ENGR 133, Lab-06

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Exercise #1...Cross-sectional Area

Problem Presentation

Given the depths of water at various distances from the shore of a river, compute the cross-sectional area.

Solution Process (Pseudocode)

- Initialize variables
- Perform calculations
- Display results

Solution

Initialize variables

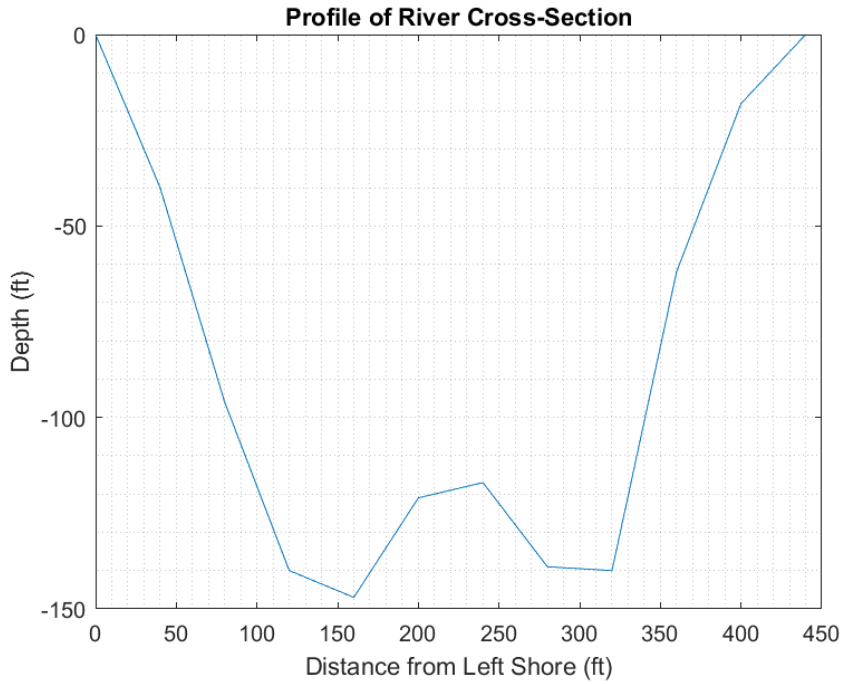
```
clc,clear,close all
distance = (0:40:440); % distance between intervals. (ft)
depth = [0 40 96 140 147 121 117 139 140 62 18 0]; % depth of each interval.
(ft)
```

Perform calculations

```
area = trapz(distance,depth); % computing area.
```

Display results

```
plot(distance,-depth); grid minor
title('Profile of River Cross-Section')
xlabel('Distance from Left Shore (ft)')
ylabel('Depth (ft)')
```




```
fprintf('The cross-sectional area is %5.0f feet. \n\n',area)
```

```
The cross-sectional area is 40800 feet.
```

Exercise #2...Problem 9.10

Problem Presentation

Here we have the case of a rocket launch where the fuel burns for a specified lenght of time and we are interested in knowing the velocity at the end of the fuel burn. We are given the function that describes the acceleration (dv/dt) and mass as a function of time as fuel burns.m(

$$m(t)\frac{\mathrm{dv}}{\mathrm{dt}} = T - m(t)g$$

$$m(t) = m_0(1 - \mathrm{rt}/b)$$

Solution Process (Pseudocode)

- Solve for dv/dt
- Initialize variables
- Perform calculations
- Display results

Solution

Solve for dv/dt

$$\frac{\mathrm{dv}}{\mathrm{dt}} = \frac{T}{m(t)} - g = \left(\frac{T}{m_{0(1-\mathrm{rt}/b)}} - g\right)$$

Initialize variables

```
clc,clear,close all
T = 48000; % Thrust in Newtons
mo = 2200; % Initial mass in kilograms
r = 0.8; % Fuel fraction of mass
b = 40; % Burn time in seconds
g = 9.81; % gravitational constant in meters per second squared
to = 0; % Set lower limit of integral
tf = b; % set upper limit of integral
```

Perform calculations

```
dv = @(t) T./(mo*(1-r*t/b))-g; % Anonymous function
v = integral(dv,to,tf); % Integrating velocity
```

Display results

```
fprintf('The velocity at %2.0f seconds is %5.1f m/s. \n\n',b,v)
```

```
The velocity at 40 seconds is 1363.4 m/s.
```