

LAMPIRAN A
KODE PROGRAM

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%-----
%% 1. Analysis parameters
% Sampling frequency (Hz)
smpfreq = 8000;
% Half the frame length
frmext = 120; % 15 ms
% Hop size
hopsz = 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. Read signal and pitch track
% Load input signal (signal stored in IEEE little endian short format)

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

sig = wavread('signal_2'); % data sendiri

% Load pitch table (time in s, frequency in Hz) and convert to sample and
% radian frequency
load signal.dat;
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. Declare arrays
% Synthetic signals
synth_ar = zeros(size(sig));
synth_olc = zeros(size(sig));
% Normalization
olanorm = zeros(size(sig));

simpan=[];

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%%%% 4. Main analysis loop (i is the frame index)
for i = 1:frmnb
    % 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)-frmext:frmloc(i)+frmext)';
        s = sig(ind);
        % Compute number of harmonics
        hrmb = floor(pi*0.96/pitch(i));
        % Compute the amplitudes of the harmonics using tapered Fourier transform
        REG = exp(j*pitch(i)*ind*(1:hrmb));
        theta = REG'*(taper.*s)*(2/st);
        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:hrmb), cn));

        %%% 4.b. Estimation of the envelope using AR
        [a_ar, e_ar] = aryule(s.*taper, 12);
        % Energy correction for windowing
        e_ar = e_ar*((2*frmext+1)/st2)*2/hrmb;

        %%% 4.c. Estimation using OLC or WLS
        % 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:hrmb), n, options);
        % Alternatively use WLS by uncommenting this line (and commenting the
        % previous one)
        c_olc = WLS(a, pitch(i)*(1:hrmb), 40, n);

        %%% 4.d. Plots
        % Compute the apparent noise epsd estimate
        nhathat = (4*st2/(st^2))*exp(cepsval(wtr, cn));
        % Compute envelope estimated using AR
        ehathat_ar = 20*log10(abs(freqz(sqrt(e_ar), a_ar, wtr)));
        % Compute envelope estimated using OLC
        ehathat_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(nhathat), ':'); % estimated noise level
    end
end

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

%%%% 4.e. Signal reconstruction using 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 using modeled amplitudes and original phases
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;
% Keep track of normalization
olanorm(ind) = olanorm(ind) + taper;
end
end
%%%% 5. Normalize the signals
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 spektral 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 WLS, pada frame 10

