

# **LAMPIRAN A**

# **KODE PROGRAM**

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%-----
%% 1. parameter analisis
% frekuensi sampling (Hz)
smpfreq = 8000;
% Half the frame length
frmext = 120; % 15 ms
% Hop size
hopsze = 40; % 5 ms
% Data taper
taper = hanning(2*frmext+1);
st = sum(taper);
st2 = sum(taper.^2);
% Optimization options for OLC
options = optimset('LargeScale', 'off', 'GradObj', 'on', 'TolFun', 1e-3, ...
    'TolX', 1e-3, 'MaxFunEvals', 250, 'LineSearchType', 'cubicpoly', ...
    'Display', 'off', 'DerivativeCheck', 'off');
% Frequency axis for plotting spectra
wtr = linspace(0, pi, 1024);

%% 2. Signal dan Pitch

% fid = fopen('signal.raw', 'rb', 'ieee-le');
% sig = fread(fid, 'short');
% fclose(fid);
sig=wavread('Speech'); % data sendiri

% Load pitch table (time in s, frequency in Hz) and convert to sample and
% radian frequency
load signal.dat;

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pitch = 2*pi*signal(:,2)/smpfreq;

% Position of the analysis frames (use the same as for the pitch)
frmloc = 1 + round(smpfreq*signal(:,1));
frmb = length(frmloc);

%% 3. Deklarasi arrays
% Synthetic signals
synth_ar = zeros(size(sig));
synth_olc = zeros(size(sig));
% Normalization
olanorm = zeros(size(sig));

simpan=[];

%% 4. Analisa Loop (i adalah frame index)
for i = 1:frmb
    % Only do something when the frame is voiced
    if (~isnan(pitch(i)))
        simpan=[simpan i];
        %% 4.a. Compute harmonic amplitudes and apprent noise level
        % Signal frame
        ind = (frmloc(i)-frmbext:frmloc(i)+frmbext)';
        s = sig(ind);
        % Compute number of harmonics
        hrmnb = floor(pi*0.96/pitch(i));
        % Compute the amplitudes of the harmonics using tapered Fourier transform
        REG = exp(j*pitch(i)*ind*(1:hrmnb));
        theta = REG*(taper.*s)*(2/st);
    end
end

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a = abs(theta).^2;
% Estimate noise psd
cn = robnest(s-real(REG*theta), pitch(i), 16);
% Apparent noise level
n = (4*st2/(st^2))*exp(cepsval(pitch(i)*(1:hrmnb), cn));

%% 4.b. Estimasi selubung spektral menggunakan AR
[a_ar, e_ar] = aryule(s.*taper, 12);
% Energy correction for windowing
e_ar = e_ar*((2*frmext+1)/st2)*2/hrmnb;

%% 4.c. Estimasi selubung spektral OLC
% Preliminary estimate using discrete power cepstrum
c_ls = LS(a, pitch(i), 40);
% Estimate the envelope using OLC
c_olc = OLC(c_ls, a, pitch(i)*(1:hrmnb), n, options);

%% 4.d. Plots
% Compute the apparent noise psd estimate
nhat = (4*st2/(st^2))*exp(cepsval(wtr, cn));
% Compute envelope estimated using AR
ehat_ar = 20*log10(abs(freqz(sqrt(e_ar), a_ar, wtr)));
% Compute envelope estimated using OLC
ehat_olc = 10*cepsval(wtr, c_olc)/log(10);
clf;
S = fft(s.*taper, 256)*(2/st);
plot(2*pi*(0:128)/256, 20*log10(abs(S(1:129)))); % Periodogram
hold on;
plot(wtr, 10*log10(nhat), '!'); % estimated noise level

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plot(wtr, ehat_ar, 'k'); % Selubung AR
plot(wtr, ehat_olc, '-r'); % Selubung OLC
xlabel('radian frequency');
ylabel('dB');
title(['Frame ' int2str(i)]);
drawnow;

%%%% 4.e. sinyal rekontruksi menggunakan OLA
% Compute the harmonic magnitudes from the envelope
mamp_ar = abs(freqz(sqrt(e_ar), a_ar, pitch(i)*(1:hrmnb)));
mamp_olc = exp(cepsval(pitch(i)*(1:hrmnb), c_olc)/2);
% Time domain synthetic signal menggunakan model amplitud dan fasa original
phase = angle(theta);
s_ar = real(REG*(mamp_ar'.*exp(j*phase)));
s_olc = real(REG*(mamp_olc'.*exp(j*phase)));
% OLA
synth_ar(ind) = synth_ar(ind) + s_ar.*taper;
synth_olc(ind) = synth_olc(ind) + s_olc.*taper;
% penentuan track dari normalization
olanorm(ind) = olanorm(ind) + taper;
end
end
%%%% 5. sinyal Normalize
ind = find(olanorm > 0);
synth_ar(ind) = synth_ar(ind)./olanorm(ind);
synth_olc(ind) = synth_olc(ind)./olanorm(ind);

