Contents

Example 1 Student: Daniel Clark

```
clear all                                          % Instructor: Dr. Ha-Rok Bae
close all                                          % Class: ME 7060 Spring 2016
clc
format shorte
```

Given

```
delta_max = @(P,L,E,I,w) (P.*L.^3)./ (48.*E.*I) + (5*w.*L.^4)./(385.*E.*I);
%constants
mu_E = 29*10^6;        % lb/in^2
mu_L = 30*12;          % was ft now in
mu_I = 1.33*10^3;      % in^4
```

Normal

```
mu_w = 1*10^3/12;      % was kip/ft now lbs/in
sigma_w = 0.1*10^3/12; % was kip/ft now lbs/in
mu_P = 50*10^3;        % was kip now lbs
sigma_P = 10*10^3;     % was kip now lbs
```

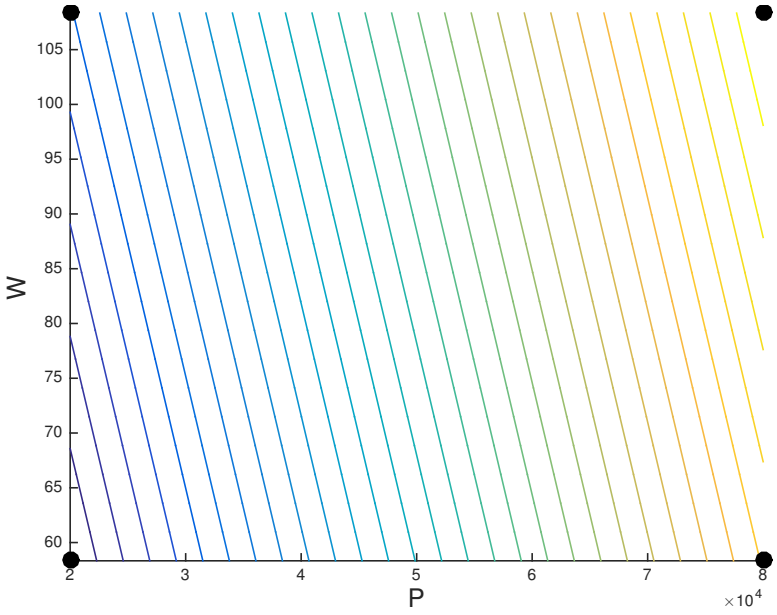
Lets look at the response surface

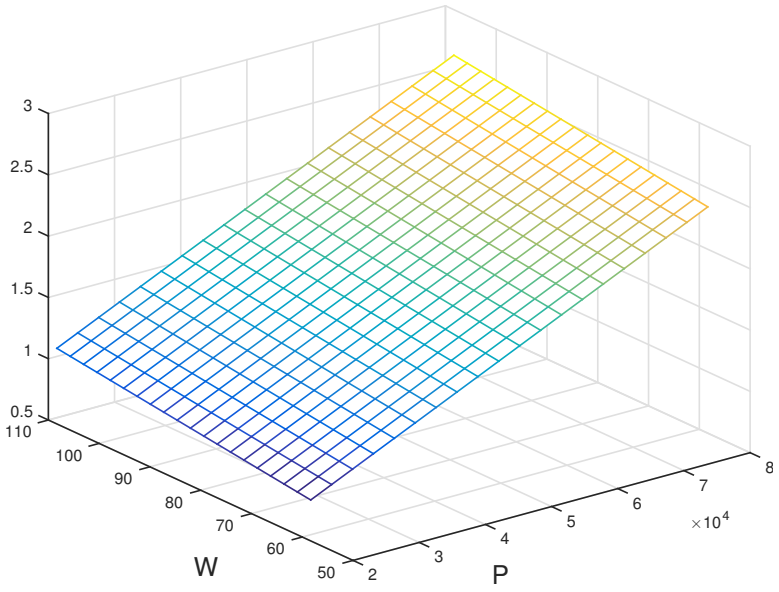
```
gridNum = 20;
S = [mu_P-3*sigma_P , mu_w-3*sigma_w; mu_P+3*sigma_P , mu_w+3*sigma_w];
testpoints = gridsamp([min(S(:,1)) min(S(:,2)); max(S(:,1)) max(S(:,2))], gridNum);
oneM = ones(1,gridNum*gridNum)';

M = [testpoints(:,1), oneM*mu_L, oneM*mu_E, oneM*mu_I,testpoints(:,2)];

Y_true = delta_max(M(:,1),M(:,2),M(:,3),M(:,4),M(:,5));
Es = reshape(testpoints(:,1),gridNum,gridNum);
Is = reshape(testpoints(:,2),gridNum,gridNum);
Response = reshape(Y_true, size(Es));

Samples = [S(1,1),S(1,2);
```

```
            S(2,1),S(1,2);
            S(1,1),S(2,2);
            S(2,1),S(2,2)]
            % mu_P,mu_w];
oneM = ones(1,length(Samples))';
M = [Samples(:,1), oneM*mu_L, oneM*mu_E, oneM*mu_I,Samples(:,2)];
SampleResponse = delta_max(M(:,1),M(:,2),M(:,3),M(:,4),M(:,5));
```

```
Samples =

   2.0000e+04   5.8333e+01
   8.0000e+04   5.8333e+01
   2.0000e+04   1.0833e+02
   8.0000e+04   1.0833e+02
```

