AIM:RADIATION PATTERN WITH BEAMWIDTH

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clc;

clear;

clf(); // Clear previous plots


// --- Radiation Pattern Function ---
function val=rad_pattern(theta)
    val = cos(theta)^2; // Simple radiation pattern
endfunction

// --- Define angle ranges ---
theta = linspace(0, %pi, 100);  // Theta: 0 to π
phi = linspace(0, 2 * %pi, 100); // Phi: 0 to 2π

// --- Calculate Total Radiated Power ---
total_power = 0;
for i = 1:length(theta)
    for j = 1:length(phi)
        total_power = total_power + rad_pattern(theta(i)) *
sin(theta(i));
    end
end

// --- Directivity (Unitless) ---
max_val = max(rad_pattern(theta)); // Maximum radiation
D = (4 * %pi * max_val) / total_power;
disp("Directivity = " + string(D)); // No dB, just raw value

// --- Beamwidth Calculation ---
theta_bw = linspace(-%pi/2, %pi/2, 200);
pattern = rad_pattern(theta_bw);

half_power = max(pattern) / sqrt(2); // Half power level
idx = find(pattern >= half_power);
beamwidth = theta_bw(idx($)) - theta_bw(idx(1));
beam_deg = beamwidth * 180 / %pi;

disp("Beamwidth = " + string(beam_deg) + " degrees");

// --- Plot Radiation Pattern ---
plot(theta_bw, pattern, 'b');
xgrid();
xlabel("Theta (radians)");
ylabel("Radiation Pattern");
title("Radiation Pattern with -3 dB Line");

// Draw horizontal line at half-power level
```

```
plot([theta_bw(1), theta_bw($)], [half_power, half_power], 'r--'); //
red dashed line
```

OUTPUT :

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"Directivity: 0.0059831 dB"

 "Beamwidth: 63.636364 degrees"
```