APPENDIX

```
%% Wind Power Data Analysis
% Jim Gao  UC Berkeley

%% Load Data

clc
clear all
close all

% Site selection corresponding to mountainous region in WY between
Cheyenne
% and Laramie. Obtained from NREL Western Wind Integration Study 2004-
2006.
% Wind turbine output data is corrected using the SCORE-lite method.

% 10 randomly-selected test sites

data_13103 = xlsread('13103.csv');
data_13583 = xlsread('13583.csv');
data_14391 = xlsread('14391.csv');
data_15705 = xlsread('15705.csv');
data_16242 = xlsread('16242.csv');
data_18345 = xlsread('18345.csv');
data_18559 = xlsread('18559.csv');
data_19149 = xlsread('19149.csv');
data_19379 = xlsread('19379.csv');
data_19501 = xlsread('19501.csv');

data_13103(:,1:3) = [];
data_13583(:,1:3) = [];
data_14391(:,1:3) = [];
data_15705(:,1:3) = [];
data_16242(:,1:3) = [];
data_18345(:,1:3) = [];
data_18559(:,1:3) = [];
data_19149(:,1:3) = [];
data_19379(:,1:3) = [];
data_19501(:,1:3) = [];

dataVec = [data_13103 data_13583 data_14391 data_15705 data_16242
data_18345 data_18559 data_19149 data_19379 data_19501];
save('dataVec')

%% Wind Power Data Analysis
% Jim Gao  UC Berkeley

%% Lagrange Multipliers Method
% Analyze 2 year period using 2004-2005 NREL data.

clc
clear all
```

```
close all

load('dataVec')

mean_13103 = mean(dataVec(:,1));
mean_13583 = mean(dataVec(:,2));
mean_14391 = mean(dataVec(:,3));
mean_15705 = mean(dataVec(:,4));
mean_16242 = mean(dataVec(:,5));
mean_18345 = mean(dataVec(:,6));
mean_18559 = mean(dataVec(:,7));
mean_19149 = mean(dataVec(:,8));
mean_19379 = mean(dataVec(:,9));
mean_19501 = mean(dataVec(:,10));

var1 = zeros(length(dataVec)-1,1);
var2 = zeros(length(dataVec)-1,1);
var3 = zeros(length(dataVec)-1,1);
var4 = zeros(length(dataVec)-1,1);
var5 = zeros(length(dataVec)-1,1);
var6 = zeros(length(dataVec)-1,1);
var7 = zeros(length(dataVec)-1,1);
var8 = zeros(length(dataVec)-1,1);
var9 = zeros(length(dataVec)-1,1);
var10 = zeros(length(dataVec)-1,1);

for i=2:length(dataVec)

    var1(i-1) = abs(dataVec(i,1) - dataVec(i-1,1))/dataVec(i,1);
    var2(i-1) = abs(dataVec(i,2) - dataVec(i-1,2))/dataVec(i,2);
    var3(i-1) = abs(dataVec(i,3) - dataVec(i-1,3))/dataVec(i,3);
    var4(i-1) = abs(dataVec(i,4) - dataVec(i-1,4))/dataVec(i,4);
    var5(i-1) = abs(dataVec(i,5) - dataVec(i-1,5))/dataVec(i,5);
    var6(i-1) = abs(dataVec(i,6) - dataVec(i-1,6))/dataVec(i,6);
    var7(i-1) = abs(dataVec(i,7) - dataVec(i-1,7))/dataVec(i,7);