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# **LAMPIRAN B**

## **HASIL ESTIMASI**

**Estimasi selubung sepkrtral dari bunyi *voiced* menggunakan metode Auto-Regressive, pada frame 10**

Columns 1 through 5

-50.6695 -50.6675 -50.6616 -50.6516 -50.6376

Columns 6 through 10

-50.6196 -50.5976 -50.5715 -50.5414 -50.5072

Columns 11 through 15

-50.4689 -50.4265 -50.3798 -50.3290 -50.2740

Columns 16 through 20

-50.2146 -50.1510 -50.0829 -50.0105 -49.9335

Columns 21 through 25

-49.8520 -49.7658 -49.6750 -49.5794 -49.4790

Columns 26 through 30

-49.3736 -49.2632 -49.1476 -49.0268 -48.9007

Columns 31 through 35

-48.7691 -48.6318 -48.4888 -48.3399 -48.1850

Columns 36 through 40

-48.0238 -47.8562 -47.6820 -47.5010 -47.3129

Columns 41 through 45

-47.1175 -46.9146 -46.7038 -46.4849 -46.2575

Columns 46 through 50

-46.0212 -45.7758 -45.5207 -45.2555 -44.9797

Columns 51 through 55

-44.6927 -44.3939 -44.0827 -43.7584 -43.4200

Columns 56 through 60

-43.0668 -42.6976 -42.3114 -41.9068 -41.4825

Columns 61 through 65

-41.0367 -40.5675 -40.0729 -39.5502 -38.9964

Columns 66 through 70

-38.4082 -37.7813 -37.1109 -36.3907 -35.6135

Columns 71 through 75  
-34.7698 -33.8482 -32.8334 -31.7059 -30.4400

Columns 76 through 80  
-29.0016 -27.3469 -25.4280 -23.2308 -20.9502

Columns 81 through 85  
-19.4577 -19.9494 -21.8498 -23.9416 -25.7947

Columns 86 through 90  
-27.3671 -28.7005 -29.8416 -30.8287 -31.6908

Columns 91 through 95  
-32.4498 -33.1222 -33.7209 -34.2559 -34.7351

Columns 96 through 100  
-35.1649 -35.5503 -35.8957 -36.2043 -36.4792

Columns 101 through 105  
-36.7225 -36.9364 -37.1225 -37.2822 -37.4165

Columns 106 through 110  
-37.5265 -37.6130 -37.6766 -37.7178 -37.7372

Columns 111 through 115  
-37.7351 -37.7119 -37.6681 -37.6039 -37.5201

Columns 116 through 120  
-37.4171 -37.2961 -37.1583 -37.0056 -36.8404

Columns 121 through 125  
-36.6662 -36.4875 -36.3104 -36.1426 -35.9935

Columns 126 through 130  
-35.8744 -35.7980 -35.7773 -35.8245 -35.9494

Columns 131 through 135  
-36.1575 -36.4493 -36.8201 -37.2610 -37.7601

Columns 136 through 140  
-38.3048 -38.8826 -39.4824 -40.0948 -40.7122

Columns 141 through 145  
-41.3287 -41.9401 -42.5431 -43.1355 -43.7159

Columns 146 through 150  
-44.2833 -44.8373 -45.3776 -45.9043 -46.4175

Columns 151 through 155  
-46.9176 -47.4048 -47.8796 -48.3424 -48.7936

Columns 156 through 160  
-49.2336 -49.6628 -50.0818 -50.4908 -50.8903

Columns 161 through 165  
-51.2806 -51.6621 -52.0351 -52.4000 -52.7570

Columns 166 through 170  
-53.1065 -53.4487 -53.7839 -54.1123 -54.4341

Columns 171 through 175  
-54.7497 -55.0592 -55.3627 -55.6606 -55.9529

Columns 176 through 180  
-56.2398 -56.5216 -56.7983 -57.0702 -57.3373

Columns 181 through 185  
-57.5997 -57.8577 -58.1114 -58.3607 -58.6060

Columns 186 through 190  
-58.8472 -59.0844 -59.3179 -59.5476 -59.7737

Columns 191 through 195  
-59.9961 -60.2151 -60.4308 -60.6430 -60.8520

Columns 196 through 200  
-61.0579 -61.2606 -61.4602 -61.6569 -61.8506

Columns 201 through 205  
-62.0415 -62.2295 -62.4148 -62.5973 -62.7772

Columns 206 through 210  
-62.9545 -63.1291 -63.3013 -63.4710 -63.6382

Columns 211 through 215  
-63.8030 -63.9655 -64.1256 -64.2834 -64.4390

Columns 216 through 220  
-64.5923 -64.7435 -64.8925 -65.0394 -65.1841

Columns 221 through 225  
-65.3269 -65.4675 -65.6062 -65.7428 -65.8775

Columns 226 through 230  
-66.0103 -66.1411 -66.2701 -66.3972 -66.5225

Columns 231 through 235  
-66.6459 -66.7675 -66.8873 -67.0054 -67.1218

Columns 236 through 240  
-67.2364 -67.3493 -67.4605 -67.5700 -67.6779

Columns 241 through 245  
-67.7841 -67.8887 -67.9918 -68.0932 -68.1930

Columns 246 through 250  
-68.2912 -68.3880 -68.4831 -68.5768 -68.6689

Columns 251 through 255  
-68.7595 -68.8486 -68.9363 -69.0225 -69.1072

Columns 256 through 260  
-69.1904 -69.2723 -69.3527 -69.4317 -69.5092

Columns 261 through 265  
-69.5854 -69.6602 -69.7336 -69.8056 -69.8763

Columns 266 through 270  
-69.9456 -70.0135 -70.0801 -70.1454 -70.2093

Columns 271 through 275  
-70.2720 -70.3332 -70.3932 -70.4519 -70.5093

Columns 276 through 280  
-70.5653 -70.6201 -70.6736 -70.7259 -70.7768

Columns 281 through 285  
-70.8265 -70.8749 -70.9220 -70.9679 -71.0126

