Homework #7

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ENGR 108

Matlab for Engineers, Third Edition

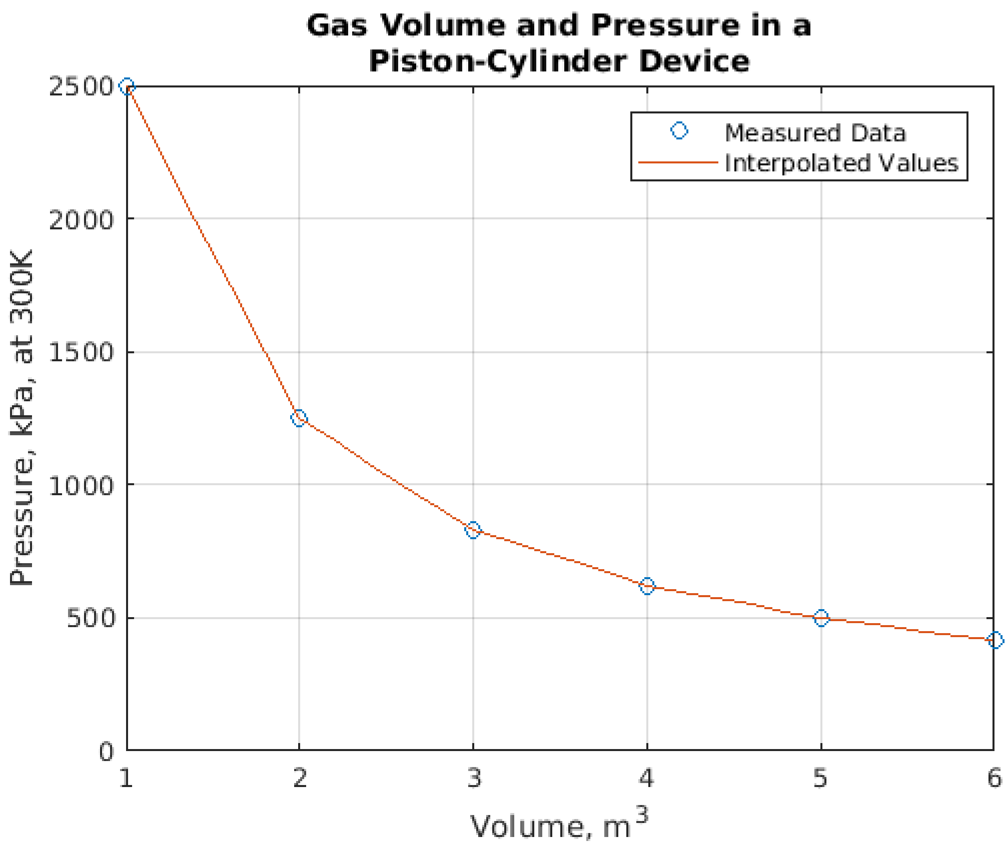
Problem 13.2

```
% Defines a vector from measured volume data in m^3
Volume = 1:6;
% Defines a vector from measured pressure data in kPa at 300K
Pressure = [2494 1247 831 623 499 416];
% Defines a vector with volume measurements every 0.2m^3
New_Volume = 1:0.2:6;
% Estimates new pressure measurements for the new volume
% measurements with linear interpolation
New_Pressure = interp1(Volume,Pressure,New_Volume);
% Groups the new pressure and new volume values into a table
table =[New_Volume; New_Pressure];
% Displays the title of the table
disp('Expanded Volume-Pressure Table')
% Displays the column headers of the table
disp('Volume, m^3   Pressure, kPa, at 300K')
% Displays and formats the new pressure and new volume values
fprintf('%7.2f %20.2f \n', table)

% Plots the volume and pressure data as circles and plots the
% new volume and new pressure data as a solid line
plot(Volume,Pressure,'o',New_Volume,New_Pressure)
% Creates a title
title({'Gas Volume and Pressure in a', 'Piston-Cylinder Device'})
% Creates an x-axis label
xlabel('Volume, m^3')
% Creates a y-axis label
ylabel('Pressure, kPa, at 300K')
% Creates a background grid
grid on
% Creates a legend
legend('Measured Data','Interpolated Values')
```

```
Expanded Volume-Pressure Table
Volume, m^3   Pressure, kPa, at 300K
```

1.00	2494.00
1.20	2244.60
1.40	1995.20
1.60	1745.80
1.80	1496.40
2.00	1247.00
2.20	1163.80
2.40	1080.60
2.60	997.40
2.80	914.20
3.00	831.00
3.20	789.40
3.40	747.80
3.60	706.20
3.80	664.60
4.00	623.00
4.20	598.20
4.40	573.40
4.60	548.60
4.80	523.80
5.00	499.00
5.20	482.40
5.40	465.80
5.60	449.20
5.80	432.60
6.00	416.00