Columns 1 through 3

-34.2386 -34.2385 -34.2381

Columns 4 through 6

-34.2376 -34.2368 -34.2359

Columns 7 through 9

-34.2348 -34.2337 -34.2325

Columns 10 through 12

-34.2314 -34.2303 -34.2293

Columns 13 through 15

-34.2286 -34.2280 -34.2278

Columns 16 through 18

-34.2279 -34.2285 -34.2294

Columns 19 through 21

-34.2308 -34.2327 -34.2351

Columns 22 through 24

-34.2381 -34.2415 -34.2454

Columns 25 through 27

-34.2497 -34.2544 -34.2595

Columns 28 through 30

-34.2649 -34.2704 -34.2761

Columns 31 through 33

-34.2817 -34.2872 -34.2925

Columns 34 through 36

-34.2975 -34.3020 -34.3059

Columns 37 through 39

-34.3090 -34.3113 -34.3127

Columns 40 through 42

-34.3129 -34.3120 -34.3099

Columns 43 through 45

-34.3064 -34.3016 -34.2953

Columns 46 through 48

-34.2876 -34.2786 -34.2682

Columns 49 through 51

-34.2565 -34.2436 -34.2296

Columns 52 through 54

-34.2148 -34.1992 -34.1832

Columns 55 through 57

-34.1669 -34.1507 -34.1348

Columns 58 through 60

-34.1196 -34.1055 -34.0928

Columns 61 through 63

-34.0820 -34.0735 -34.0677

Columns 64 through 66

-34.0652 -34.0664 -34.0717

Columns 67 through 69

-34.0817 -34.0968 -34.1176

Columns 70 through 72

-34.1444 -34.1778 -34.2181

Columns 73 through 75

-34.2659 -34.3214 -34.3852

Columns 76 through 78

-34.4574 -34.5384 -34.6285

Columns 79 through 81

-34.7279 -34.8367 -34.9552

Columns 82 through 84

-35.0833 -35.2212 -35.3687

Columns 85 through 87

-35.5260 -35.6928 -35.8690

Columns 88 through 90

-36.0544 -36.2488 -36.4519

Columns 91 through 93

-36.6633 -36.8826 -37.1096

Columns 94 through 96

-37.3436 -37.5844 -37.8313

Columns 97 through 99

-38.0838 -38.3414 -38.6037

Columns 100 through 102

-38.8699 -39.1396 -39.4122

Columns 103 through 105

-39.6871 -39.9638 -40.2418

Columns 106 through 108

-40.5206 -40.7996 -41.0785

Columns 109 through 111

-41.3567 -41.6338 -41.9096

Columns 112 through 114

-42.1836 -42.4556 -42.7253

Columns 115 through 117

-42.9924 -43.2569 -43.5186

Columns 118 through 120

-43.7774 -44.0333 -44.2862

Columns 121 through 123

-44.5363 -44.7835 -45.0280

Columns 124 through 126

-45.2699 -45.5094 -45.7468

Columns 127 through 129

-45.9822 -46.2159 -46.4481

Columns 130 through 132

-46.6792 -46.9094 -47.1391

Columns 133 through 135

-47.3685 -47.5980 -47.8278

Columns 136 through 138

-48.0582 -48.2896 -48.5222

Columns 139 through 141

-48.7563 -48.9920 -49.2296

Columns 142 through 144

-49.4693 -49.7113 -49.9556

Columns 145 through 147

-50.2025 -50.4519 -50.7039

Columns 148 through 150

-50.9586 -51.2160 -51.4760

Columns 151 through 153

-51.7385 -52.0035 -52.2709

Columns 154 through 156

-52.5405 -52.8122 -53.0859

Columns 157 through 159

-53.3612 -53.6381 -53.9163

Columns 160 through 162

-54.1957 -54.4759 -54.7568

Columns 163 through 165

-55.0382 -55.3198 -55.6015

Columns 166 through 168

-55.8830 -56.1642 -56.4449

Columns 169 through 171

-56.7249 -57.0041 -57.2824

Columns 172 through 174

-57.5596 -57.8358 -58.1108

Columns 175 through 177

-58.3847 -58.6574 -58.9290

Columns 178 through 180

-59.1994 -59.4688 -59.7373

Columns 181 through 183

-60.0048 -60.2717 -60.5380

Columns 184 through 186

-60.8038 -61.0694 -61.3349

Columns 187 through 189

-61.6005 -61.8664 -62.1327

Columns 190 through 192

-62.3998 -62.6677 -62.9367

Columns 193 through 195

-63.2070 -63.4786 -63.7519

Columns 196 through 198

-64.0268 -64.3035 -64.5822

Columns 199 through 201

-64.8628 -65.1455 -65.4303

Columns 202 through 204

-65.7171 -66.0060 -66.2969

Columns 205 through 207

-66.5896 -66.8842 -67.1803

Columns 208 through 210