Columns 286 through 290  
-71.0559 -71.0981 -71.1390 -71.1786 -71.2170

Columns 291 through 295  
-71.2542 -71.2901 -71.3249 -71.3583 -71.3906

Columns 296 through 300  
-71.4216 -71.4514 -71.4800 -71.5073 -71.5335

Columns 301 through 305  
-71.5584 -71.5821 -71.6046 -71.6259 -71.6459

Columns 306 through 310  
-71.6647 -71.6823 -71.6987 -71.7139 -71.7279

Columns 311 through 315  
-71.7406 -71.7521 -71.7625 -71.7715 -71.7794

Columns 316 through 320  
-71.7860 -71.7914 -71.7956 -71.7985 -71.8002

Columns 321 through 325  
-71.8007 -71.8000 -71.7980 -71.7947 -71.7902

Columns 326 through 330  
-71.7845 -71.7775 -71.7692 -71.7597 -71.7489

Columns 331 through 335  
-71.7368 -71.7235 -71.7089 -71.6929 -71.6757

Columns 336 through 340  
-71.6573 -71.6375 -71.6163 -71.5939 -71.5702

Columns 341 through 345  
-71.5451 -71.5187 -71.4910 -71.4619 -71.4314

Columns 346 through 350  
-71.3996 -71.3664 -71.3318 -71.2958 -71.2584

Columns 351 through 355  
-71.2197 -71.1795 -71.1378 -71.0947 -71.0502

Columns 356 through 360  
-71.0042 -70.9568 -70.9078 -70.8573 -70.8054

Columns 361 through 365  
-70.7519 -70.6969 -70.6403 -70.5821 -70.5224

Columns 366 through 370  
-70.4611 -70.3981 -70.3336 -70.2674 -70.1995

Columns 371 through 375  
-70.1299 -70.0587 -69.9857 -69.9110 -69.8346

Columns 376 through 380  
-69.7563 -69.6763 -69.5944 -69.5107 -69.4252

Columns 381 through 385  
-69.3377 -69.2484 -69.1571 -69.0638 -68.9686

Columns 386 through 390  
-68.8713 -68.7720 -68.6706 -68.5671 -68.4615

Columns 391 through 395  
-68.3537 -68.2437 -68.1315 -68.0170 -67.9002

Columns 396 through 400  
-67.7811 -67.6596 -67.5358 -67.4094 -67.2806

Columns 401 through 405  
-67.1493 -67.0154 -66.8789 -66.7398 -66.5979

Columns 406 through 410  
-66.4534 -66.3061 -66.1559 -66.0029 -65.8470

Columns 411 through 415  
-65.6882 -65.5264 -65.3615 -65.1936 -65.0226

Columns 416 through 420  
-64.8485 -64.6712 -64.4907 -64.3069 -64.1200

Columns 421 through 425  
-63.9298 -63.7363 -63.5395 -63.3396 -63.1364

Columns 426 through 430  
-62.9300 -62.7205 -62.5079 -62.2925 -62.0741

Columns 431 through 435  
-61.8532 -61.6297 -61.4040 -61.1763 -60.9469

Columns 436 through 440  
-60.7163 -60.4848 -60.2530 -60.0214 -59.7907

Columns 441 through 445  
-59.5617 -59.3352 -59.1122 -58.8937 -58.6808

Columns 446 through 450  
-58.4748 -58.2770 -58.0887 -57.9113 -57.7463

Columns 451 through 455  
-57.5951 -57.4588 -57.3389 -57.2363 -57.1519

Columns 456 through 460  
-57.0863 -57.0400 -57.0130 -57.0052 -57.0161

Columns 461 through 465  
-57.0450 -57.0911 -57.1532 -57.2300 -57.3203

Columns 466 through 470  
-57.4225 -57.5354 -57.6575 -57.7873 -57.9237

Columns 471 through 475  
-58.0655 -58.2114 -58.3604 -58.5117 -58.6643

Columns 476 through 480  
-58.8175 -58.9707 -59.1233 -59.2748 -59.4247

Columns 481 through 485  
-59.5727 -59.7184 -59.8615 -60.0020 -60.1394

Columns 486 through 490  
-60.2738 -60.4049 -60.5327 -60.6571 -60.7780

Columns 491 through 495  
-60.8953 -61.0091 -61.1193 -61.2259 -61.3289

Columns 496 through 500  
-61.4283 -61.5240 -61.6163 -61.7049 -61.7901

Columns 501 through 505  
-61.8717 -61.9498 -62.0245 -62.0958 -62.1637

Columns 506 through 510  
-62.2282 -62.2893 -62.3472 -62.4018 -62.4532

Columns 511 through 515  
-62.5014 -62.5464 -62.5882 -62.6269 -62.6626

Columns 516 through 520  
-62.6952 -62.7247 -62.7513 -62.7749 -62.7955

Columns 521 through 525  
-62.8133 -62.8281 -62.8401 -62.8492 -62.8555

Columns 526 through 530  
-62.8589 -62.8597 -62.8576 -62.8529 -62.8454

Columns 531 through 535  
-62.8353 -62.8225 -62.8071 -62.7892 -62.7686

Columns 536 through 540  
-62.7455 -62.7199 -62.6918 -62.6613 -62.6284

Columns 541 through 545  
-62.5931 -62.5555 -62.5157 -62.4736 -62.4293

Columns 546 through 550  
-62.3829 -62.3345 -62.2840 -62.2317 -62.1775

Columns 551 through 555  
-62.1215 -62.0639 -62.0047 -61.9441 -61.8822

Columns 556 through 560  
-61.8191 -61.7549 -61.6898 -61.6240 -61.5576

Columns 561 through 565  
-61.4908 -61.4239 -61.3571 -61.2905 -61.2245

Columns 566 through 570  
-61.1593 -61.0952 -61.0324 -60.9714 -60.9125

Columns 571 through 575  
-60.8558 -60.8020 -60.7512 -60.7038 -60.6603

Columns 576 through 580  
-60.6210 -60.5862 -60.5564 -60.5319 -60.5130

