

Problem Solving

Well-Posed Problems

- In reality, *you* define the problem

Example: At Exxon, Professor Green was told that the “lubricant gums up in the engine.”
Had to take ill-posed problem and transform to a well-posed problem.

- Could solve kinetics
- Could solve thermodynamics

RECOGNIZE WHAT TYPE OF PROBLEM → Rewrite equations in standard form

- Algebraic equations
 - Linear
 - Non-linear
- Differential equations
 - ODE
 - Initial Value Problems
 - Boundary Value Problems
 - PDE
- Optimization
- Stochastic Simulations

Estimate SOLUTION

- REALITY CHECK!
- Set constraints for optimization (i.e. least-squares)
- Good initial guess
- At least think about UNITS!

Write some MATLAB → Run Computer → *SOLUTION*

- (OR) Error or warning message

Check if solution works!!

- is reasonable to spend as much time checking solution as obtaining it
 - e.g. have two different programs written by two different people
- How important is it that you are right?

$\underline{J} \cdot \underline{\Delta x} = -\underline{F}$ Solve linear equations. Then may discretize a different way to see whether we get the same answer.

Newton's method has best convergence close to minimum.

Computer Programming (Key to MATLAB)

- Reusability (avoid writing too much code)
- HEADER to function/program: inputs/outputs/function description (what it does)