Engineering Problem Solving

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Author Information

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Course Details

Description

There are three goals for this curriculum:
- Sustainability focused lab exercises
- Hands-on experience
- Project-based learning

Students who enrolled in the course will learn MATLAB through solving sustainable/renewable engineering related problems. Students will also gain hands-on experience working with hardware (developed based on Arduino UNO) to gather sunlight data. The course emphasizes topics in solar cell technology, but other topics such as green building design and electric vehicles are also briefly covered.

This course targets lower division undergraduate students (however, some senior students also enroll) in all engineering and scientific disciplines. The pre-requisite for the course is only differential and integral calculus. No computer science (programming) courses are required.

Important: Although students are introduced to various topics in sustainable engineering, the goal of the course is to teach engineering problem solving (and how to use MATLAB to model and solve engineering problems) and not sustainable engineering.

Original Course Documents

Source file URL

Course Contents

Lectures

- Sustainable Engineering Lecture
- Introductory Slides on MATLAB I/O

Lab 1

- One Dimensional Vectors Lab
- Solutions

- Accompanying Files
  - data.xlsx

Lab 2

- Two Dimensional Vectors Lab
- Solutions
- Accompanying Files:
  - afv.mat
  - afv.xls
  - Davis_Weather_7012010_6302011.csv
  - hev.mat
  - hev.xls
  - SAC_AP_2005_solar.csv
  - work.mat
  - work.xls

Lab 3

- Logical Operations, Flow Control, and Loops Lab
- Solutions
- Accompanying Files:
  - illum.mat
  - mppt_load.xlsx
  - myload.xlsx
  - panel_mpp.m
  - pd_mpp.asv
  - pd_mpp.m
  - Q8_soln.m

Lab 4

- Custom Functions Lab
- Solutions
- Accompanying Files:
  - q5.mat
  - lab6.mat
  - myadd.m
  - myNewton.m
  - solar_panel_optimal.asv
  - solar_panel_optimal.m
  - solar_panel.m

Projects

Project 1

- Project 1 from Winter 2012 -- Not open ended. Specific tasks for students to complete. This version does not use all data from the weather database below).

- Sample Solution
  - Accompanying Files:
    - weather.mat or weather.xlsx (contains solar, wind, precipitation, land area, and population data for 54 cities)
    - PartUSA.tif

Project 2

- Project 2 from Winter 2012 -- Five open ended topics. Topics 1 - 3 are renewable energy related, 4 and 5 are not.
- Project 2 from Summer 2011
  - Accompanying Files:
    - StatesInfoMatFile.mat
    - CitiesMatFile.mat

Solar Module

- Solar Module documentation web page
- Solar Panel Characterization web page
- Solar Cell Characterization Lab Description
- Accompanying Files:
  - HW7.pdf
  - ard_sweep.m
  - arduino.m
  - SAMPLE_sweep.m
  - load_sweep.xls
  - PV_data_7days.xls
  - Lab7_solution
  - Solar_Cell_Char_soln

Resources

- American Society for Engineering Education (ASEE) Lecture
- ASEE Paper
- Poster

Links

- About the course
- People
- Future Work
- Acknowledgements

- [MATLAB Courseware](#)
- [Hardware Resources](#)
- [Classroom Resources](#)
- [MATLAB Examples](#)
- [Books](#)
- [Tutorials](#)
- [Webinars](#)
- [Technical Articles](#)