    var8(i-1) = abs(dataVec(i,8) - dataVec(i-1,8))/dataVec(i,8);
    var9(i-1) = abs(dataVec(i,9) - dataVec(i-1,9))/dataVec(i,9);
    var10(i-1) = abs(dataVec(i,10) - dataVec(i-1,10))/dataVec(i,10);

end

var1(find(isnan(var1))) = [];
var2(find(isnan(var2))) = [];
var3(find(isnan(var3))) = [];
var4(find(isnan(var4))) = [];
var5(find(isnan(var5))) = [];
var6(find(isnan(var6))) = [];
var7(find(isnan(var7))) = [];
var8(find(isnan(var8))) = [];
var9(find(isnan(var9))) = [];
var10(find(isnan(var10))) = [];

var1(find(isinf(var1))) = [];
var2(find(isinf(var2))) = [];
var3(find(isinf(var3))) = [];
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var4(find(isinf(var4))) = [];
var5(find(isinf(var5))) = [];
var6(find(isinf(var6))) = [];
var7(find(isinf(var7))) = [];
var8(find(isinf(var8))) = [];
var9(find(isinf(var9))) = [];
var10(find(isinf(var10))) = [];

x1 = mean(var1);
x2 = mean(var2);
x3 = mean(var3);
x4 = mean(var4);
x5 = mean(var5);
x6 = mean(var6);
x7 = mean(var7);
x8 = mean(var8);
x9 = mean(var9);
x10 = mean(var10);
y1 = mean(dataVec(:,1));
y2 = mean(dataVec(:,2));
y3 = mean(dataVec(:,3));
y4 = mean(dataVec(:,4));
y5 = mean(dataVec(:,5));
y6 = mean(dataVec(:,6));
y7 = mean(dataVec(:,7));
y8 = mean(dataVec(:,8));
y9 = mean(dataVec(:,9));
y10 = mean(dataVec(:,10));

k1_vec = x1*[y1 y2 y3 y4 y5 y6 y7 y8 y9 y10] - y1*[x1 x2 x3 x4 x5 x6 x7
x8 x9 x10];
k2_vec = x2*[y1 y2 y3 y4 y5 y6 y7 y8 y9 y10] - y2*[x1 x2 x3 x4 x5 x6 x7
x8 x9 x10];
k3_vec = x3*[y1 y2 y3 y4 y5 y6 y7 y8 y9 y10] - y3*[x1 x2 x3 x4 x5 x6 x7
x8 x9 x10];
k4_vec = x4*[y1 y2 y3 y4 y5 y6 y7 y8 y9 y10] - y4*[x1 x2 x3 x4 x5 x6 x7
x8 x9 x10];
k5_vec = x5*[y1 y2 y3 y4 y5 y6 y7 y8 y9 y10] - y5*[x1 x2 x3 x4 x5 x6 x7
x8 x9 x10];
k6_vec = x6*[y1 y2 y3 y4 y5 y6 y7 y8 y9 y10] - y6*[x1 x2 x3 x4 x5 x6 x7
x8 x9 x10];
k7_vec = x7*[y1 y2 y3 y4 y5 y6 y7 y8 y9 y10] - y7*[x1 x2 x3 x4 x5 x6 x7
x8 x9 x10];
k8_vec = x8*[y1 y2 y3 y4 y5 y6 y7 y8 y9 y10] - y8*[x1 x2 x3 x4 x5 x6 x7
x8 x9 x10];
k9_vec = x9*[y1 y2 y3 y4 y5 y6 y7 y8 y9 y10] - y9*[x1 x2 x3 x4 x5 x6 x7
x8 x9 x10];
k10_vec = x10*[y1 y2 y3 y4 y5 y6 y7 y8 y9 y10] - y10*[x1 x2 x3 x4 x5 x6
x7 x8 x9 x10];

k9_vec = k9_vec - k10_vec;
k8_vec = k8_vec - k10_vec;
k7_vec = k7_vec - k10_vec;
k6_vec = k6_vec - k10_vec;
k5_vec = k5_vec - k10_vec;
k4_vec = k4_vec - k10_vec;
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k3_vec = k3_vec - k10_vec;
k2_vec = k2_vec - k10_vec;
k1_vec = k1_vec - k10_vec;
k11_vec = ones(1,10);

A = [k1_vec; k2_vec; k3_vec; k4_vec; k5_vec; k6_vec; k7_vec; k8_vec;