Columns 581 through 585  
-60.5000 -60.4934 -60.4932 -60.4998 -60.5134

Columns 586 through 590  
-60.5341 -60.5621 -60.5974 -60.6400 -60.6900

Columns 591 through 595  
-60.7473 -60.8118 -60.8833 -60.9616 -61.0466

Columns 596 through 600  
-61.1379 -61.2354 -61.3386 -61.4472 -61.5610

Columns 601 through 605  
-61.6795 -61.8024 -61.9294 -62.0601 -62.1941

Columns 606 through 610  
-62.3311 -62.4708 -62.6128 -62.7568 -62.9026

Columns 611 through 615  
-63.0498 -63.1982 -63.3475 -63.4975 -63.6480

Columns 616 through 620  
-63.7988 -63.9497 -64.1005 -64.2511 -64.4012

Columns 621 through 625  
-64.5509 -64.6999 -64.8481 -64.9955 -65.1420

Columns 626 through 630  
-65.2874 -65.4317 -65.5749 -65.7168 -65.8575

Columns 631 through 635  
-65.9969 -66.1349 -66.2716 -66.4068 -66.5406

Columns 636 through 640  
-66.6729 -66.8038 -66.9331 -67.0610 -67.1874

Columns 641 through 645  
-67.3122 -67.4356 -67.5574 -67.6777 -67.7965

Columns 646 through 650  
-67.9139 -68.0297 -68.1440 -68.2568 -68.3682

Columns 651 through 655  
-68.4781 -68.5866 -68.6936 -68.7992 -68.9034

Columns 656 through 660  
-69.0061 -69.1075 -69.2075 -69.3061 -69.4034

Columns 661 through 665  
-69.4994 -69.5940 -69.6874 -69.7794 -69.8702

Columns 666 through 670  
-69.9597 -70.0480 -70.1351 -70.2209 -70.3055

Columns 671 through 675  
-70.3890 -70.4713 -70.5524 -70.6324 -70.7113

Columns 676 through 680  
-70.7891 -70.8658 -70.9414 -71.0159 -71.0894

Columns 681 through 685  
-71.1618 -71.2332 -71.3037 -71.3731 -71.4415

Columns 686 through 690  
-71.5090 -71.5755 -71.6411 -71.7057 -71.7695

Columns 691 through 695  
-71.8323 -71.8943 -71.9553 -72.0155 -72.0749

Columns 696 through 700  
-72.1334 -72.1911 -72.2480 -72.3040 -72.3593

Columns 701 through 705  
-72.4138 -72.4676 -72.5205 -72.5728 -72.6242

Columns 706 through 710  
-72.6750 -72.7251 -72.7744 -72.8231 -72.8710

Columns 711 through 715  
-72.9184 -72.9650 -73.0110 -73.0563 -73.1011

Columns 716 through 720  
-73.1451 -73.1886 -73.2315 -73.2738 -73.3155

Columns 721 through 725  
-73.3566 -73.3972 -73.4372 -73.4767 -73.5156

Columns 726 through 730  
-73.5540 -73.5918 -73.6292 -73.6660 -73.7024

Columns 731 through 735  
-73.7383 -73.7736 -73.8086 -73.8430 -73.8770

Columns 736 through 740  
-73.9105 -73.9436 -73.9763 -74.0086 -74.0404

Columns 741 through 745  
-74.0718 -74.1028 -74.1334 -74.1636 -74.1935

Columns 746 through 750  
-74.2230 -74.2521 -74.2808 -74.3092 -74.3372

Columns 751 through 755  
-74.3649 -74.3923 -74.4193 -74.4460 -74.4724

Columns 756 through 760  
-74.4985 -74.5243 -74.5498 -74.5750 -74.5999

Columns 761 through 765  
-74.6246 -74.6489 -74.6730 -74.6969 -74.7205

Columns 766 through 770  
-74.7438 -74.7669 -74.7898 -74.8125 -74.8349

Columns 771 through 775  
-74.8571 -74.8791 -74.9009 -74.9225 -74.9439

Columns 776 through 780  
-74.9651 -74.9861 -75.0069 -75.0276 -75.0481

Columns 781 through 785  
-75.0685 -75.0887 -75.1088 -75.1287 -75.1485

Columns 786 through 790  
-75.1681 -75.1876 -75.2070 -75.2263 -75.2455

Columns 791 through 795  
-75.2646 -75.2836 -75.3025 -75.3213 -75.3400

Columns 796 through 800  
-75.3587 -75.3773 -75.3959 -75.4144 -75.4328

Columns 801 through 805  
-75.4512 -75.4696 -75.4879 -75.5062 -75.5245

Columns 806 through 810  
-75.5428 -75.5611 -75.5793 -75.5976 -75.6159

Columns 811 through 815  
-75.6342 -75.6526 -75.6710 -75.6894 -75.7078

Columns 816 through 820  
-75.7263 -75.7449 -75.7635 -75.7822 -75.8010

Columns 821 through 825  
-75.8198 -75.8388 -75.8578 -75.8769 -75.8961

Columns 826 through 830  
-75.9155 -75.9349 -75.9545 -75.9742 -75.9941

Columns 831 through 835  
-76.0140 -76.0342 -76.0544 -76.0749 -76.0955

Columns 836 through 840  
-76.1162 -76.1372 -76.1583 -76.1796 -76.2010

Columns 841 through 845  
-76.2227 -76.2446 -76.2666 -76.2889 -76.3114

Columns 846 through 850  
-76.3341 -76.3570 -76.3801 -76.4035 -76.4271

Columns 851 through 855  
-76.4509 -76.4749 -76.4992 -76.5237 -76.5485

Columns 856 through 860  
-76.5735 -76.5987 -76.6242 -76.6500 -76.6760

Columns 861 through 865  
-76.7022 -76.7287 -76.7555 -76.7825 -76.8097

Columns 866 through 870  
-76.8372 -76.8650 -76.8930 -76.9213 -76.9498

Columns 871 through 875  
-76.9786 -77.0076 -77.0368 -77.0664 -77.0961

