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fft\_self.m

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# FFT implementation for octave
# Example for the lecture Digital Processing of Speech and Image Signals
# RWTH Aachen University
# Aachen, 2006
#####
signal=zeros;

# Bit Reversed Sorting
function signal = bitReverse ( signal )
    N = size(signal, 2);
    j = 1;

    for i=1:N-1                # vector starts with 1(!), last one needs not to be swapped

        if (i < j)             # swap, but only once (otherwise, we keep swapping back)
            temp = signal(i);
            signal(i) = signal(j);
            signal(j) = temp;
        endif

        k=N/2;                 # set k to the highest bit
        while k < j            # if k >= j, then the last bit is not set, and we add it
            j = j - k;         # otherwise, we unset every bit until we find the first zero
            k = k / 2;         # and add a bit at that point
        endwhile
        j = j + k;             # set the bit ld_2(k)
    endfor
endfunction

# Butterfly operations
function signal = butterfly ( signal )

    N = size(signal, 2);
    logN = log2(N);          # No check is done here, N is assumed 2^r

    for i = 1:logN           # iteration in the flow diagram
        myExponent = 2^i;
        stepSize = 2^(i-1);
        wPower = (1+j*0.0);
        wUni = e^(-j*2*pi/myExponent); # W_(log2(N))

        for inputBegin = 1:stepSize
            for inputP = inputBegin:myExponent:N # first coefficient of the butterfly operation
                inputQ = inputP + stepSize;      # second coefficient
                Temp = signal(inputQ) * wPower;
                signal(inputQ) = signal(inputP) - Temp; # first Q, so as not to overwrite inputP
                signal(inputP) = signal(inputP) + Temp;
            endfor
            wPower = wPower * wUni;               # W_(ld_2(N))^k
        endfor
    endfor
endfunction

demo_array = [0 1 2 3 4 5 6 7]
reversed_array = bitReverse(demo_array)

x = [1 6 4 7 2 8 9 0]
X_correct = butterfly(bitReverse(x))
X_control = fft(x)

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