k9_vec; k11_vec]

b = [0 0 0 0 0 0 0 0 0 1]';

x1 = A\b;
x = zeros(10,1);

for n=1:10
    if A(:,n) == [0 0 0 0 0 0 0 0 0 0]'
        x1(n) = 0;
    end
end

xNorm = norm(x1-x)/norm(x1);

while xNorm >= 10^-5

    z = find(x1 < zeros(size(x1)));

    for i = 1:length(z)
        A(z(i),z(i)) = A(z(i),z(i)) + 500*abs(x1(z(i)));
    end

    x = A\b;

    for n=1:10
        if A(:,n) == [0 0 0 0 0 0 0 0 0 0]'
            x(n) = 0;
        end
    end

    xNorm = norm(x-x1)/norm(x1);
    x1 = x;

end

x_vec = x1/sum(x1)

x_vec(find(x_vec < 0)) = 0;

x_vec = x_vec/sum(x_vec)

save('kVals_Lagrange')

%% Variability and total power analysis

clc
```

```
load('kVals_Lagrange')

Output = zeros(10*10527,1);
DistGen = zeros(10*10527,1);

for j=1:10*10527

    Output(j) = dataVec(j,:)*x_vec;

end

for i = 1:10*10527

    DistGen(i) = mean(dataVec(i,:));

end

site_13103 = dataVec(1:10*10527,1); %Test sites
site_13583 = dataVec(1:10*10527,2);
site_14391 = dataVec(1:10*10527,3);
site_15705 = dataVec(1:10*10527,4);
site_16242 = dataVec(1:10*10527,5);
site_18345 = dataVec(1:10*10527,6);
site_18559 = dataVec(1:10*10527,7);
site_19149 = dataVec(1:10*10527,8);
site_19379 = dataVec(1:10*10527,9);
site_19501 = dataVec(1:10*10527,10);

% figure(1)
%
plot(1:10:100*10527,Output,'g',1:10:100*10527,DistGen,1:10:100*10527,si
te_13103,'r')
% xlabel('Time')
% ylabel('Total Power Output (MW)')
% title('Wind Production for Optimized, Distributed, and Individual
Scenarios')
% legend('Optimized','Distributed','Site 19598')

mean_Output = mean(Output)
mean_DistGen = mean(DistGen)

[m,n] = size(Output);
var_Output = zeros(m-1,1);
var_DistGen = zeros(m-1,1);
var_13103 = zeros(m-1,1);
var_13583 = zeros(m-1,1);
var_14391 = zeros(m-1,1);
var_15705 = zeros(m-1,1);
var_16242 = zeros(m-1,1);
var_18345 = zeros(m-1,1);
var_18559 = zeros(m-1,1);
var_19149 = zeros(m-1,1);
var_19379 = zeros(m-1,1);
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```
var_19501 = zeros(m-1,1);


for i=1:m-1
    var_Output(i) = abs(Output(i+1) - Output(i))/mean_Output;
    var_DistGen(i) = abs(DistGen(i+1) - DistGen(i))/mean_DistGen;
    var_13103(i) = (abs(site_13103(i+1) - site_13103(i)))/mean_13103;
    var_13583(i) = (abs(site_13583(i+1) - site_13583(i)))/mean_13583;
    var_14391(i) = (abs(site_14391(i+1) - site_14391(i)))/mean_14391;
    var_15705(i) = (abs(site_15705(i+1) - site_15705(i)))/mean_15705;
    var_16242(i) = (abs(site_16242(i+1) - site_16242(i)))/mean_16242;
