Welcome to BIOE 504

Michael Insana 8/2020
Department of Bioengineering
mfi@Illinois.edu

Objectives

- Develop/reinforce skills needed for graduate-level engineering research and development
- Skills: mathematics, statistics, computation, communication…
- … in the context of measurements and data science in biomedicine

Topics

- Review of linear algebra and Matlab (these topics are not formally covered in notes but are important)
- Linear measurement equation $\mathbf{g} = \mathcal{H}\mathbf{f} + \mathbf{e}$
- Basis decomposition: Fourier, eigen, SVD, Laplace
- Statistical decision making for experimental design
- Statistical pattern recognition (flow cytometry eg.)
- ODE models of biological systems and sensors
- Not reviewing statistical methods (505). Chapter 2 and 3 of the notes describe statistical methods.

Learning Objectives

- Model biomedical experiments
- Find information within a data set
- Describe data in “frequency space” as well as you can in space & time
- Minimize anxiety over use of engineering skills
- Learning via repetition: seeing things many times, in different ways. (Seminar mode, comfortable with partial knowledge that builds slowly).

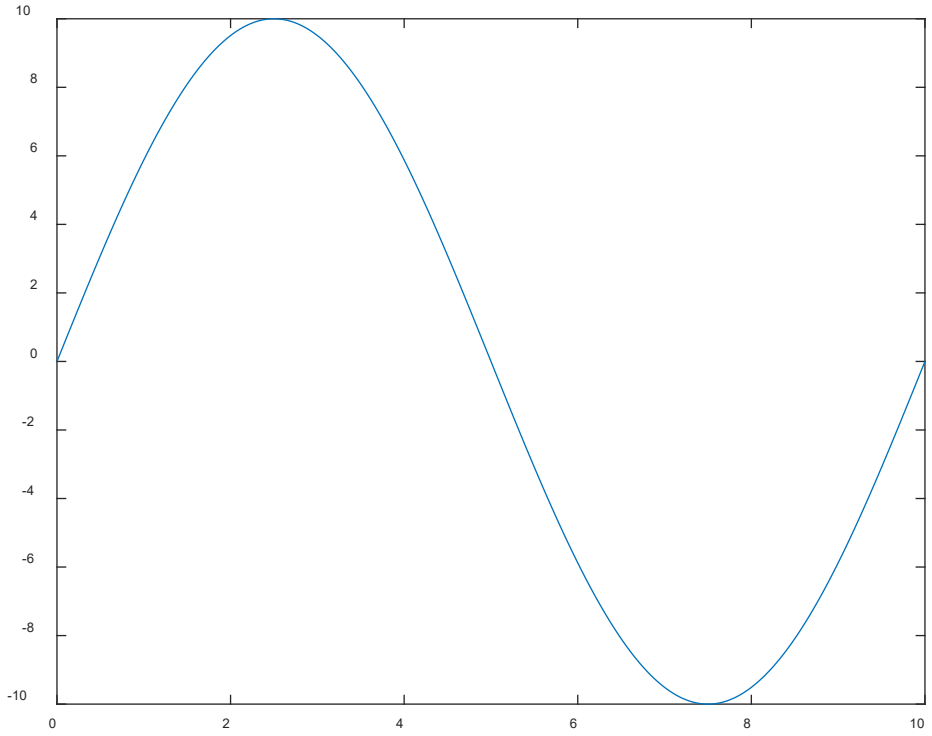
Assessment

- 67% weekly homework: modeling and evaluating
- Form 2-3 person teams to work together and complete HW assignments. This is where you will learn. Gaps in schedule to adjust pace.
- Collaboration requires effective communication
- 33% take-home final exam (like HW but solo)
- Use resources but do so fairly: cite sources
- Course is challenging depending on background but I will work with you to make it manageable