Columns 876 through 880  
-77.1261 -77.1563 -77.1868 -77.2175 -77.2484

Columns 881 through 885  
-77.2795 -77.3109 -77.3424 -77.3742 -77.4062

Columns 886 through 890  
-77.4384 -77.4708 -77.5034 -77.5361 -77.5691

Columns 891 through 895  
-77.6022 -77.6355 -77.6690 -77.7026 -77.7364

Columns 896 through 900  
-77.7703 -77.8043 -77.8385 -77.8728 -77.9072

Columns 901 through 905  
-77.9418 -77.9764 -78.0111 -78.0459 -78.0808

Columns 906 through 910  
-78.1158 -78.1509 -78.1860 -78.2211 -78.2563

Columns 911 through 915  
-78.2915 -78.3267 -78.3620 -78.3973 -78.4326

Columns 916 through 920  
-78.4678 -78.5031 -78.5383 -78.5735 -78.6087

Columns 921 through 925  
-78.6438 -78.6788 -78.7138 -78.7487 -78.7836

Columns 926 through 930  
-78.8183 -78.8530 -78.8875 -78.9220 -78.9563

Columns 931 through 935  
-78.9905 -79.0245 -79.0584 -79.0922 -79.1258

Columns 936 through 940  
-79.1592 -79.1925 -79.2256 -79.2585 -79.2912

Columns 941 through 945  
-79.3237 -79.3560 -79.3881 -79.4199 -79.4516

Columns 946 through 950  
-79.4830 -79.5141 -79.5450 -79.5757 -79.6061

Columns 951 through 955  
-79.6362 -79.6660 -79.6956 -79.7249 -79.7538

Columns 956 through 960  
-79.7825 -79.8109 -79.8390 -79.8668 -79.8942

Columns 961 through 965  
-79.9214 -79.9482 -79.9746 -80.0007 -80.0265

Columns 966 through 970  
-80.0520 -80.0770 -80.1018 -80.1261 -80.1501

Columns 971 through 975  
-80.1737 -80.1970 -80.2199 -80.2424 -80.2645

Columns 976 through 980  
-80.2862 -80.3075 -80.3284 -80.3489 -80.3691

Columns 981 through 985  
-80.3888 -80.4081 -80.4270 -80.4454 -80.4635

Columns 986 through 990  
-80.4811 -80.4983 -80.5151 -80.5315 -80.5474

Columns 991 through 995  
-80.5628 -80.5779 -80.5925 -80.6067 -80.6204

Columns 996 through 1000  
-80.6336 -80.6465 -80.6588 -80.6708 -80.6822

Columns 1001 through 1005  
-80.6932 -80.7038 -80.7139 -80.7235 -80.7327

Columns 1006 through 1010  
-80.7414 -80.7496 -80.7574 -80.7647 -80.7716

Columns 1011 through 1015  
-80.7780 -80.7839 -80.7893 -80.7943 -80.7988

Columns 1016 through 1020  
-80.8028 -80.8064 -80.8095 -80.8121 -80.8142

Columns 1021 through 1024  
-80.8159 -80.8171 -80.8178 -80.8180

**Estimasi selubung spektral dari bunyi *voiced* menggunakan metode OLC, pada frame 10**

Columns 1 through 5  
-31.7971 -31.7968 -31.7960 -31.7946 -31.7927

Columns 6 through 10  
-31.7904 -31.7877 -31.7847 -31.7815 -31.7781

Columns 11 through 15  
-31.7747 -31.7713 -31.7680 -31.7651 -31.7624

Columns 16 through 20  
-31.7602 -31.7586 -31.7575 -31.7571 -31.7575

Columns 21 through 25  
-31.7587 -31.7606 -31.7634 -31.7670 -31.7714

Columns 26 through 30  
-31.7765 -31.7824 -31.7888 -31.7957 -31.8031

Columns 31 through 35  
-31.8107 -31.8184 -31.8261 -31.8336 -31.8407

Columns 36 through 40  
-31.8473 -31.8532 -31.8582 -31.8622 -31.8649

Columns 41 through 45  
-31.8663 -31.8663 -31.8646 -31.8612 -31.8561

Columns 46 through 50  
-31.8492 -31.8404 -31.8299 -31.8177 -31.8039

Columns 51 through 55  
-31.7886 -31.7719 -31.7542 -31.7356 -31.7164

Columns 56 through 60  
-31.6970 -31.6778 -31.6591 -31.6413 -31.6250

Columns 61 through 65  
-31.6106 -31.5987 -31.5897 -31.5842 -31.5828

Columns 66 through 70  
-31.5861 -31.5946 -31.6090 -31.6296 -31.6572

Columns 71 through 75  
-31.6923 -31.7352 -31.7866 -31.8469 -31.9165

Columns 76 through 80  
-31.9958 -32.0850 -32.1845 -32.2946 -32.4153

Columns 81 through 85  
-32.5468 -32.6892 -32.8425 -33.0067 -33.1816

Columns 86 through 90  
-33.3671 -33.5629 -33.7688 -33.9846 -34.2097

Columns 91 through 95  
-34.4439 -34.6866 -34.9373 -35.1956 -35.4609

Columns 96 through 100  
-35.7326 -36.0100 -36.2927 -36.5800 -36.8712

Columns 101 through 105  
-37.1657 -37.4630 -37.7624 -38.0634 -38.3654

Columns 106 through 110  
-38.6678 -38.9702 -39.2721 -39.5731 -39.8728

Columns 111 through 115  
-40.1707 -40.4667 -40.7605 -41.0518 -41.3405

Columns 116 through 120  
-41.6264 -41.9095 -42.1898 -42.4673 -42.7419

Columns 121 through 125  
-43.0139 -43.2833 -43.5502 -43.8150 -44.0777

Columns 126 through 130  
-44.3386 -44.5980 -44.8562 -45.1133 -45.3697

Columns 131 through 135  
-45.6257 -45.8815 -46.1375 -46.3938 -46.6507

Columns 136 through 140  
-46.9085 -47.1674 -47.4275 -47.6890 -47.9521