    var_18345(i) = (abs(site_18345(i+1) - site_18345(i)))/mean_18345;
    var_18559(i) = (abs(site_18559(i+1) - site_18559(i)))/mean_18559;
    var_19149(i) = (abs(site_19149(i+1) - site_19149(i)))/mean_19149;
    var_19379(i) = (abs(site_19379(i+1) - site_19379(i)))/mean_19379;
    var_19501(i) = (abs(site_19501(i+1) - site_19501(i)))/mean_19501;
end

var_Output(find(isnan(var_Output))) = [];
var_DistGen(find(isnan(var_DistGen))) = [];
var_13103(find(isnan(var_13103))) = [];
var_13583(find(isnan(var_13583))) = [];
var_14391(find(isnan(var_14391))) = [];
var_15705(find(isnan(var_15705))) = [];
var_16242(find(isnan(var_16242))) = [];
var_18345(find(isnan(var_18345))) = [];
var_18559(find(isnan(var_18559))) = [];
var_19149(find(isnan(var_19149))) = [];
var_19379(find(isnan(var_19379))) = [];
var_19501(find(isnan(var_19501))) = [];

var_Output(find(isinf(var_Output))) = [];
var_DistGen(find(isinf(var_DistGen))) = [];
var_13103(find(isinf(var_13103))) = [];
var_13583(find(isinf(var_13583))) = [];
var_14391(find(isinf(var_14391))) = [];
var_15705(find(isinf(var_15705))) = [];
var_16242(find(isinf(var_16242))) = [];
var_18345(find(isinf(var_18345))) = [];
var_18559(find(isinf(var_18559))) = [];
var_19149(find(isinf(var_19149))) = [];
var_19379(find(isinf(var_19379))) = [];
var_19501(find(isinf(var_19501))) = [];

totalVarOutput = sum(var_Output)
totalDistGen = sum(var_DistGen)
total_13103 = sum(var_13103)
total_13583 = sum(var_13583)
total_14391 = sum(var_14391)
total_15705 = sum(var_15705)
total_16242 = sum(var_16242)
total_18345 = sum(var_18345)
total_18559 = sum(var_18559)
total_19149 = sum(var_19149)
total_19379 = sum(var_19379)
total_19501 = sum(var_19501)
```

```
totalVarOutput2 = std(Output)/mean(Output)
totalDistGen2 = std(DistGen)/mean(DistGen)
total2_13103 = std(site_13103)/mean(site_13103)
total2_13583 = std(site_13583)/mean(site_13583)
total2_14391 = std(site_14391)/mean(site_14391)
total2_15705 = std(site_15705)/mean(site_15705)
total2_16242 = std(site_16242)/mean(site_16242)
total2_18345 = std(site_18345)/mean(site_18345)
total2_18559 = std(site_18559)/mean(site_18559)
total2_19149 = std(site_19149)/mean(site_19149)
total2_19379 = std(site_19379)/mean(site_19379)
total2_19501 = std(site_19501)/mean(site_19501)

monthAvgOutputL = zeros(1,24);
monthAvgVarL = zeros(1,24);

for i=1:24

    monthAvgOutputL(i) = mean(Output(4386*(i-1)+1:4386*i)); %
Approximately 4386 10 min intervals per month.