Expectations

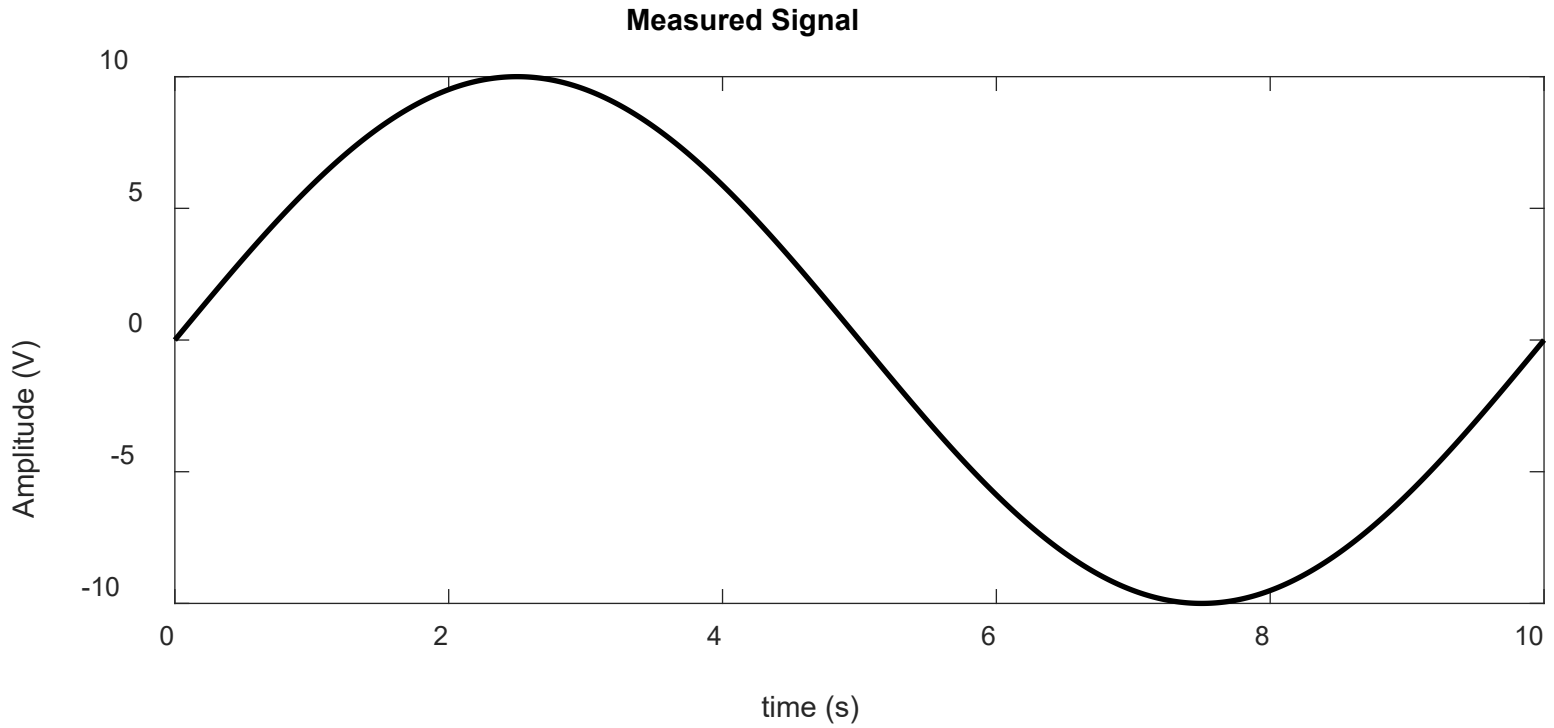
- HW problems are where learning takes place, not just for assessment. HW reviews as time permits.
- You must take the lead in active learning: work in a team and ask for help when needed.
- You must read sections assigned. Lectures augment reading and aid with HW assignments.
- Take pride in how data are presented in HW solutions. Learn to tell stories with data and analysis.

The default setting on plots…




```
t=0:0.01:10;
x=10*sin(2*pi*0.1*t);
plot(t,x)
```

…needs improvement.




```
t=0:0.01:10; A=10; f=0.1;                          % initialize parameters
x=A*sin(2*pi*f*t);                                 % create x(t)
plot(t,x,'k','linewidth',2)                        % visualize result
xlabel('time (s)');ylabel('Amplitude (V)');        % label axes with units
title('Measured Signal')                           % title when appropriate
```

Resources: VPN and Matlab

1. https://webstore.illinois.edu/home/ Webstore !
2. Access the VPN (virtual private network) at the webstore via (it's free): https://webstore.illinois.edu/Shop/product.aspx?zpid=2600

   You can also obtain a VPN through the AppStore for iPads and other Apple products.
3. You may use Engineering IT's Citrix Workspace to access Matlab at this site:

https://it.engineering.illinois.edu/services/instructional-services/remote-connections-citrix/remote-connections-citrix-sld

At the bottom of the page, you'll find this link for connecting to Citrix:

https://it.engineering.illinois.edu/ews/lab-information/remote-connections/connecting-citrix

You need to connect to the campus VPN. Try it & let me know if you have difficulties.

4. Purchase Matlab at Webstore. Consider using LaTeX (free! but will take effort)

Textbook

- Notes with HW problems available at the Illini Union Bookstore, 809 S. Wright Street, C.
- Purchase online. Also see lower level, look for a tag on the shelf. IUB phone: 217.244.3730
- $32.75 paper only. ($31.50??)
- “Write with a pencil”…lectures will commence by annotating the notes. Reading notes is important to prepare for lectures.

Do Now

- Obtain software and establish website connections.
- Obtain notes and review Appendix A. Nine linear algebra problems are due on GradeScope September 2.
- Examine Matlab Intro on C2G. Complete lab assignment due September 9. Email your lab report to me directly.