```matlab
%main program
clc;
clear all;
InputFilename = 'coba2.wav';
[inspeech, Fs, bits] = wavread(InputFilename);
tic
outspeech1 = speechcoder1(inspeech);
outspeech2 = speechcoder2(inspeech);
toc

figure(1);
subplot(3,1,1);
plot(inspeech);
grid;
subplot(3,1,2);
plot(outspeech1);
grid;
subplot(3,1,3);
plot(outspeech2);
grid;
disp('u/ dengerin suara asli!');
pause;
soundsc(inspeech, Fs);
disp('u/ dengerin suara compressed LPC!');
pause;
soundsc(outspeech1, Fs);
disp('u/ dengerin voice-excited compressed LPC!');
pause;
soundsc(outspeech2, Fs);

%hitunglpc
function [aCoeff,resid,pitch,G,parcor,stream] = proclpc(data,sr,L,fr,fs,preemp)
```

```matlab
if (nargin<3), L = 10; end
if (nargin<4), fr = 20; end
if (nargin<5), fs = 30; end
if (nargin<6), preemp = .9378; end
[row col] = size(data);
if col==1 data=data'; end

nframe = 0;
msfr = round(sr/1000*fr);
msfs = round(sr/1000*fs);
duration = length(data);
speech = filter([1 -preemp], 1, data)';
msoverlap = msfs - msfr;
ramp = [0:1/(msoverlap-1):1]';
for frameIndex=1:msfr:duration-msfs+1
frameData = speech(frameIndex:(frameIndex+msfs-1));
nframe = nframe+1;
autoCor = xcorr(frameData);
autoCorVec = autoCor(msfs+[0:L]);
err(1) = autoCorVec(1);
k(1) = 0;
A = [];
for index=1:L
numerator = [1 A.']*autoCorVec(index+1:-1:2);
denominator = -1*err(index);
k(index) = numerator/denominator;
A = [A+k(index)*flipud(A); k(index)];
err(index+1) = (1-k(index)^2)*err(index);
end

aCoeff(:,nframe) = [1; A];
```

```matlab
parcor(:,nframe) = k';

if 0
gain=0;
cft=0:(1/255):1;
for index=1:L
gain = gain + aCoeff(index,nframe)*exp(-i*2*pi*cft).^index;
end
gain = abs(1./gain);
spec(:,nframe) = 20*log10(gain(1:128))';
plot(20*log10(gain));
title(nframe);
drawnow;
end

if 0
impulseResponse = filter(1, aCoeff(:,nframe), [1 zeros(1,255)]);
freqResp = 20*log10(abs(fft(impulseResponse)));
plot(freqResp);
end
errSig = filter([1 A'],1,frameData);
G(nframe) = sqrt(err(L+1));
autoCorErr = xcorr(errSig);
[B,I] = sort(autoCorErr);
num = length(I);
if B(num-1) > .01*B(num)
pitch(nframe) = abs(I(num) - I(num-1));
else
pitch(nframe) = 0;
end

resid(:,nframe) = errSig/G(nframe);
```

```
if(frameIndex==1)
stream = resid(1:msfr,nframe);
else
stream = [stream;
overlap+resid(1:msoverlap,nframe).*ramp;
resid(msoverlap+1:msfr,nframe)];
end
if(frameIndex+msfr+msfs-1 > duration)
stream = [stream; resid(msfr+1:msfs,nframe)];
else
overlap = resid(msfr+1:msfs,nframe).*flipud(ramp);
end
end
stream = filter(1, [1 -preemp], stream)';



%LPC vocoder

function [ outspeech ] = speechcoder1( inspeech )

if ( nargin ~= 1)
error('argument check failed');
end;

Fs = 16000;
Order = 10;
[aCoeff, resid, pitch, G, parcor, stream] = proclpc(inspeech, Fs, Order);
outspeech = synlpc(aCoeff, pitch, Fs, G);



%Voice-excited LPC vocoder
```

```matlab
function [ outspeech ] = speechcoder2( inspeech )

if ( nargin ~= 1)
error('argument check failed');
end;


Fs = 16000;
