Lecture 1

Monday, January 8, 2018 9:35 AM

Reasoning, justification to humans

Read syllabus

ABE 301 Reflection/Feedback

"Chance favors only the prepared mind."
- L. Pasteur, 1854

Overall

- Understanding importance of reasoning/justification in model development/human interaction
  - Recognizing benefits/limitations of language/science/mathematics
- Understanding of how to use/incorporate your knowledge (prior studies) to develop models in food/molecular biological/pharmaceutical engineering.
- Understanding modeling process (assumptions/iterations to improve)
- Comprehension of impact of modeling in development of biological engineering discipline.

What is the main purpose of engineering/engineers?

What:
Create new technology to solve problems?
Develop processes to make products more efficiently?
Conduct research to solve scientific questions?
Be a problem solver?
Make money for a company?

WHY:
To serve other people using their skills/knowledge and be compensated
(same as anyone in a community)

Recognize what the world wants from you

- In a survey of 800 executives, 78% stated that a person's background is actually a poor indicator of future success. 87% believe that personal traits explain the difference in performance between good and great.
- On top of the list comes personal drive and ambition. Climbing to the top means hard work and long hours; e.g., from age 5-13, Bill Gates spent 10,000 hours programming (avg. of 3.5 hrs/day, 365 days/year)
- Communication skills are high up on the list of requirements. Convincing others to follow your goals/ideas is difficult. Not all future CEOs possess natural talent. So for some of them it comes back to the hard work of analyzing situations, synthesizing action models and convincing others.

Recognize the world is changing

- In the 20th century, automation replaced skilled human craftsmen, resulting in significant social/economic upheaval. Machines, and later robots, replace human labor in manual assembly and transportation.
- Today, advances in computational artificial intelligence of data analysis/analytics in medical diagnostics has demonstrated that is it can effectively replace human physician diagnoses.
- Engineering design is very highly rule-based and structured. As the cost of artificial intelligence systems decline, it is possible that engineering design/analysis may replace human engineers (faster, cheaper, more thorough).
- What is the value of human engineers in this scenario? What skills will human engineers have that artificial intelligence computers do not?

How to be successful

- Be prepared
  - Know the things you are supposed to know (if not, learn them now!)
- Learn not be afraid to ask/be asked questions
  - "The best coaches are the ones that make you run wind sprints"
  - Acquire the skills to ask and respond/learn to think on your feet
- Think about the learning methods you have used before and change them if they are not working
  - "Insanity: doing the same thing over and over again and expecting different results." – Albert Einstein
- Teaching others may be the best way for you to learn.
  - Peer education may work well for you

Learn how to evaluate Why, in addition to What and How.

Future classes

- Build relationships
  - Please stop by instructor office to introduce yourself and develop a relationship before you need something (will help with future recommendations, job searches, etc.)
- Read the syllabus and schedule
- Do not be afraid to ask questions!

Final thoughts/suggestions

(Useful things I hope you have gained from this class)

How to do well in life/future classes/work

"Be prepared and be honest. "
"If you don't have time to do it right, when will you have time to do it over? "
– John Wooden, former UCLA basketball coach

"Preparation is the key to victory in any game that you play. The will to prepare to win is far more important than the will to win." – Bob Knight, former IU basketball coach

"Insanity: doing the same thing over and over again and expecting different results." – Albert Einstein

Modeling

The purpose of modeling is to provide you with tools to be a more effective engineer. This includes both communication and computations.

Critical argument – a form of reasoning used to analyze/create communications to persuade changes in actions/behavior

Numerical model – a form of reasoning used to analyze/create a mathematical approximation of the behavior/performance of a physical system

modeling – communication – persuasion to make a decision.
→ numbers are objective and clear
– describe situations w/ logic / reason

Arguments vs. Models: Parallel structure

- Knowledge
  - Inductive/deductive
- Premises
  - Accuracy/truth
  - HOS
- Conclusion
  - Logical construction
- Behavioral change/decision

- Knowledge
  - Theory/observation
- Assumptions
  - Accuracy/precision
  - Definitions
- Model
  - Logical construction (mathematical)
- Application/Utility decision

Same analysis/thinking skills needed for both
Hence, why this class teaches critical argument and numerical modeling in the same course

Significance of Critical Arguments

- Explaining why we behave the way we do, i.e. choices, actions
- Persuade others to change their behavior/decisions/choices

The role of engineers is to use their technical understanding to beneficially impact the lives of people.
Critical arguments are the tools used to understand why/how people make decisions/act (analysis) and persuade others to act/behave in specific ways (synthesis) to incur benefits.

What teaching changes would be beneficial for this topic in the future?

Quantitative Modeling

- Review of fundamental principles/models
- Review calculus/geometrical shell elements
- Analytical vs. Numerical models
- Computational Accuracy/Precision/Error
- Approximation methods/algorithms, error, interpolation
- Iterative modeling process

What did you learn/take away from this section of the course?
Is being able to develop quantitative models (vs. qualitative) useful/valuable to you?

What teaching changes would be beneficial for this topic in the future?

biological engineering understanding how to use concepts

10-12 questions on basic concepts and syllabus questions

questions for Tao

2nd law of thermo entropy