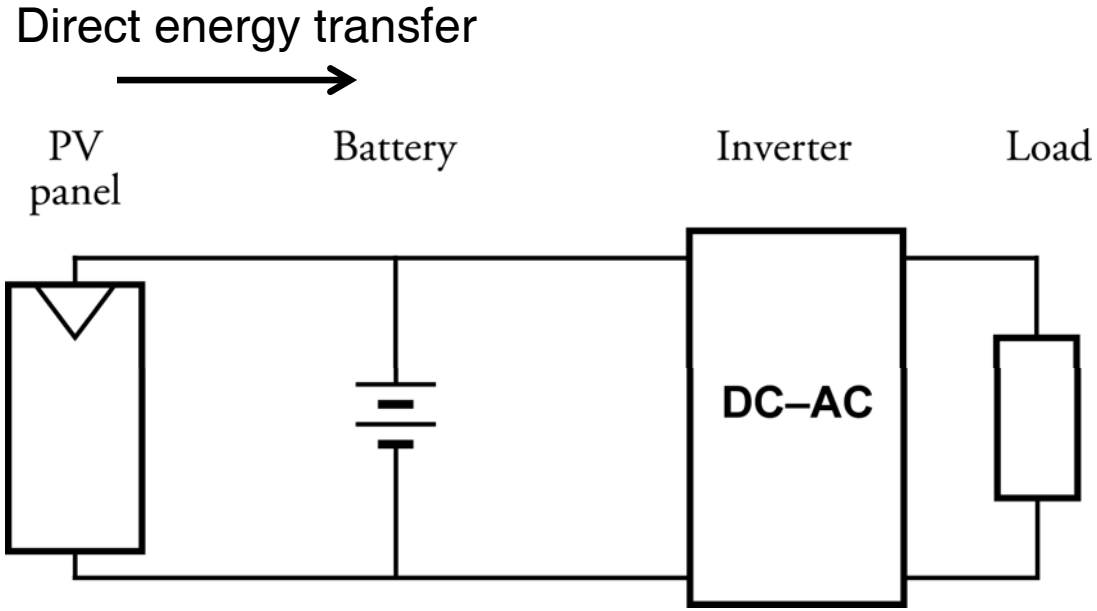
Experiments



1. Introduction to PV systems, battery characteristics, direct energy transfer
2. Introduction to TI MSP430 microcontroller
3. Buck DC-DC converter for maximum power point tracking (MPPT) and battery charge control
4. Step-up 12-200V DC-DC converter
5. Single-phase DC-AC inverter

