EC7611 RF AND MICROWAVE LABORATORY

REPORT

Simulation of voltage waves in a transmission line

About:

A visualization project were the incident voltage waves, reflected voltage wave, total voltage wave and standing wave travelling in a transmission line under various conditions are plotted using MATLAB.

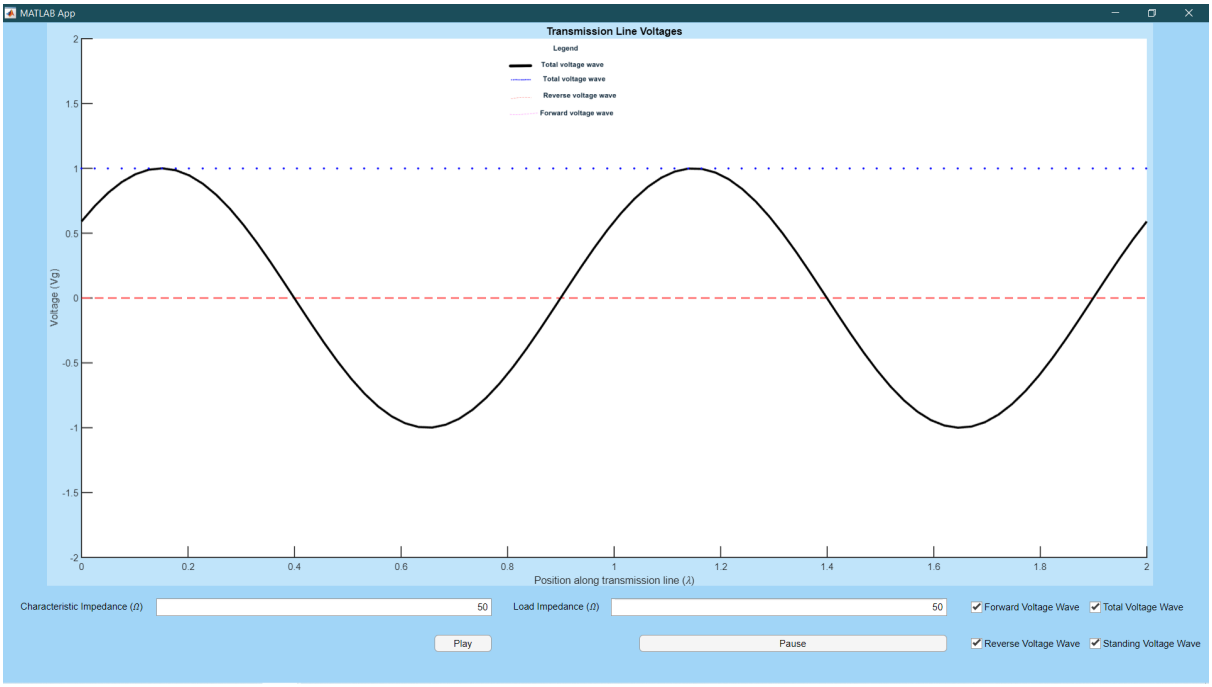
Code:

```
properties (Access = private)
        %default values
        play = true;
        position = 0;
        Zo = 50;
        ZL = 50;
        %values needed of calculation
        freq = 300000000; %3Mhz
        lambda = 1;
        beta = 2*pi;
        gamma = 1j*2*pi;
        omega = 2*pi*300000000; % 2*pi*f
        ref = 0; % zr (normalized impedence)
        %check box values
        forVol = true;
        revVol = true;
        totVol = true;
        stdVol = true;
    end
 methods (Access = private)

        function plotWaves(app,T)
            t=6.28*T/100/app.omega; %increment through the time, to run two periods
            z=linspace(0,2*app.lambda,80); %initialize vector for distance values along the t-line
            Vfor=real((exp(-app.gamma*z)*exp(1j*app.omega*t)));   %compute the forward power
            Vrev=real(app.ref*exp(app.gamma*z)*exp(1j*app.omega*t));
            Vtot=Vfor+Vrev;  %compute the total power
```