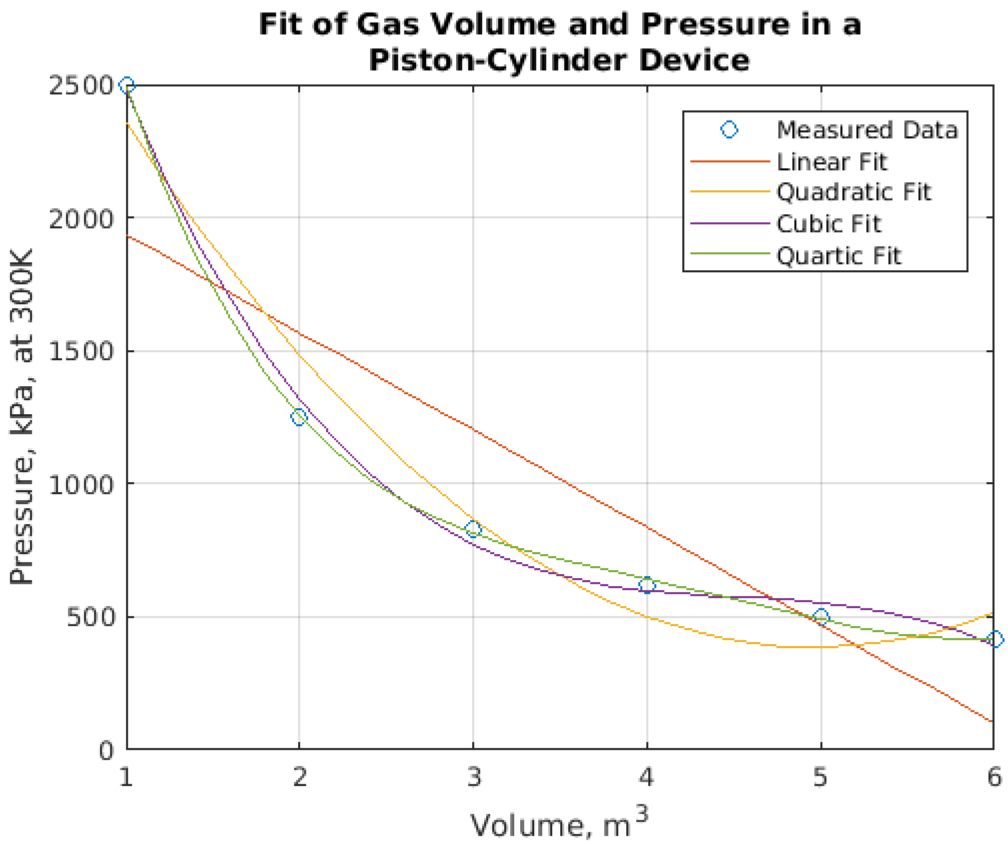
Problem 13.7

```
% Defines a vector from measured volume data in m^3
V = 1:6;
% Defines a vector from measured pressure data in kPa at 300K
P = [2494 1247 831 623 499 416];
% Defines a vector with volume measurements every 0.2m^3
new_V = 1:0.2:6;

% Fits the data with the polyfit function for first-, second-,
% third-, and fourth-order polynomials and the polyval function
% calculates new pressure values
new_P1 = polyval(polyfit(V,P,1),new_V);
new_P2 = polyval(polyfit(V,P,2),new_V);
new_P3 = polyval(polyfit(V,P,3),new_V);
new_P4 = polyval(polyfit(V,P,4),new_V);

% Plots the volume and pressure data as circles and plots the
% new volume and new pressure data as solid lines
plot(V,P,'o',new_V,new_P1,new_V,new_P2,new_V,new_P3,new_V,new_P4)
% Creates a title
title({'Fit of Gas Volume and Pressure in a', 'Piston-Cylinder
 Device'})
% Creates an x-axis label
xlabel('Volume, m^3')
% Creates a y-axis label
ylabel('Pressure, kPa, at 300K')
% Creates a background grid
grid on
% Creates a legend
legend('Measured Data','Linear Fit','Quadratic Fit','Cubic Fit', ...
    'Quartic Fit')


% The fourth-order model seems to do the best job since it follows
% the measured data points the best.
```



Problem 13.13

```
% a)
% Defines a vector from -5 to +5
x = -5:5;
% Defines a function
y = 12*x.^3 - 5*x.^2 + 3;
% Approximates the derivative at each x value
dydx_approx = diff(y)./diff(x)

% b)
% Analytically determines the derivative at each x value
dydx_analytical = 36*x.^2 - 10*x

% The total number of results differ, and the corresponding
% values of the results all differ.


dydx_approx =

   777    479    253     99     17      7     69    203    409    687


dydx_analytical =

   950    616    354    164     46      0     26    124    294    536    850
```

Problem 13.17

```
% Computes the integral under a curve using adaptive Simpson
% quadrature
quad_solution = quad('5*x.^3 - 2*x.^2 + 3',-1,1)
% Computes the integral under a curve using adaptive Lobatto
% quadrature
quadl_solution = quadl('5*x.^3 - 2*x.^2 + 3',-1,1)

% Computes the integral by finding the symbolic integral
% Note: Unable to use int since the DSP System Toolbox and Symbolic
%       Toolbox are not installed on my version of MATLAB
% Was able to confirm the code works by reviewing the practice
% exercises
% int_solution = double(int('5*x^3 - 2*x^2 + 3',-1,1))

% Defines a varible 'a'
a = -1;
% Defines a variable 'b'
b = 1;
% Calculates the integral by using the analytical method
analytical_solution = 5/4*(b^4-a^4) - 2/3*(b^3-a^3) + 3*(b-a)

% All methods of calculating the integral returned the same value
```

```
quad_solution =

    4.6667


quadl_solution =

    4.6667


analytical_solution =

    4.6667
```

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