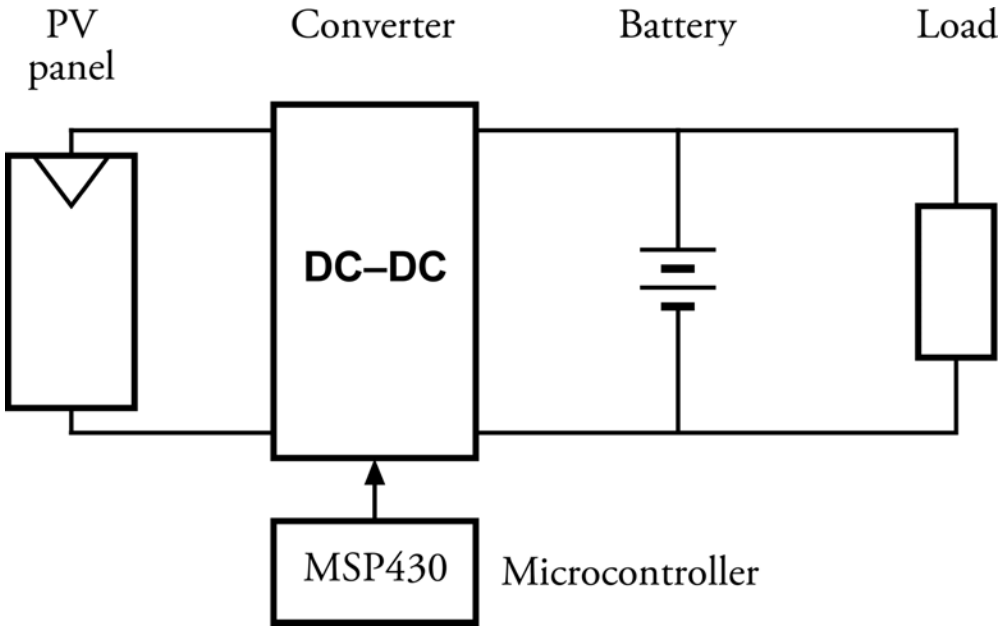
   Expo: complete system demonstration

Experiment 1
Introduction to PV systems



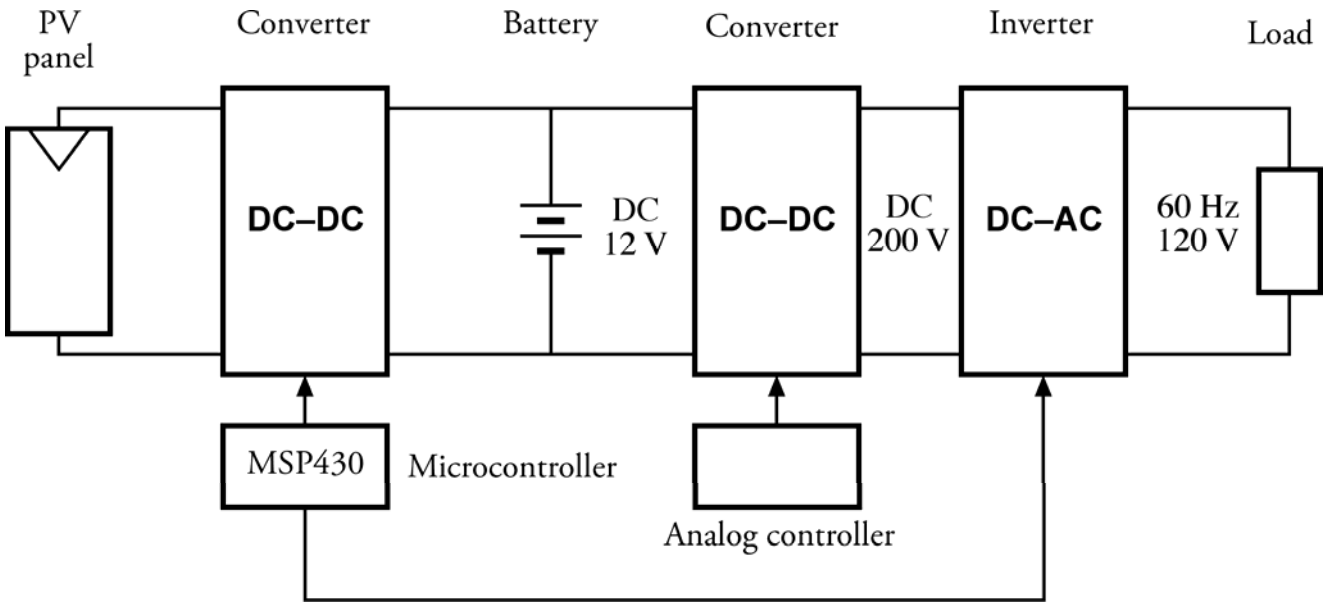
- Model PV panel
- Investigate direct energy transfer system behavior
- Investigate effects of shading
- Observe behavior of lead-acid battery

Experiments 2 and 3
Maximum Power Point Tracking



- Design and construct dc-dc converter
- Employ microcontroller to achieve maximum power point tracking (MPPT) and battery charge control

Experiments 4 and 5
Add Inverter to System



- Build your own inverter system to drive AC loads from your battery
- Step up the battery voltage to 200 VDC as needed by inverter
- Regulate the 200 VDC with an analog feedback loop
- Change the 200 VDC into 120 VAC

ECEE Expo: ECEN4517/5517 Lab Competition

- Operate your complete system
- Competition during ECEE Expo: capture the most energy with your system outside

Previous year's competition poster

Lab Format

Two-person groups, up to 10 groups per section

This week: lab organizational meetings

Parts kits:

- One kit needed per group
- Contains power and control electronic parts needed for experiments
- Available from E Store; cost: around $160
- You will also need other small resistors etc. from undergraduate circuits kit

Lab: room ECEE 1B65

- Access via CUID card reader
- Computer login via CU Identikey
- You may optionally store your parts in your own locked drawer in your lab bench. Lock and key deposit for the semester at E Store.

Lab Work and Grading

Your course grade will be based on the following:

- Prelab assignments (group)
- Lab final reports (group)
- Quizzes: online and in-class (individual)
- Expo (group)
- Attendance and lab performance (individual)

Weightings for assignments are listed in the course D2L site

Late work will not be accepted

Course D2L site

- Lab modules: slides, videos, on-line quizzes
- Upload of prelabs and reports to appropriate D2L dropbox folders
- All due dates and all grading

Lab reports

- One report per group. Include names of every group member on first page of report.
- Report all data from every step of procedure and calculations. Adequately document each step.
- Discuss every step of procedure and calculations
  - It is your job to convince the grader that you understand what is going on with every step
  - Interpret the data
  - Clearly annotate waveforms and circuit diagrams, include figure captions
  - Concise is good
  - Regurgitating the data, with no discussion or interpretation, will not yield very many points
  - Messy work will not receive credit

Upcoming assignments

This week: brief lab orientation meeting in the lab

Experiment 1: Intro to PV Systems, direct energy transfer

- View Exp 1 modules and do online quizzes on D2L by 12pm Jan 21
- Do Exp. 1 in the lab next week, Jan. 21-22
- Exp. 1 report due in D2L dropbox by 6:00 pm on Friday Jan. 31.

Experiment 2: Intro to MSP430 microcontroller

- View Exp 2 modules and do online quizzes on D2L by 2pm Jan 27
- Do Exp. 2 in the lab during week of Jan. 28-29
- Exp. 2 report uploaded to D2L dropbox by 6:00 pm Friday on Feb. 7

Experiment 3: Buck MPPT converter … etc. see schedule on D2L and the course website

Experiment 1: Intro to PV Systems

Characterize the SQ-85 PV panels, and find numerical values of electric circuit model parameters for use now and later in the semester

Examine effects of shading

Observe operation of lead-acid battery

Test the inverter provided

Charge the battery from the panel, using the Direct Energy Transfer method

Work to be done:

- View Exp 1 modules and do on-line quizzes on D2L by 12pm Tuesday, Jan.21
- Experiment 1 to be performed next week (Jan.21-22): hope for sun!
- Final report for Exp. 1 due in D2L dropbox by 6pm on Friday, Jan 30

In case of bad weather (<250W/m2 irradiance): Exp 1 Lab page on the course website provides instructions on how to proceed

ECEN4517/5517 PV Cart