Field Winding Design for 6-Pole DC Shunt Machine

**CODE:**

clc; clear;

%

% Given data V = 450;

% Rated voltage (V) p = 6;

% Number of poles AT\_per\_pole = 6500;

% AT per pole Lp = 180e-3; bp = 100e-3; di = 18e-3; rho = 0.02;

V\_drop = 30;

% Pole length (m)

% Pole width (m)

% Pole depth (m) (not used directly here)

% Resistivity (ohm·m/mm^2)

% Regulator drop (V)

ins\_thickness = 0.01e-3; % Insulation thickness (m)

%

% Step 1: Voltage across shunt field winding Vf\_total = V - V\_drop;

% V across field winding

Vf\_per\_coil = Vf\_total / p; % V across each field coil

% Step 2: Length of mean turn (formula from book) Lmt = 2 \* (Lp + bp) + 4 \* di; % m

% Step 3: Area of conductor (mm^2)

ai = (AT\_per\_pole \* rho \* Lmt) / Vf\_per\_coil;

% Step 4: Diameter of conductor (mm) d\_bare = sqrt((4 \* ai) / pi);

% mm

d\_with\_ins = d\_bare + 2 \* (ins\_thickness \* 1e3); % add insulation (mm)

% Step 5: Number of turns height = 0.10; % 10 cm = 0.10 m

depth = 0.018; % 1.8 cm = 0.018 m

turns\_height = floor(height / (d\_with\_ins \* 1e-3)); turns\_depth = floor(depth / (d\_with\_ins \* 1e-3)); T\_per\_pole = turns\_height \* turns\_depth;

% Step 6: Field current

If = AT\_per\_pole / T\_per\_pole;

% Step 7: Losses in field coil P\_loss = Vf\_per\_coil \* If;

% Step 8: Dissipating surface area (cm^2)

S = 2 \* Lmt \* (height + depth) \* 1e4; % convert m^2 to cm^2

%

% Display results

fprintf('Voltage across each field coil = %.2f V\n', Vf\_per\_coil); fprintf('Length of mean turn Lmt = %.3f m\n', Lmt); fprintf('Conductor cross-sectional area ai = %.3f mm^2\n', ai); fprintf('Bare conductor diameter = %.2f mm\n', d\_bare); fprintf('Diameter with insulation = %.3f mm\n', d\_with\_ins); fprintf('Turns per pole = %d\n', T\_per\_pole);

fprintf('Field current If = %.3f A\n', If); fprintf('Losses in field coil = %.2f W\n', P\_loss); fprintf('Dissipating surface area = %.2f cm^2\n', S);