    monthAvgVarL(i) = sum(abs(diff(Output(4386*(i-
1)+1:4386*i))))/mean(Output);

end

save('monthAvgL','monthAvgOutputL','monthAvgVarL')



%% Wind Power Data Analysis
% Jim Gao  UC Berkeley

clc
clear all
close all

load('dataVec')

x_vec = zeros(10527,10);

dataVec1 = zeros(length(dataVec),10);


% dataVec1 = zeros(length(dataVec)-1,10);

mean_13103 = mean(dataVec(:,1));
mean_13583 = mean(dataVec(:,2));
mean_14391 = mean(dataVec(:,3));
mean_15705 = mean(dataVec(:,4));
mean_16242 = mean(dataVec(:,5));
mean_18345 = mean(dataVec(:,6));
mean_18559 = mean(dataVec(:,7));
mean_19149 = mean(dataVec(:,8));
```

```
mean_19379 = mean(dataVec(:,9));
mean_19501 = mean(dataVec(:,10));

% mean_vec = mean(dataVec,2);
% absMean = mean(mean_vec);

for i=1:length(dataVec)-1
    dataVec1(i,1) = (abs(dataVec(i+1,1) -
dataVec(i,1)))/dataVec(i+1,1);
    dataVec1(i,2) = (abs(dataVec(i+1,2) -
dataVec(i,2)))/dataVec(i+1,2);
    dataVec1(i,3) = (abs(dataVec(i+1,3) -
dataVec(i,3)))/dataVec(i+1,3);
    dataVec1(i,4) = (abs(dataVec(i+1,4) -
dataVec(i,4)))/dataVec(i+1,4);
    dataVec1(i,5) = (abs(dataVec(i+1,5) -
dataVec(i,5)))/dataVec(i+1,5);
    dataVec1(i,6) = (abs(dataVec(i+1,6) -
dataVec(i,6)))/dataVec(i+1,6);
    dataVec1(i,7) = (abs(dataVec(i+1,7) -
dataVec(i,7)))/dataVec(i+1,7);
    dataVec1(i,8) = (abs(dataVec(i+1,8) -
dataVec(i,8)))/dataVec(i+1,8);
    dataVec1(i,9) = (abs(dataVec(i+1,9) -
dataVec(i,9)))/dataVec(i+1,9);
    dataVec1(i,10) = (abs(dataVec(i+1,10) -
dataVec(i,10)))/dataVec(i+1,10);
end

% for i=1:length(dataVec)-1
%     dataVec1(i,1) = (abs(dataVec(i+1,1) - dataVec(i,1)))/mean_13103;
%     dataVec1(i,2) = (abs(dataVec(i+1,2) - dataVec(i,2)))/mean_13583;
%     dataVec1(i,3) = (abs(dataVec(i+1,3) - dataVec(i,3)))/mean_14391;
%     dataVec1(i,4) = (abs(dataVec(i+1,4) - dataVec(i,4)))/mean_15705;
%     dataVec1(i,5) = (abs(dataVec(i+1,5) - dataVec(i,5)))/mean_16242;
%     dataVec1(i,6) = (abs(dataVec(i+1,6) - dataVec(i,6)))/mean_18345;
%     dataVec1(i,7) = (abs(dataVec(i+1,7) - dataVec(i,7)))/mean_18559;
%     dataVec1(i,8) = (abs(dataVec(i+1,8) - dataVec(i,8)))/mean_19149;
%     dataVec1(i,9) = (abs(dataVec(i+1,9) - dataVec(i,9)))/mean_19379;
%     dataVec1(i,10) = (abs(dataVec(i+1,10) -
dataVec(i,10)))/mean_19501;
% end

% for i=1:length(dataVec)-1
%     dataVec1(i,1) = ((dataVec(i+1,1) -
dataVec(i,1))^2)/dataVec(i+1,1);
%     dataVec1(i,2) = ((dataVec(i+1,2) -
dataVec(i,2))^2)/dataVec(i+1,2);
%     dataVec1(i,3) = ((dataVec(i+1,3) -
dataVec(i,3))^2)/dataVec(i+1,3);
%     dataVec1(i,4) = ((dataVec(i+1,4) -
dataVec(i,4))^2)/dataVec(i+1,4);
%     dataVec1(i,5) = ((dataVec(i+1,5) -
dataVec(i,5))^2)/dataVec(i+1,5);
%     dataVec1(i,6) = ((dataVec(i+1,6) -
dataVec(i,6))^2)/dataVec(i+1,6);
```

```
%     dataVec1(i,7) = ((dataVec(i+1,7) -
dataVec(i,7))^2)/dataVec(i+1,7);
%     dataVec1(i,8) = ((dataVec(i+1,8) -
dataVec(i,8))^2)/dataVec(i+1,8);
