Simplified IBL model – a fully Implicit version (BTCS).

```
% Implicit IBL 5
steps=10;
z01=0.001; z02=0.1; z20=20; U0=10; vk=0.4;
N=101; ztop = 20; zetatop=log(1+ztop/z02);
z01p=z01/z02; z20p=z20/z02; dzeta=zetatop/(N-
1);dzeta2=dzeta^2;
zetaA=ones(1,N); emzeta=ones(1,N); U0A=ones(1,N);
zA=zeros(1,N);
U0P=ones(1,N); UAN=ones(1,N);
ustar = vk*U0/log(1+z20/z01);
ustar2 = vk*U0/log(1+z20/z02); %changed for more mixing
for iz=1:N
    zeta=(iz-1)*dzeta;
    zetaA(iz)=zeta;
    emzeta(iz)= exp(-zeta);
    zA(iz)= (exp(zeta)-1)*z02;
    U0A(iz)=(ustar/vk)*log(1+zA(iz)/z01);
    U0P(iz)=U0A(iz)/U0;
    UAN(iz)=U0P(iz);
end
figure
plot(U0P,zetaA);
xlabel('wind speed/U0')
ylabel('zeta')
ylim([0 6])
hold on
%start of x stepping
dx = 0.1; dxp = dx/z02; dxpi=1/dxp; x=0;
for iss = 1: steps
isteps = 200;
   for is = 1:isteps
     x=x+dx;
     for iz = 2:N-1
        AL(iz-1)=-vk*ustar2*emzeta(iz)*dxp/(U0*dzeta2);
        AR(iz)= AL(iz-1);
        AD(iz)= 1.0+2*vk*ustar2*emzeta(iz)*dxp/(U0*dzeta2);
        BB(iz) = UAN(iz);
     end
     AD(N)=dxpi+2*vk*ustar2*emzeta(N)/(U0*dzeta2);
    AD(1)=dxpi; AR(1)=-vk*ustar2*emzeta(1)/(U0*dzeta2);
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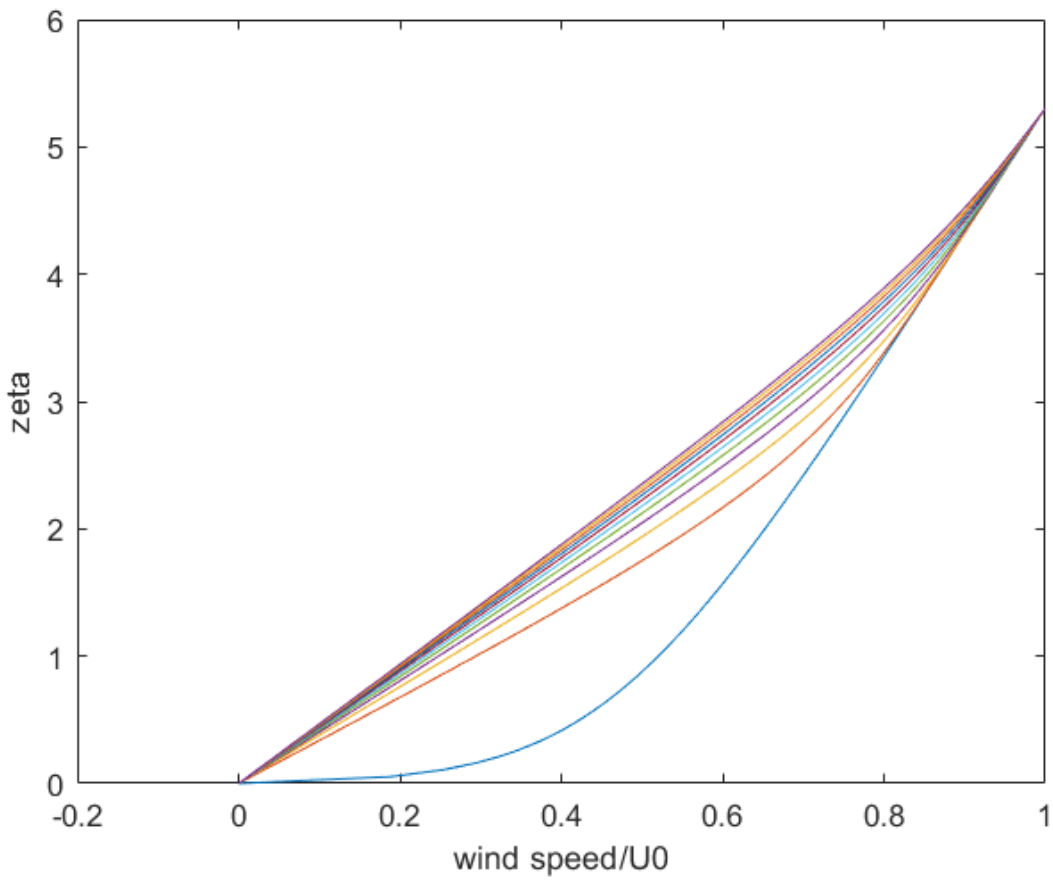
```
    AL(N-1)=-vk*ustar2*emzeta(N)/(U0*dzeta2);
    BB(1)= 0;AR(1)=0; AD(1)=1; BB(N)=1.0;
    AD(N)=1.0;AL(N-1)=0;
    MM=diag(AD,0)+diag(AL,-1)+diag(AR,1); %NEED CARE HERE
    UAN=MM\BB';
  end
plot (UAN,zetaA)
hold on
end
```



Integrating 200m in 10 steps of 20m.