-67.4780 -67.7768 -68.0767

Columns 211 through 213

-68.3773 -68.6785 -68.9797

Columns 214 through 216

-69.2808 -69.5814 -69.8810

Columns 217 through 219

-70.1794 -70.4762 -70.7708

Columns 220 through 222

-71.0629 -71.3522 -71.6380

Columns 223 through 225

-71.9202 -72.1981 -72.4715

Columns 226 through 228

-72.7400 -73.0030 -73.2604

Columns 229 through 231

-73.5117 -73.7566 -73.9948

Columns 232 through 234

-74.2260 -74.4500 -74.6665

Columns 235 through 237

-74.8754 -75.0765 -75.2697

Columns 238 through 240

-75.4548 -75.6319 -75.8009

Columns 241 through 243

-75.9617 -76.1145 -76.2593

Columns 244 through 246

-76.3963 -76.5256 -76.6473

Columns 247 through 249

-76.7616 -76.8689 -76.9693

Columns 250 through 252

-77.0632 -77.1508 -77.2324

Columns 253 through 255

-77.3085 -77.3794 -77.4454

Columns 256 through 258

-77.5070 -77.5645 -77.6183

Columns 259 through 261

-77.6689 -77.7166 -77.7618

Columns 262 through 264

-77.8050 -77.8465 -77.8866

Columns 265 through 267

-77.9258 -77.9645 -78.0028

Columns 268 through 270

-78.0412 -78.0800 -78.1194

Columns 271 through 273

-78.1597 -78.2011 -78.2438

Columns 274 through 276

-78.2879 -78.3337 -78.3813

Columns 277 through 279

-78.4308 -78.4822 -78.5355

Columns 280 through 282

-78.5909 -78.6483 -78.7076

Columns 283 through 285

-78.7688 -78.8319 -78.8967

Columns 286 through 288

-78.9631 -79.0310 -79.1002

Columns 289 through 291

-79.1705 -79.2418 -79.3139

Columns 292 through 294

-79.3865 -79.4595 -79.5327

Columns 295 through 297

-79.6057 -79.6784 -79.7506

Columns 298 through 300

-79.8220 -79.8924 -79.9616

Columns 301 through 303

-80.0294 -80.0956 -80.1600

Columns 304 through 306

-80.2223 -80.2826 -80.3405

Columns 307 through 309

-80.3960 -80.4490 -80.4992

Columns 310 through 312

-80.5467 -80.5914 -80.6331

Columns 313 through 315

-80.6720 -80.7078 -80.7407

Columns 316 through 318

-80.7707 -80.7977 -80.8218

Columns 319 through 321

-80.8431 -80.8616 -80.8775

Columns 322 through 324

-80.8907 -80.9015 -80.9099

Columns 325 through 327

-80.9160 -80.9200 -80.9220

Columns 328 through 330

-80.9222 -80.9206 -80.9175

Columns 331 through 333

-80.9130 -80.9071 -80.9002

Columns 334 through 336

-80.8922 -80.8834 -80.8738

Columns 337 through 339

-80.8636 -80.8529 -80.8419

Columns 340 through 342

-80.8305 -80.8190 -80.8074

Columns 343 through 345

-80.7958 -80.7842 -80.7727

Columns 346 through 348

-80.7614 -80.7502 -80.7394

Columns 349 through 351

-80.7287 -80.7184 -80.7083

Columns 352 through 354

-80.6985 -80.6890 -80.6798

Columns 355 through 357

-80.6708 -80.6620 -80.6535

Columns 358 through 360

-80.6451 -80.6369 -80.6288

Columns 361 through 363

-80.6208 -80.6129 -80.6049

Columns 364 through 366

-80.5970 -80.5890 -80.5809

Columns 367 through 369

-80.5728 -80.5645 -80.5561

Columns 370 through 372

-80.5475 -80.5387 -80.5298

Columns 373 through 375

-80.5207 -80.5114 -80.5020

Columns 376 through 378

-80.4923 -80.4825 -80.4725

Columns 379 through 381

-80.4624 -80.4522 -80.4418

Columns 382 through 384

-80.4314 -80.4210 -80.4105

Columns 385 through 387

-80.4000 -80.3895 -80.3791

Columns 388 through 390

-80.3687 -80.3584 -80.3483

Columns 391 through 393

-80.3383 -80.3284 -80.3188

Columns 394 through 396

-80.3093 -80.2999 -80.2908

Columns 397 through 399

-80.2819 -80.2733 -80.2648

Columns 400 through 402

-80.2565 -80.2484 -80.2405

Columns 403 through 405

-80.2327 -80.2251 -80.2177

Columns 406 through 408

-80.2103 -80.2031 -80.1959

Columns 409 through 411

-80.1888 -80.1816 -80.1745

Columns 412 through 414