%     dataVec1(i,9) = ((dataVec(i+1,9) -
dataVec(i,9))^2)/dataVec(i+1,9);
%     dataVec1(i,10) = ((dataVec(i+1,10) -
dataVec(i,10))^2)/dataVec(i+1,10);
% end

% for i=1:length(dataVec)-1
%     dataVec1(i,1) = ((dataVec(i+1,1) - dataVec(i,1))^2)/mean_13103;
%     dataVec1(i,2) = ((dataVec(i+1,2) - dataVec(i,2))^2)/mean_13583;
%     dataVec1(i,3) = ((dataVec(i+1,3) - dataVec(i,3))^2)/mean_14391;
%     dataVec1(i,4) = ((dataVec(i+1,4) - dataVec(i,4))^2)/mean_15705;
%     dataVec1(i,5) = ((dataVec(i+1,5) - dataVec(i,5))^2)/mean_16242;
%     dataVec1(i,6) = ((dataVec(i+1,6) - dataVec(i,6))^2)/mean_18345;
%     dataVec1(i,7) = ((dataVec(i+1,7) - dataVec(i,7))^2)/mean_18559;
%     dataVec1(i,8) = ((dataVec(i+1,8) - dataVec(i,8))^2)/mean_19149;
%     dataVec1(i,9) = ((dataVec(i+1,9) - dataVec(i,9))^2)/mean_19379;
%     dataVec1(i,10) = ((dataVec(i+1,10) -
dataVec(i,10))^2)/mean_19501;
% end

for j=1:10527 %floor(length(dataVec)/10)

    A = dataVec1(10*(j-1)+1:10*j,:);
    b = 10527*ones(10,1);

    x1 = A\b;

    for n=1:10
        if A(:,n) == [0 0 0 0 0 0 0 0 0 0]'
            x1(n) = 0;
        end
    end

    x = zeros(10,1);

    xNorm = norm(x1-x)/norm(x1);

    while xNorm >= 10^-3

        z = find(x1 < zeros(size(x1)));

        for i = 1:length(z)
            A(z(i),z(i)) = A(z(i),z(i)) + 500*abs(x1(z(i)));
        end

        x = A\b;

        for n=1:10
            if A(:,n) == [0 0 0 0 0 0 0 0 0 0]'
                x(n) = 0;
```

```
            end
        end

        xNorm = norm(x-x1)/norm(x1);
        x1 = x;

    end

    x1 = x1/sum(x1);

    x_vec(j,:) = x1';

end

x_vec(find(isnan(x_vec))) = 0;
x_vec = mean(x_vec);
x_vec = x_vec/sum(x_vec);

k_calc = x_vec;

save('kVals_Calc')
save('k_calc','k_calc')

% Plot year's data
% Small variation in wind speed can cause a large variation in
extracted
% power. Plot wind speed vs turbine output to demonstrate.
% Point out variability, reliance upon wind
% Introduce research question
% Dynamic load stabilization
% compare with moving average
% Can be accomplished by adjusting electric load, pitch control

%% Comparison of results

load('kVals_Calc')

Output = zeros(10*10527,1);
DistGen = zeros(10*10527,1);

for j=1:10*10527

    Output(j) = dataVec(j,:)*x_vec';

end

for i = 1:10*10527

    DistGen(i) = mean(dataVec(i,:));

end

site_13103 = dataVec(1:10*10527,1); %Test sites
```

```
site_13583 = dataVec(1:10*10527,2);
site_14391 = dataVec(1:10*10527,3);
site_15705 = dataVec(1:10*10527,4);
site_16242 = dataVec(1:10*10527,5);
site_18345 = dataVec(1:10*10527,6);
site_18559 = dataVec(1:10*10527,7);
site_19149 = dataVec(1:10*10527,8);
site_19379 = dataVec(1:10*10527,9);
site_19501 = dataVec(1:10*10527,10);

% figure(1)
%
plot(1:10:100*10527,Output,'g',1:10:100*10527,DistGen,1:10:100*10527,si
te_13103,'r')
% xlabel('Time')
% ylabel('Total Power Output (MW)')