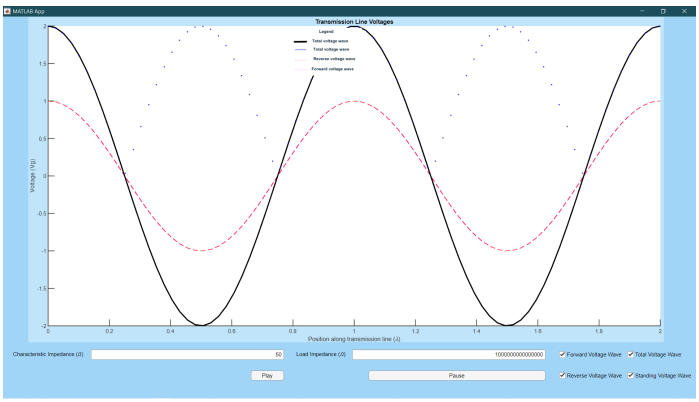
```
 Vswr=((exp(-app.gamma*z)+app.ref*exp(app.gamma*z)).*conj((exp(-app.gamma*z)+app.ref*exp
(app.gamma*z)))).^0.5;  %computer the standing wave ratio power
            cla(app.UIAxes)
            hold(app.UIAxes,'on')
            if(app.forVol == true)
                plot(app.UIAxes,z/app.lambda,Vfor,'m--');
            end
            if(app.revVol == true)
                plot(app.UIAxes,z/app.lambda,Vrev,'r--');
            end
            if(app.totVol == true)
                plot(app.UIAxes,z/app.lambda,Vtot,'Color',[0,0,0],"LineWidth",2);
            end
            if(app.stdVol == true)
                plot(app.UIAxes,z/app.lambda,Vswr,'b.');   %plot the four power signals
            end
            drawnow %display the updated plot
            hold(app.UIAxes,'off')
        end

    end

    function PlayButtonPushed(app, event)
            app.play = true;
            brk = false;
            while(brk == false && app.play == true)
                for T=app.position:300 %move through time
                    if(app.play == false)
                        break;
                    end
                    try
                    app.plotWaves(T);
                    catch
                        brk = true;
                        break;
                    end
                    %pause(.1)  %pause to control the speed of the simulation
                    if(T == 300)
                        app.position = 0;
                    else
                        app.position = T;
                    end
                end
            end
        end
```

Analytical Result:

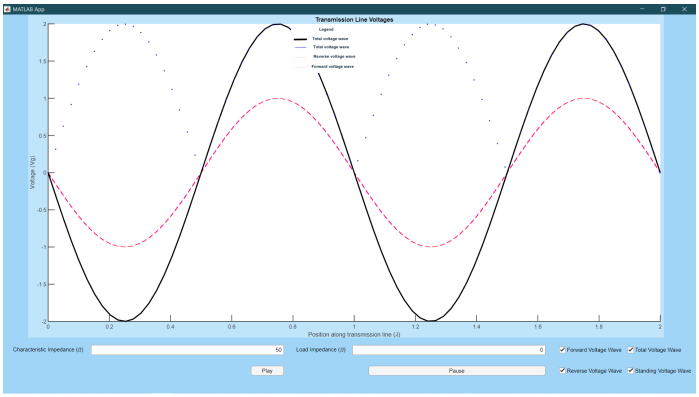
Matched transmission line



open circuited transmission line



short circuited transmission line



For matched condition: Zl=Zo, VSWR=1 and reflection coefficient=0
For short circuited load: Zl=0, VSWR=Infinity and reflection coefficient=1
For open circuited load: Zl=Infinity, VSWR=Infinity and reflection coefficient=1

Conclusion:

Thus the various voltage wave in a transmission line under matched termination, short and open circuited terminations was plotted and the result is verified.