Fluid Mechanics Program

Engineering 1282.02H

Spring, 2015

Tony Satroplus, Seat 11

S. Heglas Wednesday 3:00

Date of Submission: 2/27/15

```
% Inputs
Q=0;
P=0;
W=0;
H=0;
L=0;
u=0;
p=0;

% Choose
fprintf('\nChoose the variable you want to find.');
fprintf('\n\nTo calculate:');
fprintf('\n\tVolumeteric flow rate - Press 1');
fprintf('\n\tWidth - Press 2');
fprintf('\n\tHeight - Press 3');
fprintf('\n\tLength - Press 4');
fprintf('\n\tDelta P - Press 5');
fprintf('\n\tViscosity - Press 6\n\n');

choice = input('Enter your choice: ');


% For Q
Q = (W*(H^3)*P)/(12*u*L);

% For W
W = (12*Q*u*L)/((H^3)*P);

% For H
H = ((12*Q*u*L)/(W*P))^(1/3);

% For L
L = (W*(H^3)*P)/(12*u*Q);

% For P
P = (12*Q*u*L)/((H^3)*W);

% For u
u = (W*(H^3)*P)/(12*Q*L);

% Average velocity
v_avg = ((H^2)*P)/(12*u*L);

% Shear stress at the wall
t_wall = (H*P)/L;

% Hydraulic/effective diameter
D_h = (4*W*H)/(2*W+2*H);

% Reynold's number
Re = (p*v_avg*D_h)/u;

% Entrance length
Le = 0.06*Re*D_h;
```

```
%introduction
fprintf('\nWelcome!\n');
fprintf('Tony Satroplus      DMG      3:00      02/27/15\n');

%description
fprintf('\nDescription:\n');
fprintf('The program will calculate and display the value the missing \n');
fprintf('variable for the data set. In addition, the average velocity,\n');
fprintf('shear stress at the wall, Reynolds number, and entrance\n');
fprintf('length of the channel will be calculated and displayed.\n');
fprintf('The plot of velocity and shear stress across the channel\n');
fprintf('will be plotted as well.\n');

%directions
fprintf('\nDirections:\n');
fprintf('When prompted please enter the character corresponding to\n');
fprintf('the missing variable in the data set and press enter. Please\n');
fprintf('enter all lengths in cm, pressure in dyne/cm^2, and viscosities\n');
fprintf('in cp');

%ask for missing variable
fprintf('\nWhich variable would you like to solve for?\n');
fprintf('Enter the corresponding letter of whichever variable you would like
to solve for: \n');
fprintf('q/Q   - Volumetric Flow Rate\n');
fprintf('w/W   - Width\n');
fprintf('h/H   - Height\n');
fprintf('l/L   - Length\n');
fprintf('p/P   - Delta P\n');
fprintf('u/U   - Viscosity\n');

%intialize variables

%set initial loop variable
carryon = 0;
while (carryon == 0)

%input vaiable to variable C
C = input('\nEnter here: ','s');


%switch cases to decide which variable will be solved for and which
%variables should be taken as input
    switch C
       %case for calculating volumetric flow rate
        case{'q','Q'}
            iwidth = input('\nWidth of the channel: ');
            iheight = input('\nHeight: ');
            ilength = input('\nLength: ');
            ideltap = input('\nDelta P: ');
            iviscosity = input('\nViscosity: ');
            %variable for volumetric flow rate
            iflow = (iwidth*(iheight^3)*ideltap)/(12*iviscosity*ilength);
            %assign carryon
            carryon = 1;
```

```
        case{'w','W'}
            iflow = input ('\nFlowrate of channel: ');
            iheight = input('\nHeight of channel: ');
            ilength = input('\nLength: ');
            ideltap = input('\nDelta P: ');
            iviscosity = input('\nViscosity: ');
            %variable for calculated width
            iwidth = ((12*iviscosity*ilength*iflow)/((iheight^3)*ideltap));
            %assign carryon
            carryon = 1;
        case{'h','H'}
             iflow = input ('\nFlowrate of channel: ');
            iwidth = input('\nWidth of the channel: ');
            ilength = input('\nLength: ');
            ideltap = input('\nDelta P: ');
            iviscosity = input('\nViscosity: ');
            %variable for calculated height
