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Contents

MAE579 - Wind Energy HW-3

```
clear all;
close all;
clc;

% % Wind Energy HW 3

% % Import wind data

    load('Data_for_VAD.mat');
    range = Data.range;
    az = Data.az;
    el = Data.el;
    rv = Data.rv;

% % Generate random velocity vectors


    V = 20 + zeros(133,1);     % Assume wind vel in x-direction const. = 20m/s

    x = 1:133;
    y = 1:133;
    z = 1:133;

        z0 = .03 ;               % Roughness length (Assumed: Flat Plains)
        ustar = (.075) .* V ;    % Friction velocity, generally ustar/u = .05 to .1
        k = .4 ;                 % Von Karman Constant
```

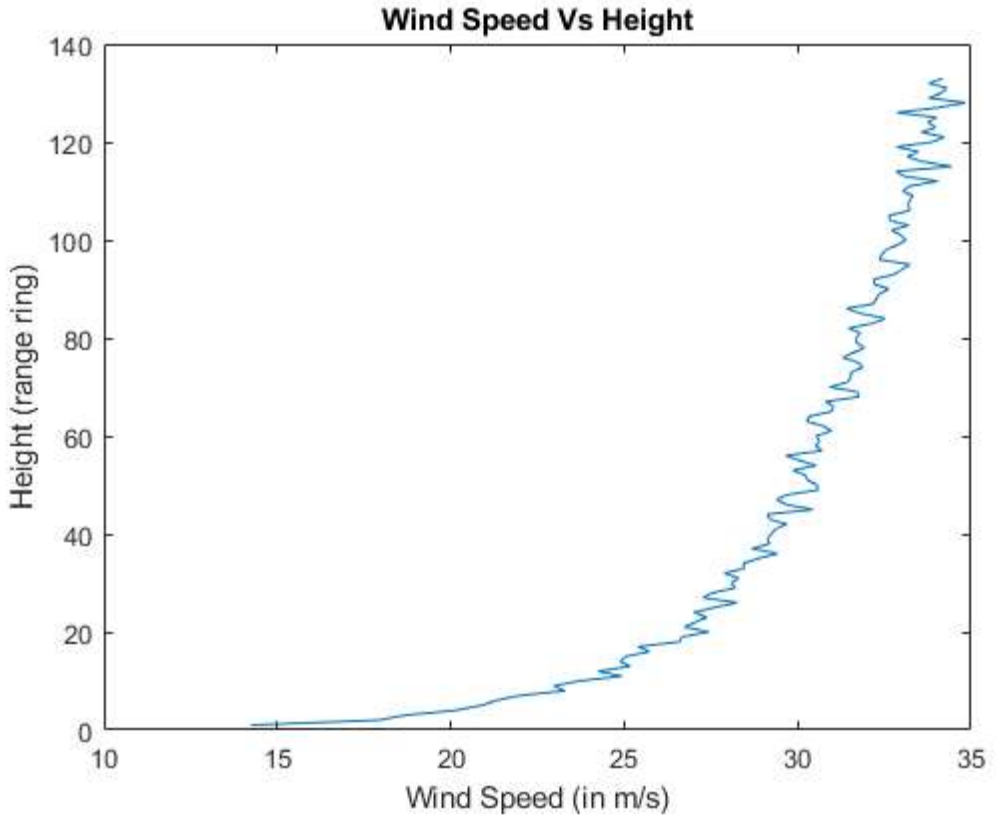
Applying log law

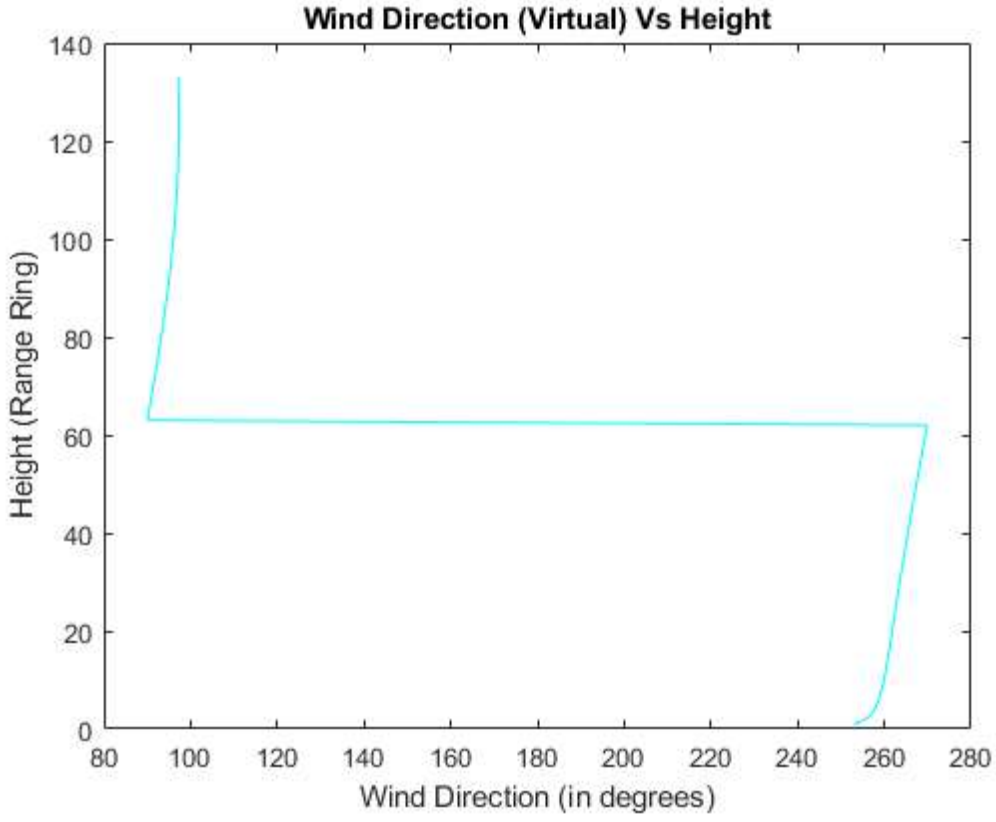
```
    u = (ustar./k).*log(z'./z0);    % u-component wind vel. with log-law


    v = zeros(133,1);

    for i=1:length(z)
        v(i,1) = 4*cos(0.025*i);
    end

    w = zeros(133,1);

    % Random kick

    rk = normrnd(.075,.015,133,1);
    for i = 1:length(rk)
        u(i) = u(i) + u(i)*rk(i);
    end

    for i = 1:length(rk)
```