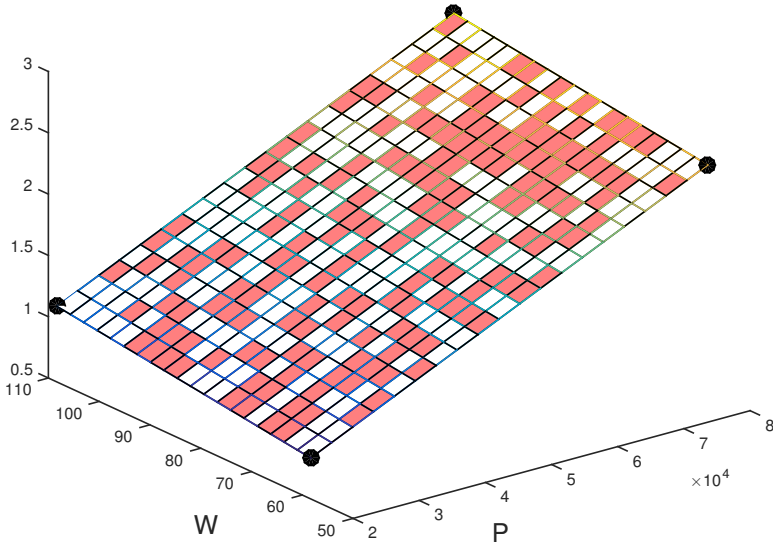
Plot of true surface and 2^k points





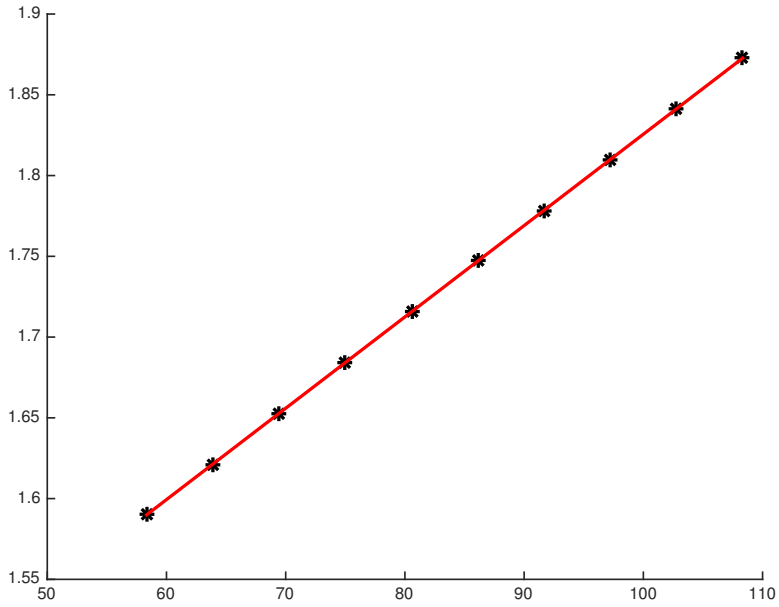
Linear Regression

```
Tables = fitlm(Samples,SampleResponse);
betas = table2array(Tables.Coefficients(:,1));

Y_hat =
Response_est = reshape(Y_hat, size(Es));
```



Error plot

```
oneM = ones(1,10)';
wpoints = linspace(mu_w-3*sigma_w, mu_w+3*sigma_w,10)';
testpoints = [oneM*mu_P,wpoints];

M = [testpoints(:,1), oneM*mu_L, oneM*mu_E, oneM*mu_I, testpoints(:,2)];
Response = delta_max(M(:,1),M(:,2),M(:,3),M(:,4),M(:,5));

Y_hat =
```


1.9
1.85
1.8
1.75
1.7
1.65
1.6
1.55
50
60
70
80
90
100
110