Columns 141 through 145  
-48.2169 -48.4834 -48.7518 -49.0220 -49.2940

Columns 146 through 150  
-49.5678 -49.8434 -50.1206 -50.3994 -50.6796

Columns 151 through 155  
-50.9611 -51.2437 -51.5272 -51.8113 -52.0960

Columns 156 through 160  
-52.3809 -52.6658 -52.9506 -53.2350 -53.5187

Columns 161 through 165  
-53.8016 -54.0834 -54.3641 -54.6433 -54.9209

Columns 166 through 170  
-55.1969 -55.4710 -55.7433 -56.0135 -56.2818

Columns 171 through 175  
-56.5480 -56.8122 -57.0744 -57.3347 -57.5931

Columns 176 through 180  
-57.8497 -58.1047 -58.3582 -58.6104 -58.8614

Columns 181 through 185  
-59.1115 -59.3608 -59.6096 -59.8581 -60.1064

Columns 186 through 190  
-60.3549 -60.6037 -60.8531 -61.1033 -61.3545

Columns 191 through 195  
-61.6068 -61.8605 -62.1157 -62.3726 -62.6313

Columns 196 through 200  
-62.8918 -63.1544 -63.4189 -63.6855 -63.9541

Columns 201 through 205  
-64.2248 -64.4975 -64.7721 -65.0484 -65.3265

Columns 206 through 210  
-65.6061 -65.8870 -66.1692 -66.4522 -66.7359

Columns 211 through 215  
-67.0201 -67.3045 -67.5887 -67.8725 -68.1556

Columns 216 through 220  
-68.4376 -68.7182 -68.9971 -69.2740 -69.5484

Columns 221 through 225  
-69.8202 -70.0889 -70.3543 -70.6160 -70.8738

Columns 226 through 230  
-71.1273 -71.3763 -71.6205 -71.8597 -72.0936

Columns 231 through 235  
-72.3221 -72.5450 -72.7620 -72.9732 -73.1783

Columns 236 through 240  
-73.3772 -73.5700 -73.7565 -73.9367 -74.1107

Columns 241 through 245  
-74.2784 -74.4399 -74.5953 -74.7446 -74.8880

Columns 246 through 250  
-75.0256 -75.1575 -75.2840 -75.4052 -75.5213

Columns 251 through 255  
-75.6326 -75.7392 -75.8415 -75.9396 -76.0339

Columns 256 through 260  
-76.1246 -76.2121 -76.2965 -76.3782 -76.4574

Columns 261 through 265  
-76.5346 -76.6099 -76.6836 -76.7561 -76.8276

Columns 266 through 270  
-76.8984 -76.9687 -77.0388 -77.1089 -77.1793

Columns 271 through 275  
-77.2502 -77.3218 -77.3942 -77.4676 -77.5422

Columns 276 through 280  
-77.6180 -77.6953 -77.7741 -77.8544 -77.9363

Columns 281 through 285  
-78.0198 -78.1050 -78.1918 -78.2802 -78.3701

Columns 286 through 290  
-78.4614 -78.5542 -78.6482 -78.7433 -78.8395

Columns 291 through 295  
-78.9365 -79.0342 -79.1324 -79.2309 -79.3295

Columns 296 through 300  
-79.4281 -79.5264 -79.6243 -79.7215 -79.8177

Columns 301 through 305  
-79.9129 -80.0068 -80.0992 -80.1900 -80.2788

Columns 306 through 310  
-80.3657 -80.4503 -80.5327 -80.6126 -80.6899

Columns 311 through 315  
-80.7645 -80.8364 -80.9055 -80.9717 -81.0349

Columns 316 through 320  
-81.0953 -81.1527 -81.2072 -81.2588 -81.3075

Columns 321 through 325  
-81.3536 -81.3969 -81.4376 -81.4759 -81.5117

Columns 326 through 330  
-81.5453 -81.5768 -81.6063 -81.6340 -81.6600

Columns 331 through 335  
-81.6845 -81.7075 -81.7294 -81.7502 -81.7701

Columns 336 through 340  
-81.7892 -81.8077 -81.8257 -81.8433 -81.8608

Columns 341 through 345  
-81.8780 -81.8953 -81.9126 -81.9301 -81.9478

Columns 346 through 350  
-81.9658 -81.9842 -82.0029 -82.0221 -82.0417

Columns 351 through 355  
-82.0617 -82.0822 -82.1031 -82.1244 -82.1462

Columns 356 through 360  
-82.1683 -82.1908 -82.2136 -82.2366 -82.2599

Columns 361 through 365  
-82.2833 -82.3069 -82.3305 -82.3542 -82.3778

Columns 366 through 370  
-82.4014 -82.4249 -82.4482 -82.4714 -82.4943

Columns 371 through 375  
-82.5170 -82.5394 -82.5615 -82.5833 -82.6047

Columns 376 through 380  
-82.6259 -82.6467 -82.6671 -82.6873 -82.7071

Columns 381 through 385  
-82.7265 -82.7457 -82.7645 -82.7830 -82.8013

Columns 386 through 390  
-82.8193 -82.8371 -82.8546 -82.8719 -82.8889

Columns 391 through 395  
-82.9058 -82.9225 -82.9389 -82.9552 -82.9713

Columns 396 through 400  
-82.9871 -83.0028 -83.0183 -83.0335 -83.0485

Columns 401 through 405  
-83.0632 -83.0777 -83.0919 -83.1058 -83.1194

Columns 406 through 410  
-83.1326 -83.1454 -83.1579 -83.1699 -83.1816

Columns 411 through 415  
-83.1928 -83.2036 -83.2139 -83.2237 -83.2331

Columns 416 through 420  
-83.2420 -83.2505 -83.2585 -83.2661 -83.2732

Columns 421 through 425  
-83.2800 -83.2863 -83.2923 -83.2980 -83.3034

Columns 426 through 430  
-83.3086 -83.3135 -83.3183 -83.3230 -83.3275

Columns 431 through 435  
-83.3321 -83.3366 -83.3413 -83.3460 -83.3508