            iheight = ((12*iviscosity*ilength*iflow)/(iwidth*ideltap))^(1/3);
            %assign carryon
            carryon = 1;
        case{'l','L'}
             iflow = input ('\nFlowrate of channel: ');
            iwidth = input('\nWidth of the channel: ');
            iheight = input('\nHeight of channel: ');
            ideltap = input('\nDelta P: ');
            iviscosity = input('\nViscosity: ');
            %variable for calculated length
            ilength = (iwidth*(iheight^3)*ideltap)/(12*iviscosity*iflow);
            %assign carryon
            carryon = 1;

        case{'p','P'}
             iflow = input ('\nFlowrate of channel: ');
            iwidth = input('\nWidth of the channel: ');
            iheight = input('\nHeight of channel: ');
            ilength = input('\nLength: ');
            iviscosity = input('\nViscosity: ');
            %variable for calculated delta p
            ideltap = (12*iviscosity*ilength*iflow)/(iwidth*(iheight^3));
            %assign carryon variable
            carryon = 1;
        case{'u','U'}
             iflow = input ('\nFlowrate of channel: ');
            iwidth = input('\nWidth of the channel: ');
            iheight = input('\nHeight of channel: ');
            ilength = input('\nLength: ');
            ideltap = input('\nDelta P: ');
            %variable for calculated viscosity
            iviscosity = (iwidth*(iheight^3)*ideltap)/(12*iflow*ilength);
            %assign carryon variable
            carryon = 1;
        otherwise
            printf('\nPlease enter a valid character.');
            carryon = 0;
    end
    %end check loop for proper character
end
```

```
%continuing calculations
%set ro
ro = 0.9977025;
%calculate hydraulic/effective diameter
dh = (4*iwidth*iheight)/(2*iwidth + 2*iheight);
%average velocity
vavg = ((iheight^2)*ideltap)/(12*iviscosity*ilength);
%shear stress at the wall
taowall = ((iheight/2)*ideltap)/ilength;
%reynolds number
reynum = (ro*vavg*dh)/iviscosity;
%entrance length
le = 0.06*reynum*dh;

%calcs for graphs
%velocity function
velx=linspace(-iheight/2,iheight/2,1000);
vely=((ideltap/(8*iviscosity*ilength))*((iheight.^2)-4*(velx).^2));
plot(velx,vely);
title('Velocity Function');
xlabel('Height cm');
ylabel('Velocity cm/s');

figure
%shear stress function
shx=linspace(-iheight/2,iheight/2,1000);
shy=((ideltap)*abs(shx))/ilength;
plot(shx,shy);
title('Shear Stress Function');
xlabel('Height cm');
ylabel('Shear Stress dynes/cm^2');


fprintf('\n_____________________________________________');
fprintf('\n| Flow Rate         | %2.2f cm^3/s   |',iflow);
fprintf('\n|_____________________________________________|');
fprintf('\n| Width             | %2.2f cm       |',iwidth);
fprintf('\n|_____________________________________________|');
fprintf('\n| Height            | %2.2f cm       |',iheight);
fprintf('\n|_____________________________________________|');
fprintf('\n| Length            | %2.2f cm       |',ilength);
fprintf('\n|_____________________________________________|');
fprintf('\n| Viscosity         | %2.2f g/cm-s   |',iviscosity);
fprintf('\n|_____________________________________________|');
fprintf('\n| Delta P           | %2.2f dyne/cm^2|',ideltap);
fprintf('\n|_____________________________________________|');
fprintf('\n| Average Velocity  | %2.2f cm/s     |',vavg);
fprintf('\n|_____________________________________________|');
fprintf('\n| Wall Shear Stress | %2.2f dyne/cm^2|',taowall);
fprintf('\n|_____________________________________________|');
fprintf('\n| Reynolds Number   | %2.2f          |',reynum);
fprintf('\n|_____________________________________________|');
fprintf('\n| Entrance Length   | %2.2f cm       |',le);
fprintf('\n|_____________________________________________|')
```