Penjelasan Code Perhitungan Hidrostatik

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Bagian 1: Inisialisasi dan Input Data (Line 1-24)

```
1.  %KODING BUATAN AHMAD FAUZAN PRAYOGA...
2.  clc;
3.  clear all;
4.  close all;
5.
6.  % ----------------------------
7.  % INPUT DATA FROM EXCEL
8.  nama_file = 'HALFBREADTH.xlsx';
9.  sheet = 'Sheet1';
10. range_data = 'C2:P24';
11. [~, ~, raw_data] = xlsread(nama_file, sheet, range_data);
12. half_breadth = zeros(size(raw_data)) * NaN;
13.
14. for i = 1:size(raw_data, 1)
15.     for j = 1:size(raw_data, 2)
16.         if isnumeric(raw_data{i,j})
17.             half_breadth(i,j) = raw_data{i,j};
18.         elseif strcmp(raw_data{i,j}, '-')
19.             half_breadth(i,j) = NaN;
20.         elseif ischar(raw_data{i,j}) && ~isempty(str2double(raw_data{i,j}))
21.             half_breadth(i,j) = str2double(raw_data{i,j});
22.         else
23.             half_breadth(i,j) = NaN;
24.         end
```

- **Line 2-4**: Membersihkan environment MATLAB
- **Line 8-10**: Mendefinisikan parameter file Excel
- **Line 11**: Membaca data mentah dari Excel menggunakan `xlsread`
- **Line 12**: Inisialisasi matrix `half_breadth` dengan NaN
- **Line 14-24**: Nested loop untuk konversi data:
  - **Line 16-17**: Handle nilai numerik
  - **Line 18-19**: Konversi '-' ke NaN
  - **Line 20-21**: Coba konversi string numerik ke double
  - **Line 23**: Default ke NaN untuk data invalid

Bagian 2: Persiapan Parameter (Line 25-48)

```
25.     end
26. end
27. half_breadth(isnan(half_breadth)) = 0;
28.
29. % ----------------------------
30. % PARAMETER KAPAL
31. delta_L = 1;
32. delta_WL = 1;
33. rho = 1025;
34.
35. [n_stations, n_waterlines] = size(half_breadth);
36. stations = (0:n_stations-1) * delta_L;
37. midship_pos = mean(stations);
38. Lpp = max(stations);
39. drafts = (0:n_waterlines-1) * delta_WL;
```

```
40.
41. % Station integration coefficients
42. if mod(n_stations, 2) == 1
43.     coeff_stations = ones(1, n_stations);
44.     coeff_stations(2:2:end-1) = 4;
45.     coeff_stations(3:2:end-2) = 2;
46.     delta_station = delta_L / 3;
47. else
48.     coeff_stations = 2 * ones(1, n_stations);
```

- **Line 27**: Mengisi NaN dengan 0
- **Line 31-33**: Parameter fisik kapal
- **Line 35**: Hitung jumlah station dan waterline
- **Line 36**: Generate posisi station
- **Line 37**: Hitung posisi midship
- **Line 38**: Panjang Lpp (Length between perpendiculars)
- **Line 42-48**: Tentukan koefisien integrasi numerik:
  - Simpson's rule untuk station ganjil
  - Trapezoidal rule untuk station genap