Columns 436 through 440  
-83.3559 -83.3611 -83.3666 -83.3724 -83.3785

Columns 441 through 445  
-83.3849 -83.3917 -83.3988 -83.4063 -83.4141

Columns 446 through 450  
-83.4223 -83.4309 -83.4397 -83.4489 -83.4584

Columns 451 through 455  
-83.4682 -83.4782 -83.4884 -83.4988 -83.5092

Columns 456 through 460  
-83.5198 -83.5304 -83.5410 -83.5515 -83.5619

Columns 461 through 465  
-83.5722 -83.5823 -83.5921 -83.6017 -83.6110

Columns 466 through 470  
-83.6199 -83.6285 -83.6367 -83.6445 -83.6519

Columns 471 through 475  
-83.6589 -83.6655 -83.6716 -83.6773 -83.6826

Columns 476 through 480  
-83.6875 -83.6920 -83.6962 -83.7001 -83.7036

Columns 481 through 485  
-83.7070 -83.7101 -83.7130 -83.7158 -83.7185

Columns 486 through 490  
-83.7211 -83.7237 -83.7263 -83.7289 -83.7317

Columns 491 through 495  
-83.7345 -83.7376 -83.7407 -83.7441 -83.7477

Columns 496 through 500  
-83.7515 -83.7556 -83.7599 -83.7645 -83.7693

Columns 501 through 505  
-83.7743 -83.7795 -83.7850 -83.7906 -83.7964

Columns 506 through 510  
-83.8024 -83.8085 -83.8146 -83.8208 -83.8271

Columns 511 through 515  
-83.8333 -83.8395 -83.8457 -83.8517 -83.8577

Columns 516 through 520  
-83.8634 -83.8690 -83.8744 -83.8796 -83.8846

Columns 521 through 525  
-83.8893 -83.8938 -83.8980 -83.9020 -83.9057

Columns 526 through 530  
-83.9092 -83.9125 -83.9155 -83.9184 -83.9211

Columns 531 through 535  
-83.9236 -83.9260 -83.9283 -83.9305 -83.9327

Columns 536 through 540  
-83.9349 -83.9370 -83.9393 -83.9415 -83.9439

Columns 541 through 545  
-83.9463 -83.9489 -83.9516 -83.9545 -83.9576

Columns 546 through 550  
-83.9608 -83.9643 -83.9678 -83.9716 -83.9755

Columns 551 through 555  
-83.9796 -83.9838 -83.9882 -83.9926 -83.9971

Columns 556 through 560  
-84.0016 -84.0062 -84.0107 -84.0152 -84.0195

Columns 561 through 565  
-84.0238 -84.0279 -84.0318 -84.0355 -84.0389

Columns 566 through 570  
-84.0420 -84.0449 -84.0474 -84.0495 -84.0513

Columns 571 through 575  
-84.0528 -84.0538 -84.0545 -84.0548 -84.0548

Columns 576 through 580  
-84.0543 -84.0536 -84.0525 -84.0511 -84.0495

Columns 581 through 585  
-84.0476 -84.0455 -84.0433 -84.0409 -84.0385

Columns 586 through 590  
-84.0360 -84.0335 -84.0311 -84.0287 -84.0265

Columns 591 through 595  
-84.0244 -84.0225 -84.0209 -84.0196 -84.0185

Columns 596 through 600  
-84.0177 -84.0173 -84.0172 -84.0175 -84.0181

Columns 601 through 605  
-84.0191 -84.0205 -84.0221 -84.0242 -84.0265

Columns 606 through 610  
-84.0290 -84.0319 -84.0349 -84.0381 -84.0414

Columns 611 through 615  
-84.0448 -84.0483 -84.0517 -84.0551 -84.0584

Columns 616 through 620  
-84.0615 -84.0644 -84.0670 -84.0694 -84.0714

Columns 621 through 625  
-84.0730 -84.0742 -84.0749 -84.0752 -84.0749

Columns 626 through 630  
-84.0741 -84.0727 -84.0708 -84.0682 -84.0651

Columns 631 through 635  
-84.0614 -84.0571 -84.0523 -84.0469 -84.0409

Columns 636 through 640  
-84.0344 -84.0274 -84.0200 -84.0121 -84.0038

Columns 641 through 645  
-83.9951 -83.9861 -83.9767 -83.9671 -83.9572

Columns 646 through 650  
-83.9471 -83.9368 -83.9263 -83.9158 -83.9051

Columns 651 through 655  
-83.8944 -83.8836 -83.8728 -83.8620 -83.8511

Columns 656 through 660  
-83.8403 -83.8295 -83.8187 -83.8080 -83.7973

Columns 661 through 665  
-83.7866 -83.7759 -83.7652 -83.7546 -83.7439

Columns 666 through 670  
-83.7333 -83.7226 -83.7119 -83.7012 -83.6904

Columns 671 through 675  
-83.6795 -83.6686 -83.6576 -83.6466 -83.6354

Columns 676 through 680  
-83.6242 -83.6129 -83.6015 -83.5900 -83.5784

Columns 681 through 685  
-83.5668 -83.5551 -83.5433 -83.5314 -83.5195

Columns 686 through 690  
-83.5076 -83.4956 -83.4837 -83.4717 -83.4597

Columns 691 through 695  
-83.4477 -83.4358 -83.4239 -83.4120 -83.4001

Columns 696 through 700  
-83.3883 -83.3765 -83.3648 -83.3530 -83.3413

Columns 701 through 705  
-83.3295 -83.3177 -83.3059 -83.2940 -83.2821

Columns 706 through 710  
-83.2700 -83.2577 -83.2453 -83.2326 -83.2197

Columns 711 through 715  
-83.2065 -83.1929 -83.1790 -83.1647 -83.1499

Columns 716 through 720  
-83.1347 -83.1189 -83.1026 -83.0857 -83.0682

Columns 721 through 725  
-83.0501 -83.0314 -83.0119 -82.9919 -82.9711

Columns 726 through 730  
-82.9497 -82.9276 -82.9048 -82.8814 -82.8574

