ENGG1003 - Monday Week 8

Solving nonlinear algebraic equations

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Lecture overview

1. Solving nonlinear algebraic equations pp. 175-176
   - generic
   - two problems: flight time, fluid level
2. Bisection method §7.7
3. Secant method §7.3
   - Newton–Raphson method
4. Extensions
   - bisection vs. secant re-write as functions
   - timing code in Python
   - initialisation & speed comparisons
   - failure to converge

1) Solving nonlinear algebraic equations

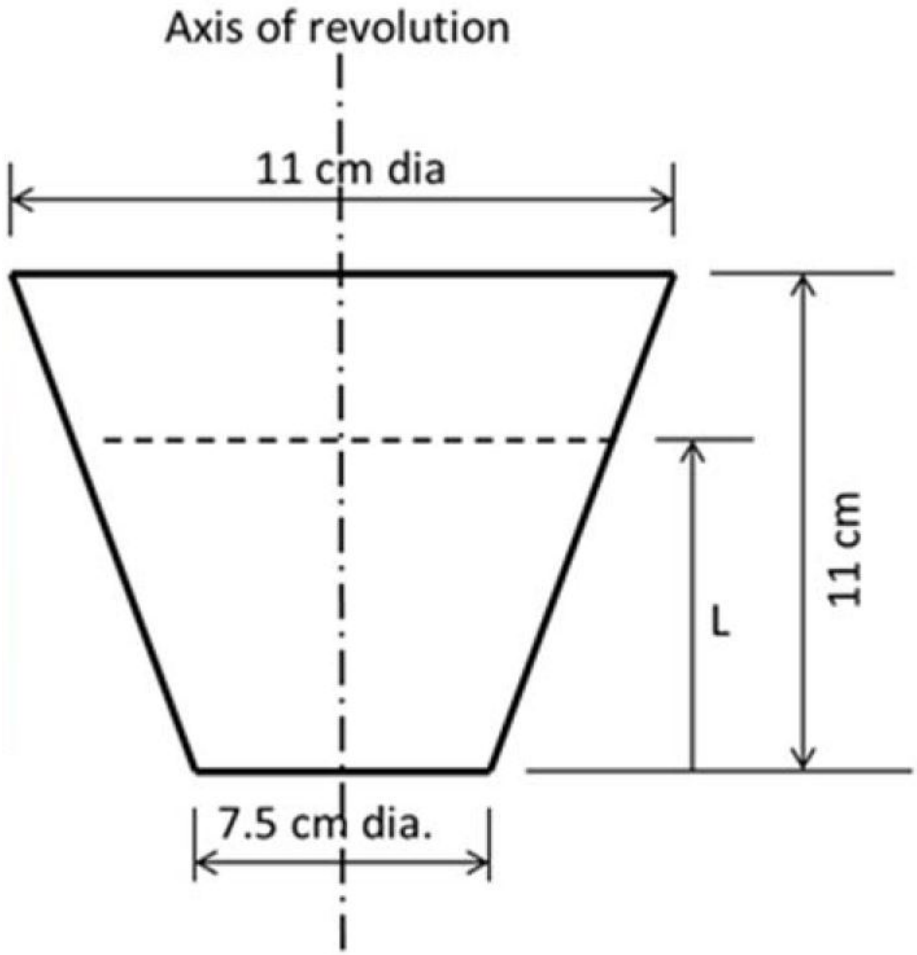
- find x satisfying $f(x) = 0$
- aka root-finding

Flight time

- one more time!

Fluid level

image of measuring cup



Fluid level

- cup dimension figure
- water in dam, coal in stockpile
- volume V (mL) depends on depth L as follows, *presented without proof:*

$$V = 0.0268L^3 + 1.884L^2 + 44.15L$$

- Question: depth L when cup holds 500 mL of water?
- solve $f(L) = 0$ where

$$F(L) = 0.0268L^3 + 1.884L^2 + 44.15L - 500$$

2) Bisection method

- basic idea: visualisation

- bisection method: key equations

- bisection method: pseudocode

- bisection method: Python code

- bisection method: simulation results

3) Secant method

- basic idea: visualisation

- secant method: key equations

- secant method: pseudocode

- secant method: Python code

- secant method: simulation results

- XXX

4) Computing integrals

- XXX

- XXX

Lecture summary

- Solving nonlinear algebraic equations
- Bisection method
- Secant method
  - Newton–Raphson method
- Extensions