% title('Wind Production for Optimized, Distributed, and Individual
Scenarios')
% legend('Optimized','Distributed','Site 19598')

mean_Output = mean(Output)
mean_DistGen = mean(DistGen)

[m,n] = size(Output);
var_Output = zeros(m-1,1);
var_DistGen = zeros(m-1,1);
var_13103 = zeros(m-1,1);
var_13583 = zeros(m-1,1);
var_14391 = zeros(m-1,1);
var_15705 = zeros(m-1,1);
var_16242 = zeros(m-1,1);
var_18345 = zeros(m-1,1);
var_18559 = zeros(m-1,1);
var_19149 = zeros(m-1,1);
var_19379 = zeros(m-1,1);
var_19501 = zeros(m-1,1);

for i=1:m-1
    var_Output(i) = abs(Output(i+1) - Output(i))/mean_Output;
    var_DistGen(i) = abs(DistGen(i+1) - DistGen(i))/mean_DistGen;
    var_13103(i) = abs(site_13103(i+1) - site_13103(i))/mean_13103;
    var_13583(i) = abs(site_13583(i+1) - site_13583(i))/mean_13583;
    var_14391(i) = abs(site_14391(i+1) - site_14391(i))/mean_14391;
    var_15705(i) = abs(site_15705(i+1) - site_15705(i))/mean_15705;
    var_16242(i) = abs(site_16242(i+1) - site_16242(i))/mean_16242;
    var_18345(i) = abs(site_18345(i+1) - site_18345(i))/mean_18345;
    var_18559(i) = abs(site_18559(i+1) - site_18559(i))/mean_18559;
    var_19149(i) = abs(site_19149(i+1) - site_19149(i))/mean_19149;
    var_19379(i) = abs(site_19379(i+1) - site_19379(i))/mean_19379;
    var_19501(i) = abs(site_19501(i+1) - site_19501(i))/mean_19501;
end

% for i=1:m-1
%     var_Output(i) = ((Output(i+1) - Output(i))^2)/mean_Output;
%     var_DistGen(i) = ((DistGen(i+1) - DistGen(i))^2)/mean_DistGen;
%     var_13103(i) = ((site_13103(i+1) - site_13103(i))^2)/mean_13103;
```

```
%     var_13583(i) = ((site_13583(i+1) - site_13583(i))^2)/mean_13583;
%     var_14391(i) = ((site_14391(i+1) - site_14391(i))^2)/mean_14391;
%     var_15705(i) = ((site_15705(i+1) - site_15705(i))^2)/mean_15705;
%     var_16242(i) = ((site_16242(i+1) - site_16242(i))^2)/mean_16242;
%     var_18345(i) = ((site_18345(i+1) - site_18345(i))^2)/mean_18345;
%     var_18559(i) = ((site_18559(i+1) - site_18559(i))^2)/mean_18559;
%     var_19149(i) = ((site_19149(i+1) - site_19149(i))^2)/mean_19149;
%     var_19379(i) = ((site_19379(i+1) - site_19379(i))^2)/mean_19379;
%     var_19501(i) = ((site_19501(i+1) - site_19501(i))^2)/mean_19501;
% end

var_Output(find(isnan(var_Output))) = [];
var_DistGen(find(isnan(var_DistGen))) = [];
var_13103(find(isnan(var_13103))) = [];
var_13583(find(isnan(var_13583))) = [];
var_14391(find(isnan(var_14391))) = [];
var_15705(find(isnan(var_15705))) = [];
var_16242(find(isnan(var_16242))) = [];
var_18345(find(isnan(var_18345))) = [];
var_18559(find(isnan(var_18559))) = [];
var_19149(find(isnan(var_19149))) = [];
var_19379(find(isnan(var_19379))) = [];
var_19501(find(isnan(var_19501))) = [];

var_Output(find(isinf(var_Output))) = [];
var_DistGen(find(isinf(var_DistGen))) = [];
var_13103(find(isinf(var_13103))) = [];
var_13583(find(isinf(var_13583))) = [];
var_14391(find(isinf(var_14391))) = [];