-80.1674 -80.1602 -80.1530

Columns 415 through 417

-80.1456 -80.1382 -80.1306

Columns 418 through 420

-80.1229 -80.1150 -80.1069

Columns 421 through 423

-80.0987 -80.0903 -80.0817

Columns 424 through 426

-80.0730 -80.0640 -80.0549

Columns 427 through 429

-80.0456 -80.0362 -80.0266

Columns 430 through 432

-80.0169 -80.0071 -79.9972

Columns 433 through 435

-79.9873 -79.9772 -79.9672

Columns 436 through 438

-79.9571 -79.9471 -79.9371

Columns 439 through 441

-79.9272 -79.9173 -79.9075

Columns 442 through 444

-79.8979 -79.8883 -79.8789

Columns 445 through 447

-79.8697 -79.8606 -79.8516

Columns 448 through 450

-79.8429 -79.8343 -79.8259

Columns 451 through 453

-79.8177 -79.8096 -79.8017

Columns 454 through 456

-79.7939 -79.7863 -79.7788

Columns 457 through 459

-79.7715 -79.7643 -79.7571

Columns 460 through 462

-79.7501 -79.7431 -79.7362

Columns 463 through 465

-79.7293 -79.7225 -79.7157

Columns 466 through 468

-79.7090 -79.7022 -79.6955

Columns 469 through 471

-79.6888 -79.6822 -79.6755

Columns 472 through 474

-79.6689 -79.6623 -79.6557

Columns 475 through 477

-79.6492 -79.6428 -79.6364

Columns 478 through 480

-79.6302 -79.6241 -79.6182

Columns 481 through 483

-79.6124 -79.6068 -79.6014

Columns 484 through 486

-79.5962 -79.5913 -79.5867

Columns 487 through 489

-79.5824 -79.5784 -79.5748

Columns 490 through 492

-79.5715 -79.5685 -79.5659

Columns 493 through 495

-79.5637 -79.5619 -79.5605

Columns 496 through 498

-79.5594 -79.5587 -79.5583

Columns 499 through 501

-79.5583 -79.5585 -79.5591

Columns 502 through 504

-79.5600 -79.5611 -79.5624

Columns 505 through 507

-79.5638 -79.5655 -79.5672

Columns 508 through 510

-79.5690 -79.5708 -79.5726

Columns 511 through 513

-79.5744 -79.5760 -79.5775

Columns 514 through 516

-79.5789 -79.5801 -79.5810

Columns 517 through 519

-79.5817 -79.5821 -79.5823

Columns 520 through 522

-79.5820 -79.5815 -79.5806

Columns 523 through 525

-79.5794 -79.5779 -79.5760

Columns 526 through 528

-79.5738 -79.5713 -79.5686

Columns 529 through 531

-79.5656 -79.5623 -79.5589

Columns 532 through 534

-79.5553 -79.5516 -79.5478

Columns 535 through 537

-79.5440 -79.5402 -79.5365

Columns 538 through 540

-79.5330 -79.5296 -79.5264

Columns 541 through 543

-79.5235 -79.5209 -79.5186

Columns 544 through 546

-79.5168 -79.5154 -79.5145

Columns 547 through 549

-79.5140 -79.5141 -79.5148

Columns 550 through 552

-79.5160 -79.5179 -79.5203

Columns 553 through 555

-79.5233 -79.5269 -79.5311

Columns 556 through 558

-79.5358 -79.5411 -79.5470

Columns 559 through 561

-79.5533 -79.5602 -79.5675

Columns 562 through 564

-79.5752 -79.5832 -79.5916

Columns 565 through 567

-79.6003 -79.6093 -79.6185

Columns 568 through 570

-79.6278 -79.6373 -79.6469

Columns 571 through 573

-79.6565 -79.6661 -79.6757

Columns 574 through 576

-79.6853 -79.6948 -79.7042

Columns 577 through 579

-79.7135 -79.7226 -79.7316

Columns 580 through 582

-79.7405 -79.7492 -79.7577

Columns 583 through 585

-79.7661 -79.7744 -79.7825

Columns 586 through 588

-79.7905 -79.7985 -79.8063

Columns 589 through 591

-79.8141 -79.8219 -79.8297

Columns 592 through 594

-79.8375 -79.8453 -79.8533

Columns 595 through 597

-79.8613 -79.8695 -79.8778

Columns 598 through 600

-79.8863 -79.8950 -79.9039

Columns 601 through 603

-79.9130 -79.9224 -79.9319

Columns 604 through 606

-79.9418 -79.9518 -79.9621

Columns 607 through 609

-79.9726 -79.9833 -79.9942

Columns 610 through 612

-80.0052 -80.0164 -80.0277

Columns 613 through 615

-80.0391 -80.0505 -80.0620

Columns 616 through 618

