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%
% Script to verify expressions for depth-induced modulations
% of bottom pressure. Fabrice Ardhuin, December 1, 2017.
%
clear all;
nf=1000;  % Number of frequencies
D0=15;    % mean water depth used for test
freq=linspace(0.0001,1,nf);
k=dispNewtonTH(freq,D0);  % uses Newton Methon for inverting ...
    sig^2 = gk tanh(kD)
khp=freq.*0;
alphas=khp;           % modulation factor
alphasi=zeros(nf,4);  % different pieces of the modulation factor
  for i=1:nf
       om=2.*pi.*freq(i); % radian frequency
       k0=k(i);
       y=k(i)*D0; % y=kD
       khp(i)=y;   % stores values of kD for later plot
       if (y < 7)
           dkdD=-2*k0^2./(2*y+ sinh(2*y));
           dkDdD=k0.*sinh(2*y)./(2*y+ sinh(2*y));
           Cg=om./k0.*0.5*(1+(2*y)/sinh(2*y));
           dCgdD=om/k(i)*(dkDdD/sinh(2*y)-2*y*dkDdD*cosh(2*y)/(sinh(2*y)^2)) ...
               ...
                       -dkdD*om/k0.^2*0.5*(1+(2*y)/sinh(2*y));
           alpha2=-(sinh(y).^2)/(y+ sinh(y).*cosh(y) );
           alpha3=-(2.*sinh(2*y)-4*y*sinh(y)^2)/((sinh(2*y)+(2*y)).^2);
           alpha3b= -0.5.*dCgdD./(Cg*k0); % This is for ...
               verification ...
           % Proposed by JFM Reviewer, his eq C3 :
           % (2*y+sinh(2*y)+sinh(2*y)* ...
           %    (sinh(2*y)-2*y*cosh(2*y)))/(2*y+sinh(2*y)).^2;
           alpha1=2./(2*y+ sinh(2*y));
           %alphas(i)=((2-2.*sinh(kh).^2).*(2*x+sinh(2*x))  ...
               -(2.*sinh(2*x)-4*x*sinh(x)^2)) ...
               /((sinh(2*x)+(2*x)).^2);
           alphas(i)=4*(y-cosh(y).*sinh(y).^3 ) ...
               /((sinh(2*y)+(2*y)).^2);
           alphasi(i,1)=alpha1;
           alphasi(i,2)=alpha2;
           alphasi(i,3)=alpha3;
           alphasi(i,4)=alpha3b;
       else
           alphas(i) = -1;
       end
end
figure(1)
clf
plot(khp,alphas,'k',khp,alphasi(:,1)+alphasi(:,2)+alphasi(:,3),'ko')
 axis([0 4 -1 5])
 hold on
plot(khp,alphasi(:,1),'r-',khp,alphasi(:,2),'g-',khp,alphasi(:,4),'go', ...
    ...
    khp,alphasi(:,3),'b-',khp,alphasi(:,3)+alphasi(:,2),'c-')
xlabel('y=k_0 D_0')
```