Order = 10;
[aCoeff, resid, pitch, G, parcor, stream] = proclpc(inspeech, Fs, Order);
resid = dct(resid);
[a,b] = size(resid);
resid = [ resid(1:50,:); zeros(430,b) ];
resid = uencode(resid,4);
resid = udecode(resid,4);
resid = idct(resid);
noise = [ zeros(50,b); 0.01*randn(430,b) ];
resid = resid + noise;
outspeech = synlpc2(aCoeff, resid, Fs, G);


%LPC Decoder

function synWave = synlpc(aCoeff,pitch,sr,G,fr,fs,preemp)

if (nargin < 5), fr = 20; end;
if (nargin < 6), fs = 30; end;
if (nargin < 7), preemp = .9378; end;

msfs = round(sr*fs/1000);
msfr = round(sr*fr/1000);
msoverlap = msfs - msfr;
ramp = [0:1/(msoverlap-1):1]';
```

```matlab
[L1 nframe] = size(aCoeff);

for frameIndex=1:nframe
A = aCoeff(:,frameIndex);
if ( pitch(frameIndex) ~= 0 )
t = 0 : 1/sr : fs*10^(-3);
d = 0 : 1/pitch(frameIndex) : 1;
residFrame = (pulstran(t, d, 'tripuls', 0.001))';
residFrame = residFrame + 0.01*randn(msfs+1,1);
else
residFrame = [];
for m = 1:msfs
residFrame = [residFrame; randn];
end
end;

synFrame = filter(G(frameIndex), A', residFrame);
if(frameIndex==1)
synWave = synFrame(1:msfr);
else
synWave = [synWave; overlap+synFrame(1:msoverlap).*ramp; ...
synFrame(msoverlap+1:msfr)];
end
if(frameIndex==nframe)
synWave = [synWave; synFrame(msfr+1:msfs)];
else
overlap = synFrame(msfr+1:msfs).*flipud(ramp);
end
end;

synWave = filter(1, [1 -preemp], synWave);
```

```
function synWave = synlpc2(aCoeff,source,sr,G,fr,fs,preemp)


if (nargin < 5), fr = 20; end;
if (nargin < 6), fs = 30; end;
if (nargin < 7), preemp = .9378; end;


msfs = round(sr*fs/1000);
msfr = round(sr*fr/1000);
msoverlap = msfs - msfr;
ramp = [0:1/(msoverlap-1):1]';
[L1 nframe] = size(aCoeff);


[row col] = size(source);
if(row==1 | col==1)
postFilter = 0; duration = length(source); frameIndex = 1;
for sampleIndex=1:msfr:duration-msfs+1
resid(:,frameIndex) = source(sampleIndex:(sampleIndex+msfs-1))';
frameIndex = frameIndex+1;
end
else
postFilter = 1; resid = source;
end


[row col] = size(resid);
if col<nframe
nframe=col;
end


for frameIndex=1:nframe
A = aCoeff(:,frameIndex);
```

```
residFrame = resid(:,frameIndex)*G(frameIndex);
synFrame = filter(1, A', residFrame);
if(frameIndex==1)
synWave = synFrame(1:msfr);
else
synWave = [synWave; overlap+synFrame(1:msoverlap).*ramp; ...
synFrame(msoverlap+1:msfr)];
end
if(frameIndex==nframe)
synWave = [synWave; synFrame(msfr+1:msfs)];
else
overlap = synFrame(msfr+1:msfs).*flipud(ramp);
end
end;

if(postFilter)
synWave = filter(1, [1 -preemp], synWave);
end
```

RESPON MEAN OPINION SCORE (MOS)

Nama   :

Jenis Kelamin : L/P (Lingkari salah satu)

No.	File output	Kualitas				
		Tidak Memuaskan	Kurang	Cukup	Baik	Memuaskan
		(1)	(2)	(3)	(4)	(5)
1.	coba1.wav					
2.	coba2.wav					
3.	coba3.wav					

Keterangan :

Berilah tanda (x) pada kolom yang tersedia, sesuai dengan kualitas suara yang dihasilkan.

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