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% Exercise 1 - Joshua Obljubek-Thomas - 400506256 - obljubej
clear all; close all %#ok<CLALL> reset everything

% phase velocity
c = 299792458;        % speed of light
eps_r = 2.0;          % relative permittivity
vp = c / sqrt(eps_r); % phase velocity

% Gaussian pulse parameters
alpha = 2.0*10^8; A = 5;

% spatial and temporal axes
dz = (3 * vp) / sqrt(2 * alpha); z = linspace(-dz, +dz, 1001);
dt =        6 / sqrt(2 * alpha); t = linspace(-dt, +dt, 2001);

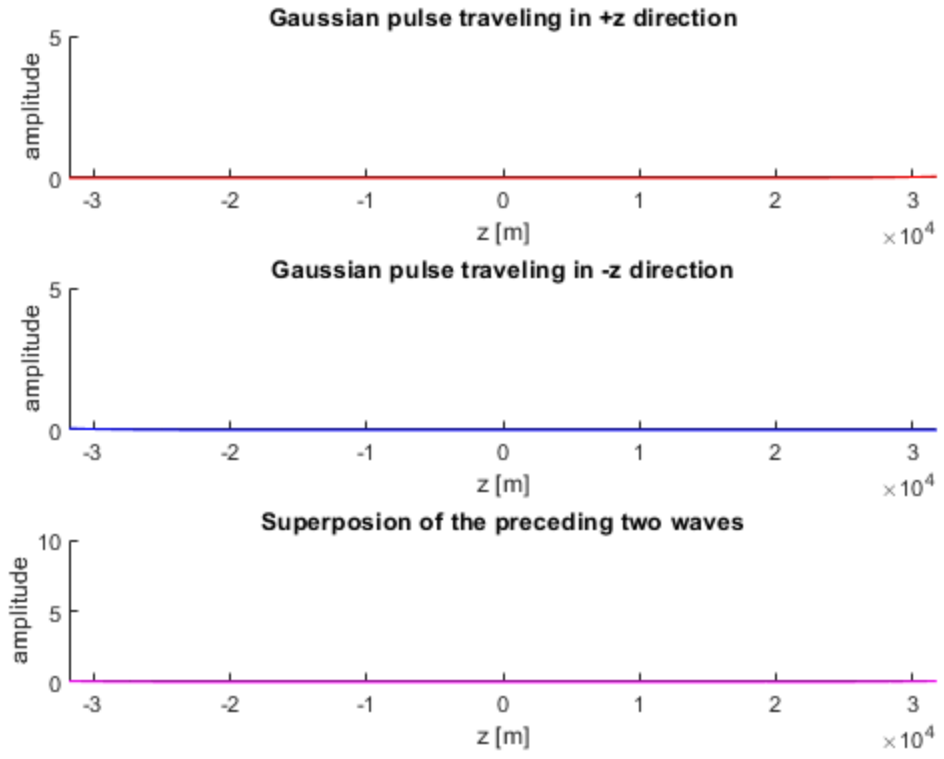
% function for a Gaussian pulse centered at the origi
gauss = @(tau) A * exp(-alpha * tau.^2);
% function for the corresponding wave over all points z at single time ti
wave = @(z, ti) gauss(ti - z / vp);

% plot specification
subplot(3, 1, 1)                                    % 3x1 grid, 1st plot
line1 = animatedline('Color', 'red');               % line in the plot
title("Gaussian pulse traveling in +z direction") % title
xlabel("z [m]"); ylabel("amplitude")                % axis labels
xlim(z([1 end])); ylim([0 A])                       % axis limits

subplot(3, 1, 2)                                    % 3x1 grid, 2nd plot
line2 = animatedline('Color', 'blue');              % line in the plot
title("Gaussian pulse traveling in -z direction") % title
xlabel("z [m]"); ylabel("amplitude")                % axis labels
xlim(z([1 end])); ylim([0 A])                       % axis limits

subplot(3, 1, 3)                                    % 3x1 grid, 3rd plot
line3 = animatedline('Color', 'magenta');           % line in the plot
title("Superposion of the preceding two waves")   % title
xlabel("z [m]"); ylabel("amplitude")                % axis labels
xlim(z([1 end])); ylim([0 2*A])                     % axis limits

% animation instructions
for ti = t
    clearpoints(line1)
    clearpoints(line2)
    clearpoints(line3)
    addpoints(line1, z, wave(+z, ti))
    addpoints(line2, z, wave(-z, ti))
    addpoints(line3, z, wave(+z, ti) + wave(-z, ti))
    drawnow limitrate
end
```



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