# Finite Elements In Fluid

## Transport problems

## Numerical examples

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Write down the Galerkin formulation and modify your code
to be able to use

- the leap-frog method

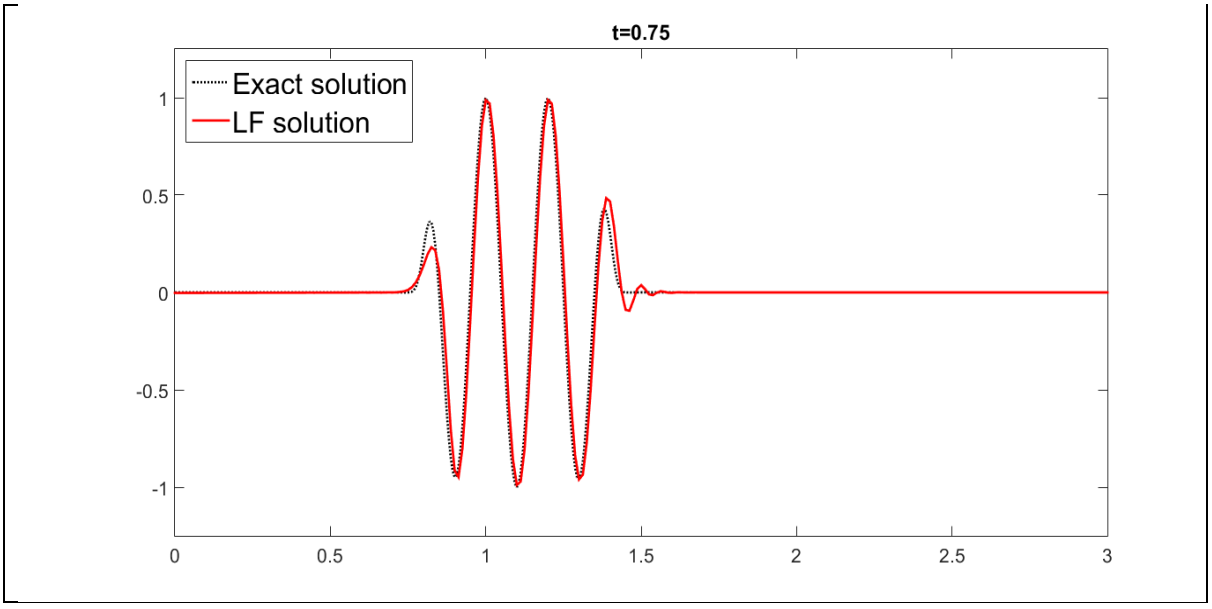
The code changed in System.m is

```
case 6 % the leap-frog method
        A=M;
        B=(-2)*dt*C*a;
         methodName = 'LF';
```

The code changed in main.m is

```
if method==6
   for n= 1:nStep
    if n==1
   [A,B,methodName]= System(1,M,K,C,a,dt);
   Du = A\(B*u(1:nPt,n) + f);
    u(1:nPt,n+1) = u(1:nPt,n) + Du;
    clear A,B;
    else
       [A,B,methodName]= System(5,M,K,C,a,dt);
   Du = A\(B*u(1:nPt,n) + f);
    u(1:nPt,n+1) = u(1:nPt,n-1) + Du;
    end
   end
```

Results obtained at t=0.9 with the above code



2)the third order and two-step third-order Taylor-Galerkin

method (use α=1/9 to reproduce the phase-speed

characteristics of the TG3 scheme)

The code changed in System.m is

```
case 7 % 2 step TG3-II
        A = M;
        B = -a*dt*C;
        methodName = 'TG3';
```

The code changed in main.m is

```
else if method==7
        for n= 1:nStep
        [A,B,methodName]= System(7,M,K,C,a,dt);
        Du = A\(B*u(1:nPt,n) + f);
          u_bar= u(1:nPt,n) + Du;
        clear A,B;
        [A,B,methodName]= System(8,M,K,C,a,dt);
        Du = A\(B*u(1:nPt,n)- .5*a^2*dt^2*K*u_bar + f);
        u(1:nPt,n+1) = u(1:nPt,n) + Du;
        end
    else
```

Results obtained at t=0.9 with the above code