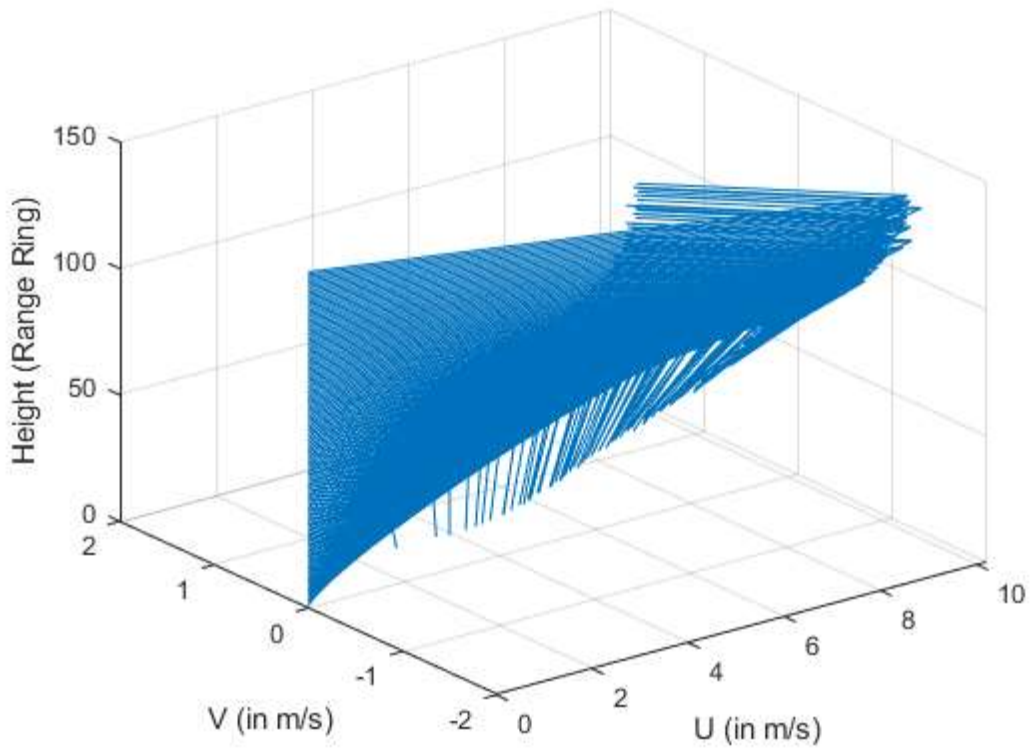
```
    v(i) = v(i) + v(i)*rk(i);
end

V_resltant = sqrt(u.^2 + v.^2);

figure
plot(V_resltant,z)
xlabel('Wind Speed (in m/s)');
ylabel('Height (range ring)');
title('Wind Speed Vs Height');

theta = zeros(133,1);

for i = 1:133
    if u(i,1) > 0 && v(i,1) > 0
        theta(i,1) = 270 - atand(abs((v(i,1)/u(i,1)))) ;
                else if u(i,1) > 0 && v(i,1) < 0
                    theta(i,1) = 90 + atand(abs((v(i,1)/u(i,1)))) ;
                    else if u(i,1) < 0 && v(i,1) < 0
                        theta(i,1) = 270 + atand(abs((v(i,1)/u(i,1)))) ;
                        else if u(i,1) < 0 && v(i,1) > 0
                            theta(i,1) = 90 - atand(abs((v(i,1)/u(i,1))));
                        end
                    end
                end
    end
end


figure
plot (theta', z, 'c');
xlabel('Wind Direction (in degrees)');
ylabel('Height (Range Ring)');
title('Wind Direction (Virtual) Vs Height')

x1 = zeros(size(z));
y1 = zeros(size(z));

figure
quiver3(x1,y1,z,u',v',w')
xlabel('U (in m/s)');
ylabel('V (in m/s)');
zlabel('Height (Range Ring)')

whos
```

```
Name              Size                 Bytes  Class     Attributes

Data              1x516            182483064  struct
V               133x1                   1064  double
V_resltant      133x1                   1064  double
az               83x133                88312  double
el               83x133                88312  double
i                 1x1                     8  double
k                 1x1                     8  double
range            83x133                88312  double
rk              133x1                   1064  double
rv               83x133                88312  double
theta           133x1                   1064  double
```

```
u               133x1                1064  double
ustar           133x1                1064  double
v               133x1                1064  double
w               133x1                1064  double
x                 1x133              1064  double
x1                1x133              1064  double
y                 1x133              1064  double
y1                1x133              1064  double
z                 1x133              1064  double
z0                1x1                   8  double
```


Wind Speed Vs Height
Height (range ring)
Wind Speed (in m/s)
0
20
40
60
80
100
120
140
10
15
20
25
30
35


Wind Direction (Virtual) Vs Height
Height (Range Ring)
Wind Direction (in degrees)
0
20
40
60
80
100
120
140
80
100
120
140
160
180
200
220
240
260
280



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