
ENGR 451 - Lab 3

Convolution, Part II

```
test_lab3; % initialize test_lab3 function

% Problems #1-4
x = ones(1, 15);
h = ones(1, 3);
for lc = 5:5:15
    test_lab3(x, h, lc);
end
test_lab3(x, h, 50);

% Problems #5-7
for lx = 14:16
    x = ones(1, lx);
    test_lab3(x, h, 15);
end

% Problem #8-9
test_lab3(1, 1, 1);
test_lab3(1, 1, 10);

% Problem #10-12
% load lab2 % assumes you have 'seashell.wav' in your directory
x = seashell(:)';
test_lab3(x, fir_lp, 100);
test_lab3(x, fir_lp, 200);
test_lab3(x, fir_hp, 100);

Problem #1
    Your overlap-add function is correct
    Your overlap-save function is correct
Problem #2
    Your overlap-add function is correct
    Your overlap-save function is correct
Problem #3
    Your overlap-add function is correct
    Your overlap-save function is correct
Problem #4
    Your overlap-add function is correct
    Your overlap-save function is correct
Problem #5
    Your overlap-add function is correct
    The length of your overlap-save is wrong
Problem #6
    Your overlap-add function is correct
    Your overlap-save function is correct
Problem #7
    Your overlap-add function is correct
    Your overlap-save function is correct
Problem #8
```

```

    Your overlap-add function is correct
    Your overlap-save function is correct
Problem #9
    Your overlap-add function is correct
    Your overlap-save function is correct
Problem #10
    Your overlap-add function is correct
    Your elapsed time is 30246.5 usecs
    which is 87.7 times Matlab's elapsed time (344.88 usecs)
    Your overlap-save function is correct
    Your elapsed time is 2947.92 usecs
    which is 8.55 times Matlab's elapsed time (344.88 usecs)
Problem #11
    Your overlap-add function is correct
    Your elapsed time is 14035 usecs
    which is 25.4 times Matlab's elapsed time (552.9 usecs)
    Your overlap-save function is correct
    Your elapsed time is 1671.12 usecs
    which is 3.02 times Matlab's elapsed time (552.9 usecs)
Problem #12
    Your overlap-add function is correct
    Your elapsed time is 67652.1 usecs
    which is 126 times Matlab's elapsed time (535.82 usecs)
    Your overlap-save function is correct
    Your elapsed time is 5841.8 usecs
    which is 10.9 times Matlab's elapsed time (535.82 usecs)

```

Program Listings

```

disp(' ')
disp('--- overlap_add.m -----')
type('overlap_add')
disp('--- overlap_save.m -----')
type('overlap_save')

```

```

--- overlap_add.m -----

```

```

% lc - chunk length

% Rewrite with while loop not 'loop' var
function y = overlap_add(x,h,lc)
    xL = length(x);
    loop = ceil(xL/lc);
    x = [x zeros(1,lc*loop-xL)];
    ys = sequence([],0);
    for i=1:loop
        temp=x(1+lc*(i-1):lc*i);
        tempoffset = lc * (i-1);
        data = conv(temp,h);
        ts = sequence(data,tempoffset);
        ys = plus(ys,ts);
    end

```

```

        y = ys.data;
        y=ys.data(find(y,1,'first'):find(y,1,'last'));
    end

    --- overlap_save.m -----

function y = overlap_save(x,h,L)
    y=[];

    Lx = length(x);
    M= length(h);
    N = L+M-1;
    xPad = L-mod(Lx,L);
    x = [x zeros(1,xPad)];
    Lx = length(x);
    c=0;

    x_c_prev = zeros(1,N);

    while( c*L+L <= Lx )
        startSampleIndex = c*L+1;
        endSampleIndex = startSampleIndex+L-1;
        x_c = [x_c_prev(end-M+2:end)
x(startSampleIndex:endSampleIndex)];
        x_c_prev = x_c;
        y_c = conv(x_c,h);
        y=[y y_c(M:end-M+1)];
        c=c+1;
    end

    y=y(find(y,1,'first'):find(y,1,'last'));

end

% Read audiofile file.wav
% [x,fs]=audioread('file.wav')
% Play sequence x convolved with sequence h
% h=sequence(sinc(t),0);soundsc(x.conv(h).data,fs)

```

Published with MATLAB® R2019b