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% Surface Acceleration and Liquefaction
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% CEEN514 Soil Dynamics
% Homework 7
% Created: April 21, 2014
%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%

% clear workspace
clear; clc; close all;

%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%

%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%% define constants
g=32.2;
gamma_sat = 123;
p=gamma_sat/g;
G=7.21e5;
E=0.09;
th=35;
Vtau_max= sqrt(G/p);
n=2*E;

increment=0.02;
tmax=29.94;
Vs= ((G*(1+(2*E*i)))/p)^.5;

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load('C:\Users\Brianna\Documents\Soil Dynamics\HW7Acceleration.txt');

t=HW7Acceleration(:,1);
accel=HW7Acceleration(:,2);

%Bedrock Motion
force=accel(:,1);
N= size(accel,1);
P=increment*fft(force);

%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%1D Ground Amplification Analysis (LH Model)
%%Initial Values
wbarstar=(pi*N)/tmax;
deltawbar=(2*wbarstar)/N;
wbar=2*wbarstar-deltawbar;

wk = 0:deltawbar:wbarstar
kstar = wk/sqrt((G*(1+(2*E*i)))/p)
TransferF = 1./(cos(kstar*th))

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%Bedrock Motion Multiplied by Transfer Function to get Surface Motion
%Size_Vw=size(749);
%N= size(force,1)-1;
z=1;
for wk=0:deltawbar:wbarstar
    kstar = wk/sqrt((G*(1+(2*E*i)))/p);
    TransferF (z,1) = 1./(cos(kstar*th));
    Vw(z,1)= TransferF(z,1).*P(z,1);
    z=z+1;
end

%%%Complex conjugate and Symmetry
Vsurf = [Vw;zeros(N/2-1,1)];
z=N/2+2; %K=N/2+2
y=N/2; %K=N/2
counter=0;
for k=z:N
    Vsurf(k,1)=conj((Vsurf(y-counter,1)));
    z=z+1;
    counter= counter +1;
end

%Back into time domain Surface Motion
Vt=wbarstar/pi.*ifft(Vsurf);

%Absolute Value of Surface Motion
abshorz=max(abs(Vsurf))

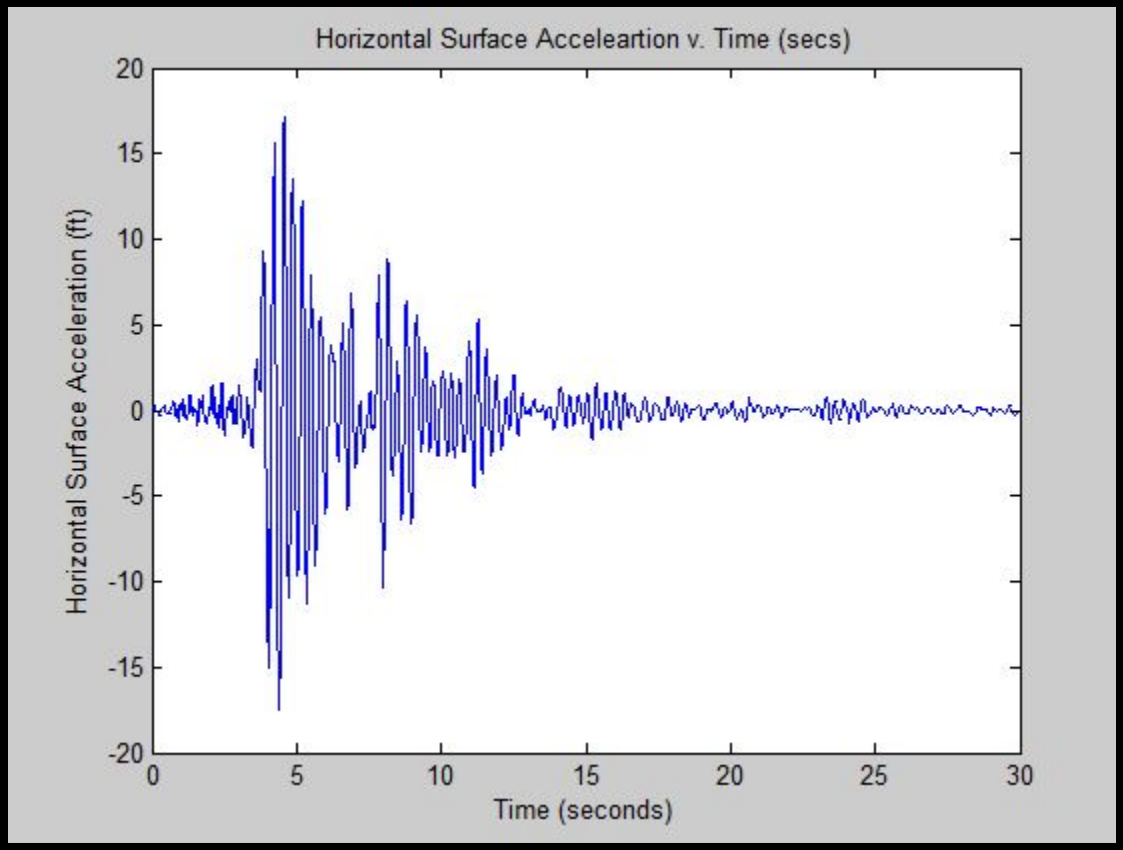
%% plot amplitude of transfer function in frequency domain
hold on;
%figure (1)
%plot(wk, TransferF)
%title ('Amplitude of transfer function in Frequency Domain')
% label figure
%xlabel('Natural Frequencies')
%ylabel('Forcing function, frequency domain')

%%Plot horizontal surface displacement in time domain
figure(2)
plot (0:tmax/N:tmax-tmax/N, Vt)
title ('Horizontal Surface Accelartion v. Time (secs)')
% label figure
xlabel('Time (seconds)')
ylabel('Horizontal Surface Acceleration (ft)')

hold off;

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Plot of Surface Acceleration



Note: Max Absolute Value of Horizontal Surface Acceleration = 17.6045