-80.0734 -80.0847 -80.0959

Columns 619 through 621

-80.1070 -80.1179 -80.1286

Columns 622 through 624

-80.1390 -80.1491 -80.1589

Columns 625 through 627

-80.1684 -80.1774 -80.1860

Columns 628 through 630

-80.1942 -80.2020 -80.2093

Columns 631 through 633

-80.2161 -80.2224 -80.2282

Columns 634 through 636

-80.2336 -80.2384 -80.2429

Columns 637 through 639

-80.2468 -80.2504 -80.2535

Columns 640 through 642

-80.2563 -80.2587 -80.2608

Columns 643 through 645

-80.2626 -80.2641 -80.2654

Columns 646 through 648

-80.2666 -80.2675 -80.2684

Columns 649 through 651

-80.2692 -80.2699 -80.2706

Columns 652 through 654

-80.2713 -80.2720 -80.2728

Columns 655 through 657

-80.2736 -80.2746 -80.2756

Columns 658 through 660

-80.2768 -80.2780 -80.2794

Columns 661 through 663

-80.2810 -80.2826 -80.2844

Columns 664 through 666

-80.2863 -80.2882 -80.2903

Columns 667 through 669

-80.2924 -80.2945 -80.2967

Columns 670 through 672

-80.2989 -80.3010 -80.3032

Columns 673 through 675

-80.3052 -80.3072 -80.3091

Columns 676 through 678

-80.3108 -80.3125 -80.3139

Columns 679 through 681

-80.3152 -80.3164 -80.3173

Columns 682 through 684

-80.3181 -80.3187 -80.3191

Columns 685 through 687

-80.3193 -80.3193 -80.3192

Columns 688 through 690

-80.3189 -80.3185 -80.3180

Columns 691 through 693

-80.3174 -80.3167 -80.3160

Columns 694 through 696

-80.3152 -80.3145 -80.3137

Columns 697 through 699

-80.3131 -80.3124 -80.3119

Columns 700 through 702

-80.3115 -80.3113 -80.3112

Columns 703 through 705

-80.3113 -80.3115 -80.3120

Columns 706 through 708

-80.3126 -80.3135 -80.3145

Columns 709 through 711

-80.3158 -80.3172 -80.3188

Columns 712 through 714

-80.3206 -80.3225 -80.3245

Columns 715 through 717

-80.3267 -80.3289 -80.3311

Columns 718 through 720

-80.3333 -80.3356 -80.3377

Columns 721 through 723

-80.3398 -80.3418 -80.3436

Columns 724 through 726

-80.3452 -80.3467 -80.3478

Columns 727 through 729

-80.3488 -80.3494 -80.3497

Columns 730 through 732

-80.3497 -80.3494 -80.3487

Columns 733 through 735

-80.3478 -80.3464 -80.3448

Columns 736 through 738

-80.3428 -80.3405 -80.3380

Columns 739 through 741

-80.3352 -80.3321 -80.3289

Columns 742 through 744

-80.3255 -80.3220 -80.3184

Columns 745 through 747

-80.3148 -80.3111 -80.3076

Columns 748 through 750

-80.3041 -80.3007 -80.2975

Columns 751 through 753

-80.2945 -80.2918 -80.2893

Columns 754 through 756

-80.2872 -80.2854 -80.2840

Columns 757 through 759

-80.2829 -80.2823 -80.2820

Columns 760 through 762

-80.2822 -80.2827 -80.2836

Columns 763 through 765

-80.2849 -80.2866 -80.2886

Columns 766 through 768

-80.2908 -80.2933 -80.2960

Columns 769 through 771

-80.2989 -80.3018 -80.3048

Columns 772 through 774

-80.3078 -80.3108 -80.3136

Columns 775 through 777

-80.3162 -80.3186 -80.3207

Columns 778 through 780

-80.3225 -80.3238 -80.3246

Columns 781 through 783

-80.3249 -80.3247 -80.3239

Columns 784 through 786

-80.3225 -80.3203 -80.3176

Columns 787 through 789

-80.3141 -80.3099 -80.3050

Columns 790 through 792

-80.2994 -80.2931 -80.2862

Columns 793 through 795

-80.2786 -80.2704 -80.2616

Columns 796 through 798

-80.2523 -80.2425 -80.2322

Columns 799 through 801

-80.2216 -80.2106 -80.1993

Columns 802 through 804

-80.1878 -80.1762 -80.1644

Columns 805 through 807

-80.1526 -80.1408 -80.1291

Columns 808 through 810

-80.1174 -80.1059 -80.0946

Columns 811 through 813

-80.0835 -80.0726 -80.0620

Columns 814 through 816

-80.0516 -80.0416 -80.0318

Columns 817 through 819

-80.0222 -80.0129 -80.0039

Columns 820 through 822