var_15705(find(isinf(var_15705))) = [];
var_16242(find(isinf(var_16242))) = [];
var_18345(find(isinf(var_18345))) = [];
var_18559(find(isinf(var_18559))) = [];
var_19149(find(isinf(var_19149))) = [];
var_19379(find(isinf(var_19379))) = [];
var_19501(find(isinf(var_19501))) = [];

totalVarOutput = sum(var_Output)
totalDistGen = sum(var_DistGen)
total_13103 = sum(var_13103)
total_13583 = sum(var_13583)
total_14391 = sum(var_14391)
total_15705 = sum(var_15705)
total_16242 = sum(var_16242)
total_18345 = sum(var_18345)
total_18559 = sum(var_18559)
total_19149 = sum(var_19149)
total_19379 = sum(var_19379)
total_19501 = sum(var_19501)

totalVarOutput2 = std(Output)/mean(Output)
totalDistGen2 = std(DistGen)/mean(DistGen)
total2_13103 = std(site_13103)/mean(site_13103)
total2_13583 = std(site_13583)/mean(site_13583)
total2_14391 = std(site_14391)/mean(site_14391)
total2_15705 = std(site_15705)/mean(site_15705)
```

```
total2_16242 = std(site_16242)/mean(site_16242)
total2_18345 = std(site_18345)/mean(site_18345)
total2_18559 = std(site_18559)/mean(site_18559)
total2_19149 = std(site_19149)/mean(site_19149)
total2_19379 = std(site_19379)/mean(site_19379)
total2_19501 = std(site_19501)/mean(site_19501)

monthAvgOutputM = zeros(1,24); % Monthly power output average for
moving window
monthAvgVarM = zeros(1,24); % Monthly output variance
monthAvgOutputD = zeros(1,24); % Evenly distributed
monthAvgVarD = zeros(1,24);
monthAvgOutputC = zeros(1,24); % Site 19379
monthAvgVarC = zeros(1,24);

for i=1:24

    monthAvgOutputM(i) = mean(Output(4386*(i-1)+1:4386*i)); %
Approximately 4386 10 min intervals per month.
    monthAvgVarM(i) = sum(abs(diff(Output(4386*(i-
1)+1:4386*i))))/mean(Output);
    monthAvgOutputD(i) = mean(DistGen(4386*(i-1)+1:4386*i));
    monthAvgVarD(i) = sum(abs(diff(DistGen(4386*(i-
1)+1:4386*i))))/mean(DistGen);
    monthAvgOutputC(i) = mean(site_19379(4386*(i-1)+1:4386*i));
    monthAvgVarC(i) = sum(abs(diff(site_19379(4386*(i-
1)+1:4386*i))))/mean(Output);
end

save('monthAvgMDC','monthAvgOutputM','monthAvgOutputD','monthAvgOutputC
','monthAvgVarM','monthAvgVarD','monthAvgVarC')
%% Create Plots

clc
clear all
close all

load('monthAvgMDC')
load('monthAvgL')

figure(1)
hold on
plot(1:24,monthAvgOutputM,'r-*',1:24,monthAvgOutputD,'g-
x',1:24,monthAvgOutputL,'c-+',1:24,monthAvgOutputC,'-o')
xlabel('Months (2004-2005)')
ylabel('Mean Power Output')
title('Monthly Power Output for Distributed and Concentrated
Scenarios')
legend('Moving-Window','Evenly-Distributed','Lagrange','Site 19379')

figure(2)
hold on
plot(1:24,monthAvgVarM,'r-*',1:24,monthAvgVarD,'g-
x',1:24,monthAvgVarL,'c-+',1:24,monthAvgVarC,'-o')
xlabel('Months (2004-2005)')
```

```
ylabel('Output Variability')
title('Monthly Output Variability for Distributed and Concentrated
Scenarios')
legend('Moving-Window','Evenly-Distributed','Lagrange','Site 19379')
```