# Task 3

LAB3: SINGLE KNIFE-EDGE DIFFRACTION

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SECTION: 5

## Objectives:

- Observing the effect of single knife -edge diffraction.
- Implementing the single knife -edge diffraction model in MATLAB.

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Fresnel-Kirchhoff diffraction parameter equation:

$$v = h\sqrt{\frac{\lambda}{2}\left(\frac{1}{d_1}+\frac{1}{d_2}\right)} = \theta\sqrt{\frac{2}{\lambda\left(\frac{1}{d_1}+\frac{1}{d_2}\right)}} = \sqrt{\frac{2h\theta}{\lambda}} = \sqrt{\frac{2d}{\lambda}.\alpha_1\alpha_2}$$

diffraction gain (or loss) equation:

$$G(v) = 6.9 + 20\,log_{10}\left(\sqrt{(v-0.1)^2+1}+v-0.1\right) \quad dB$$

"For the case where v > -0.7"

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## Task3:

a) Implement a function that calculates the diffraction loss given d1 d2, f and h.

```
%Function Description: calculates the diffraction loss
function [G_V] = diffractionLoss(h, f, dl, d2)
%Wavelength Calculation
Lamda = (3*10^8) / f;
%Fresnel-Kirchhoff diffraction parameter calculation
v = h * sqrt( ((1/dl) + (1/d2)) * Lamda/2);
%diffraction loss calculation
G_V = 6.9 + 20*log10( sqrt( (v-0.1)^2 + 1) + v - 0.1);
end
```

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b) Using the function implemented in (a) determine the diffraction loss incurred for d1=10 Km, d2 = 5 Km and h = 20 m at frequency 10 GHz.

```
1   % ~~~~~~~~~~~~~~~~~~~~ Abdelrahman Matarawy ~~~~~~~~~~~~~~~~~~~~ %
2   % ~~~~~~~~~~~~~~~~~~~~~~~~~~ Section 5 ~~~~~~~~~~~~~~~~~~~~~~~~~~ %
3   clear;
4   clc;
5   f = 10 ^9;
6   %Height of Between Obstacle and Tx
7   h = 20;
8   %Distance Between Tx and obstacle
9   dl = 10 * 10^3;
10  %Distance Between Rx and obstacle
11  d2 = 5 * 10^3;
12  %Diffraction Loss Value
13  [loss] = diffractionLoss(h, f, dl, d2)
```

Command Window

```
loss =

    7.1967
```

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c) Implement a function that calculates the diffraction loss given the Fresnel-Kirchoff diffraction parameter.

```
function [G] = Knife_Edge_Model_Plot(V)
    %Loop for Differant Values of V
    for n =1 : 1 : size(V, 2)
        %In case v < -0.7 Loss = 0
        if V(n) < -0.7
            G(n) = 0;
        else
            %In case v > -0.7 Loss equal This Equation
            G(n) = 6.9 + 20*log10( sqrt( (V(n) - 0.1).^2 + 1) + V(n) - 0.1);
        end

    end

end
```

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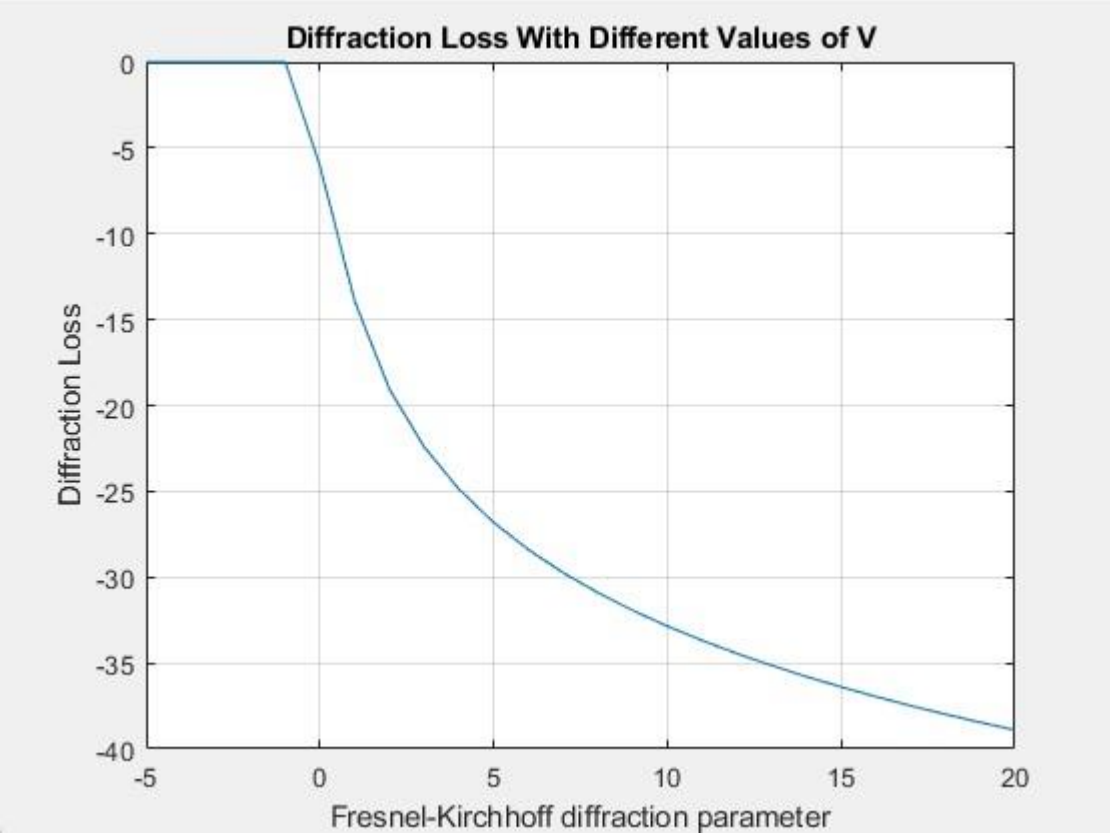
d) Use the function in (c) to plot the diffraction gain versus the Fresnel – Kirchoff parameter. Take the range of v from -5 to 20. (any value less than -0.7 assume the gain = 0 dB).

```
clear;
clc;
v = -5 : 1 : 20;
[G] = Knife_Edge_Model_Plot(v);
plot(v, -G)
title('Diffraction Loss With Different Values of V');
xlabel('Fresnel-Kirchhoff diffraction parameter');
ylabel('Diffraction Loss');
grid on;
```


Diffraction Loss With Different Values of V
Diffraction Loss
Fresnel-Kirchhoff diffraction parameter
0
-5
-10
-15
-20
-25
-30
-35
-40
-5
0
5
10
15
20