Columns 731 through 735  
-82.8327 -82.8075 -82.7818 -82.7556 -82.7289

Columns 736 through 740  
-82.7018 -82.6743 -82.6465 -82.6185 -82.5903

Columns 741 through 745  
-82.5619 -82.5334 -82.5049 -82.4765 -82.4481

Columns 746 through 750  
-82.4198 -82.3917 -82.3638 -82.3362 -82.3089

Columns 751 through 755  
-82.2819 -82.2553 -82.2290 -82.2031 -82.1777

Columns 756 through 760  
-82.1526 -82.1280 -82.1038 -82.0799 -82.0565

Columns 761 through 765  
-82.0333 -82.0105 -81.9880 -81.9657 -81.9437

Columns 766 through 770  
-81.9218 -81.9001 -81.8784 -81.8567 -81.8351

Columns 771 through 775  
-81.8134 -81.7916 -81.7696 -81.7474 -81.7250

Columns 776 through 780  
-81.7024 -81.6794 -81.6562 -81.6326 -81.6086

Columns 781 through 785  
-81.5843 -81.5596 -81.5345 -81.5091 -81.4833

Columns 786 through 790  
-81.4572 -81.4308 -81.4042 -81.3773 -81.3502

Columns 791 through 795  
-81.3230 -81.2958 -81.2684 -81.2412 -81.2139

Columns 796 through 800  
-81.1869 -81.1600 -81.1334 -81.1071 -81.0812

Columns 801 through 805  
-81.0557 -81.0307 -81.0062 -80.9822 -80.9588

Columns 806 through 810  
-80.9361 -80.9140 -80.8925 -80.8717 -80.8516

Columns 811 through 815  
-80.8321 -80.8132 -80.7950 -80.7773 -80.7602

Columns 816 through 820  
-80.7435 -80.7273 -80.7114 -80.6959 -80.6806

Columns 821 through 825  
-80.6654 -80.6504 -80.6353 -80.6202 -80.6049

Columns 826 through 830  
-80.5893 -80.5735 -80.5572 -80.5404 -80.5231

Columns 831 through 835  
-80.5052 -80.4866 -80.4673 -80.4472 -80.4264

Columns 836 through 840  
-80.4046 -80.3821 -80.3587 -80.3345 -80.3094

Columns 841 through 845  
-80.2836 -80.2571 -80.2298 -80.2020 -80.1736

Columns 846 through 850  
-80.1447 -80.1155 -80.0861 -80.0566 -80.0271

Columns 851 through 855  
-79.9977 -79.9687 -79.9401 -79.9121 -79.8848

Columns 856 through 860  
-79.8585 -79.8333 -79.8094 -79.7868 -79.7659

Columns 861 through 865  
-79.7466 -79.7293 -79.7140 -79.7008 -79.6900

Columns 866 through 870  
-79.6816 -79.6757 -79.6724 -79.6719 -79.6741

Columns 871 through 875  
-79.6792 -79.6872 -79.6982 -79.7121 -79.7290

Columns 876 through 880  
-79.7489 -79.7717 -79.7974 -79.8261 -79.8575

Columns 881 through 885  
-79.8917 -79.9285 -79.9679 -80.0098 -80.0541

Columns 886 through 890  
-80.1006 -80.1493 -80.2000 -80.2525 -80.3067

Columns 891 through 895  
-80.3626 -80.4199 -80.4785 -80.5383 -80.5992

Columns 896 through 900  
-80.6610 -80.7235 -80.7867 -80.8505 -80.9147

Columns 901 through 905  
-80.9792 -81.0440 -81.1089 -81.1739 -81.2389

Columns 906 through 910  
-81.3038 -81.3686 -81.4332 -81.4977 -81.5619

Columns 911 through 915  
-81.6258 -81.6896 -81.7530 -81.8162 -81.8791

Columns 916 through 920  
-81.9418 -82.0042 -82.0664 -82.1284 -82.1902

Columns 921 through 925  
-82.2518 -82.3133 -82.3747 -82.4359 -82.4971

Columns 926 through 930  
-82.5581 -82.6191 -82.6800 -82.7407 -82.8014

Columns 931 through 935  
-82.8619 -82.9223 -82.9825 -83.0424 -83.1021

Columns 936 through 940  
-83.1614 -83.2203 -83.2788 -83.3367 -83.3939

Columns 941 through 945  
-83.4505 -83.5062 -83.5611 -83.6149 -83.6676

Columns 946 through 950  
-83.7191 -83.7692 -83.8180 -83.8652 -83.9109

Columns 951 through 955  
-83.9548 -83.9968 -84.0370 -84.0753 -84.1114

Columns 956 through 960  
-84.1455 -84.1774 -84.2071 -84.2346 -84.2598

Columns 961 through 965  
-84.2827 -84.3033 -84.3217 -84.3378 -84.3517

Columns 966 through 970  
-84.3635 -84.3731 -84.3807 -84.3864 -84.3901

Columns 971 through 975  
-84.3922 -84.3925 -84.3914 -84.3888 -84.3849

Columns 976 through 980  
-84.3799 -84.3739 -84.3670 -84.3594 -84.3513

Columns 981 through 985  
-84.3426 -84.3337 -84.3247 -84.3156 -84.3066

Columns 986 through 990  
-84.2979 -84.2894 -84.2815 -84.2741 -84.2673

Columns 991 through 995  
-84.2612 -84.2559 -84.2514 -84.2478 -84.2450

Columns 996 through 1000  
-84.2432 -84.2423 -84.2423 -84.2432 -84.2450

Columns 1001 through 1005  
-84.2476 -84.2510 -84.2550 -84.2598 -84.2651

Columns 1006 through 1010  
-84.2709 -84.2771 -84.2837 -84.2905 -84.2974

Columns 1011 through 1015  
-84.3043 -84.3112 -84.3179 -84.3244 -84.3306

Columns 1016 through 1020  
-84.3364 -84.3417 -84.3464 -84.3505 -84.3539

Columns 1021 through 1024  
-84.3567 -84.3586 -84.3598 -84.3602