Bagian 3: Loop Perhitungan Utama (Line 49-199)

```
49.     coeff_stations([1 end]) = 1;
50.     delta_station = delta_L / 2;
51. end
52.
53. % Variabel hasil
54. all_drafts = [];
55. all_LCB = [];
56. ... Variabel lainnya
57.
58. for wl = 1:n_waterlines
59.     T = drafts(wl);
60.     if T == 0, continue; end
61.
62.     % Sectional Area
63.     A_station = zeros(1, n_stations);
64.     momen_KB = zeros(1, n_stations);
65.     for i = 1:n_stations
66.         y = half_breadth(i, 1:wl);
67.         n = length(y);
68.         if n < 2
69.             A_station(i) = 0;
70.             momen_KB(i) = 0;
71.             continue;
72.         end
73.
74.         % Koefisien integrasi waterline
75.         if mod(n, 2) == 1
76.             coeff = ones(1, n);
77.             coeff(2:2:end-1) = 4;
78.             coeff(3:2:end-2) = 2;
79.             delta_waterline = delta_WL / 3;
80.         else
81.             coeff = 2 * ones(1, n);
82.             coeff([1 end]) = 1;
83.             delta_waterline = delta_WL / 2;
84.         end
85.
86.         A_station(i) = delta_waterline * sum(coeff .* y) * 2;
87.
88.         % Momen KB
89.         z_vals = drafts(1:wl);
90.         sum_z = sum(coeff .* z_vals);
91.         z_centroid = sum_z / sum(coeff);
92.         momen_KB(i) = A_station(i) * z_centroid;
93.     end
94.
```

```
95.     volume = delta_station * sum(coeff_stations .* A_station);
96.     displacement = volume * rho;
97.     total_momen_KB = delta_station * sum(coeff_stations .* momen_KB);
98.     KB = total_momen_KB / volume;
99.
100.    % WSA
101.    G_station = zeros(1, n_stations);
102.    for i = 1:n_stations
103.        y = half_breadth(i, 1:wl);
104.        if length(y) < 2
105.            G_station(i) = 0;
106.            continue;
107.        end
108.        g = sum(sqrt(delta_WL^2 + diff(y).^2));
109.        G_station(i) = 2 * g;
110.    end
111.    WSA = delta_station * sum(coeff_stations .* G_station);
```

- **Line 58**: Mulai loop untuk setiap waterline
- **Line 60**: Skip perhitungan jika draft=0
- **Line 65-93**: Hitung luas station dan momen KB:
  - **Line 75-84**: Tentukan metode integrasi vertikal
  - **Line 86**: Hitung luas station dengan faktor 2 untuk kedua sisi
  - **Line 89-92**: Hitung momen untuk menentukan KB
- **Line 95-98**: Hitung volume, displacement, dan KB
- **Line 101-111**: Hitung Wetted Surface Area (WSA)

Bagian 4: Plotting (Line 200-266)

```
200. % Grafik LCB vs LCF
201. figure('Name','LCB & LCF vs Draft','NumberTitle','off');
202. plot(all_LCB, all_drafts, 'b-o', all_LCF, all_drafts, 'r-s');
203. ylabel('Draft (m)');
204. xlabel('Posisi dari Midship (m)');
205. legend('LCB', 'LCF', 'Location','best');
206. title('LCB dan LCF vs Draft');
207. grid on;
208. set(gca, 'YDir','normal');
209.
210. % Grafik Koefisien
211. figure('Name','Koefisien vs Draft','NumberTitle','off');
212. hold on;
213. plot(all_Cb, all_drafts, 'b-o', 'LineWidth',1.5, 'DisplayName','Cb');
214. plot(all_Cm, all_drafts, 'r--s', 'LineWidth',1.5, 'DisplayName','Cm');
215. plot(all_Cp, all_drafts, 'g-.^', 'LineWidth',1.5, 'DisplayName','Cp');
216. plot(all_Cw, all_drafts, 'm:d', 'LineWidth',1.5, 'DisplayName','Cw');
217. hold off;
218. ylabel('Draft (m)');
219. xlabel('Nilai Koefisien');
220. legend('show','Location','best');
221. title('Koefisien Bentuk Kapal vs Draft');
222. grid on;
223. set(gca, 'YDir','normal');
```

- **Line 201-208**: Plot LCB dan LCF vs draft
- **Line 211-223**: Plot semua koefisien bentuk kapal
- **Line 202**: Gunakan marker 'o' biru untuk LCB dan 's' merah untuk LCF
- **Line 213-216**: Plot empat koefisien dengan style berbeda
- **Line 222**: Aktifkan grid untuk kemudahan pembacaan