Al-Mustaqbal University / College of Engineering & Technology
Department (Chemical and Petrochemical engineering)
Class (second stage)
Subject (Computer Programming**)**
Lecturer (Abrar Falah Naji)

2nd term – Lecture No. & Lecture Name (Polynomials – Interpolation)
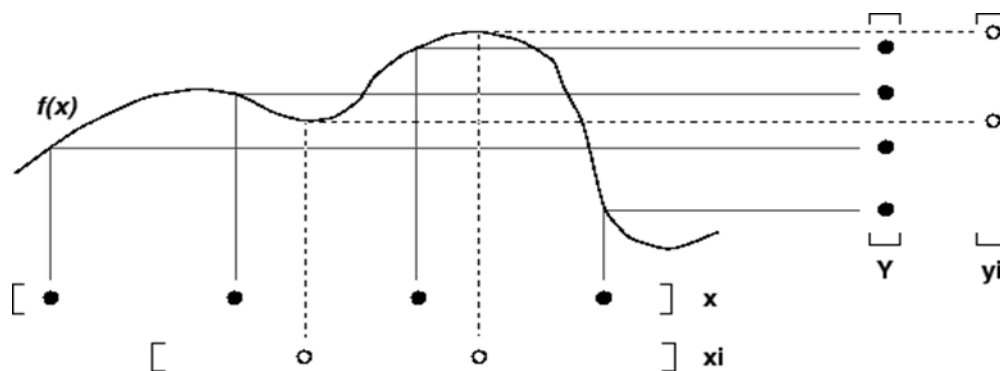
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Polynomials - Interpolation

1.One-Dimensional Interpolation

The command interp1 interpolates between data points. It finds values at intermediate points, of a one-dimensional function that underlies the data. This function is shown below, along with the relationship between vectors x, y, xi, and yi.

Interpolation is the same operation as table lookup. Described in table lookup terms, the table is [x,y] and interp1 looks up the elements of xi in x, and, based upon their locations, returns values yi interpolated within the elements of y.
Syntax

yi = interp1(x,y,xi)
where xi may be single element or a vector of elements.

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Exercise 1:

The vapor pressures of 1-chlorotetradecane at several temperatures are tabulated here.

T (^{o}C)	98.5	131.8	148.2	166.2	199.8	215.5
P*(mmHg)	1	5	10	20	60	100

Calculate the value of vapor pressure corresponding to 150 oC? Solution:
T= [98.5 131.8 148.2 166.2 199.8 215.5];
P= [1 5 10 20 60 100];
Pi=interp1 (T, P, 150)
The result will be:
Pi=
11.0000

Exercise 2:

The heat capacity of a gas is tabulated at a series of temperatures:

T (^{o}C)	20	50	80	110	140	170	200	230
Cpj/mol.^{o}C	28.95	29.13	29.30	29.48	29.65	29.82	29.99	30.16

Calculate the values of heat capacity corresponding to 30, 70, 100 and 210 ^{o}C. Solution:

T= [20 50 80 110 140 170 200 230];

CP= [28.95 29.13 29.30 29.48 29.65 29.82 29.99 30.16];

Xi=[30 70 100 210];

CPi=interp1 (T, CP,Xi)

The results will be

Pv =

 29.0100   29.2433   29.4200   30.0467

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Exercise 3:

Chemical engineer, as well as most other engineers, uses thermodynamics extensively in their work. The following polynomial can be used to relate specific heat of dry air, C_p KJ/(Kg K), to temperature (K):

$C_p = 0.994 + 1.617 \times 10^{-4}T + 9.7215 \times 10^{-8}T^2 - 9.5838 \times 10^{-11}T^3 + 1.9520 \times 10^{-14}T^4$

Determine the temperature that corresponds to a specific heat of 1.2 KJ/(Kg K).