-79.9950 -79.9863 -79.9778

Columns 823 through 825

-79.9693 -79.9608 -79.9523

Columns 826 through 828

-79.9437 -79.9350 -79.9261

Columns 829 through 831

-79.9169 -79.9074 -79.8976

Columns 832 through 834

-79.8873 -79.8765 -79.8652

Columns 835 through 837

-79.8533 -79.8408 -79.8277

Columns 838 through 840

-79.8139 -79.7995 -79.7844

Columns 841 through 843

-79.7687 -79.7523 -79.7354

Columns 844 through 846

-79.7179 -79.6999 -79.6815

Columns 847 through 849

-79.6628 -79.6437 -79.6245

Columns 850 through 852

-79.6052 -79.5859 -79.5669

Columns 853 through 855

-79.5481 -79.5297 -79.5119

Columns 856 through 858

-79.4948 -79.4786 -79.4634

Columns 859 through 861

-79.4493 -79.4366 -79.4252

Columns 862 through 864

-79.4155 -79.4076 -79.4014

Columns 865 through 867

-79.3973 -79.3953 -79.3955

Columns 868 through 870

-79.3981 -79.4030 -79.4104

Columns 871 through 873

-79.4204 -79.4329 -79.4482

Columns 874 through 876

-79.4660 -79.4866 -79.5098

Columns 877 through 879

-79.5357 -79.5642 -79.5954

Columns 880 through 882

-79.6290 -79.6651 -79.7037

Columns 883 through 885

-79.7445 -79.7876 -79.8328

Columns 886 through 888

-79.8799 -79.9290 -79.9798

Columns 889 through 891

-80.0323 -80.0863 -80.1416

Columns 892 through 894

-80.1982 -80.2559 -80.3146

Columns 895 through 897

-80.3742 -80.4344 -80.4953

Columns 898 through 900

-80.5568 -80.6186 -80.6807

Columns 901 through 903

-80.7430 -80.8055 -80.8680

Columns 904 through 906

-80.9305 -80.9929 -81.0552

Columns 907 through 909

-81.1174 -81.1794 -81.2411

Columns 910 through 912

-81.3027 -81.3640 -81.4251

Columns 913 through 915

-81.4860 -81.5467 -81.6072

Columns 916 through 918

-81.6675 -81.7276 -81.7877

Columns 919 through 921

-81.8476 -81.9074 -81.9672

Columns 922 through 924

-82.0269 -82.0866 -82.1463

Columns 925 through 927

-82.2060 -82.2657 -82.3254

Columns 928 through 930

-82.3851 -82.4448 -82.5045

Columns 931 through 933

-82.5641 -82.6236 -82.6829

Columns 934 through 936

-82.7421 -82.8010 -82.8595

Columns 937 through 939

-82.9177 -82.9754 -83.0325

Columns 940 through 942

-83.0890 -83.1447 -83.1996

Columns 943 through 945

-83.2535 -83.3064 -83.3581

Columns 946 through 948

-83.4085 -83.4576 -83.5052

Columns 949 through 951

-83.5512 -83.5955 -83.6381

Columns 952 through 954

-83.6788 -83.7176 -83.7543

Columns 955 through 957

-83.7891 -83.8217 -83.8521

Columns 958 through 960

-83.8804 -83.9064 -83.9302

Columns 961 through 963

-83.9518 -83.9711 -83.9883

Columns 964 through 966

-84.0033 -84.0161 -84.0269

Columns 967 through 969

-84.0357 -84.0426 -84.0477

Columns 970 through 972

-84.0510 -84.0527 -84.0528

Columns 973 through 975

-84.0516 -84.0490 -84.0453

Columns 976 through 978

-84.0406 -84.0350 -84.0286

Columns 979 through 981

-84.0216 -84.0141 -84.0062

Columns 982 through 984

-83.9982 -83.9900 -83.9818

Columns 985 through 987

-83.9737 -83.9659 -83.9585

Columns 988 through 990

-83.9514 -83.9449 -83.9389

Columns 991 through 993

-83.9336 -83.9290 -83.9252

Columns 994 through 996

-83.9221 -83.9198 -83.9183

Columns 997 through 999

-83.9177 -83.9178 -83.9187

Columns 1000 through 1002

-83.9204 -83.9228 -83.9258

Columns 1003 through 1005

-83.9295 -83.9337 -83.9385

Columns 1006 through 1008

-83.9436 -83.9491 -83.9548

Columns 1009 through 1011

-83.9608 -83.9668 -83.9729

Columns 1012 through 1014

-83.9789 -83.9848 -83.9904

Columns 1015 through 1017

-83.9958 -84.0008 -84.0054

Columns 1018 through 1020

-84.0094 -84.0130 -84.0160

Columns 1021 through 1023

-84.0183 -84.0200 -84.0210

Column 1024

-84.0214