الهدف هو تحديد درجة الحراره عندما تكون الحرار النوعية =١.٢

Solution:

   T=10:10:10000;

١ . في البداية، يتم تحديد نطاق درجات الحرارة الذي سيتم فيه حساب قيم الحرارة النوعية. يتم إنشاء متجه**T**

   Cp=0.99403+1.617e-4*T+9.7215e-8*T.^2-9.5838e-11*T.^3+1.9520e-14*T.^4;

٢ . بعد ذلك، يتم حساب قيم الحرارة النوعية لكل درجة حرارة باستخدام المعادلة المعطاة. يتم تخزين هذه القيم في متجه**Cp**

   Ti=interp1(Cp,T,1.2)

٣ . بعد ذلك، يتم استخدام دالة interp1 للبحث عن درجة الحرارة **T**التي تقابل قيمة الحرارة النوعية **Cp=1.2** يعمل الأمر interp1على إجراء الاستيفاء الأحادي البُعد، حيث يبحث عن قيمة **T**التي تعطي قيمة حرارة نوعية قريبة من ١.٢

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2.   Two-Dimensional Interpolation

The interp2 command performs two-dimensional interpolation between data points.

It finds values of a two-dimensional function underlying the data at intermediate points>

Its most general form is:

Zi = interp2(X, Y, Z, Xi, Yi)

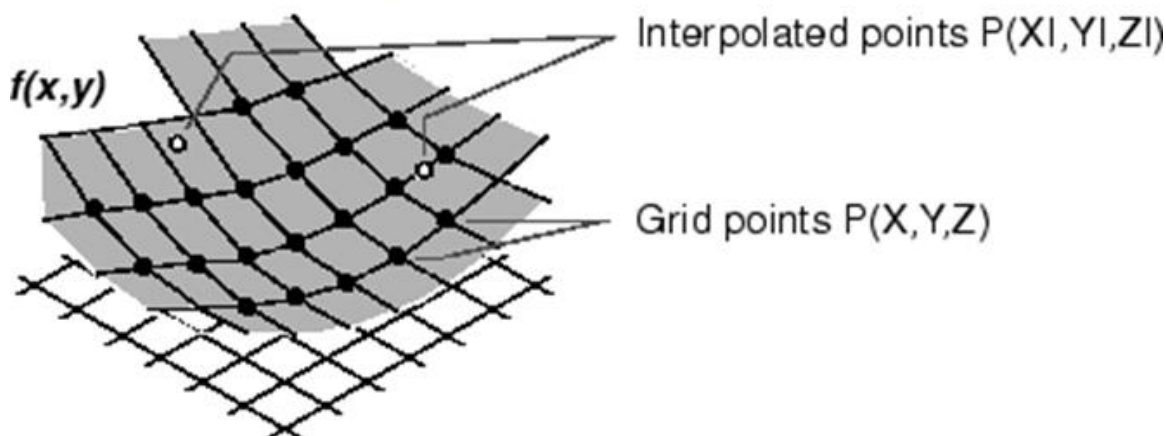Zvector = interp2(X, Y, Z, Xvector, Yvector)

X =القيم على المحور.X

Y = القيم على المحور.Y

Z = مصفوفة تحتوي على القيم المقابلة على شبكة من النقاط التي يتم تحديدها بواسطة Xو. Y

Xi, Yi = النقاط التي تريد استيفاء القيم لها على الشبكة.

Note: the number of elements of the X vector and Z matrix rows must be the same, while the number of elements of the Y vector and Z matrix columns must be the same.

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Exercise 4:

Calculate the values of z corresponding to (x,y)=(1.3, 1.5) and (1.5,2.3)
from data as following:

x=1, 2
y= 1, 2, 3
z = 10 20
    40 50
    70 80

الهدف يُطلب منك حساب قيم z المقابلة لنقاط (x, y) معينة باستخدام الاستيفاء ثنائي البُعد.

Solution

x = [1 2];
y = [1 2 3];
z = [10 20; 40 50; 70 80];
z1 = interp2(x,y,z,1.3,1.5)

The results will be

z1 =

28

To interpolate a vector of x, y points repeat the same code with small change:

z12 = interp2(x,y,z,[1.3,1.5],[1.5,2.3])

z12 =

28   54