1 Transmission and reflexion at interfaces

Question 1

The electric impendance Z measures the opposition to electrons flow (i.e. current I) showed by a circuit under tension U. Similarly, one can define an *acoustic impedance* which caracterizes material resistance to particles flow (i.e. velocity) under a given pressure. Starting from the propagation of an elastic wave moving at a speed c along a 1d bar $u(x,t) = f(x+ct)$, find the expression of the acoustic impedance.

Question 2

Two bars of different materials but of the same length L are assembled into a single bar of length $2L$. The material properties of the bars are:

- Bar 1 is made out of material 1: $E_1 = 100\,\text{GPa}$, $\rho_1 = 10000\,\text{kg/m}^3$
- Bar 2 is made out of material 2: $E_2 = 50\,\text{GPa}$, $\rho_2 = 5000\,\text{kg/m}^3$

Compute the impedances ratio at their interface.

Question 3

Recall the two mechanical conditions that must be satisfied at the interface between the two bars.

Question 4

Give the expression for the coefficient of reflexion f_R and the coefficient of transmission f_T for a signal f_I arriving at the bar interface.

Question 5

Let's consider bar 1 as being on the left-hand side of bar 2. A compression wave of amplitude σ_0 and period t_0 is traveling in bar 1 towards bar 2. Describe the phenomena of reflexion and refraction occuring at the bar interface.

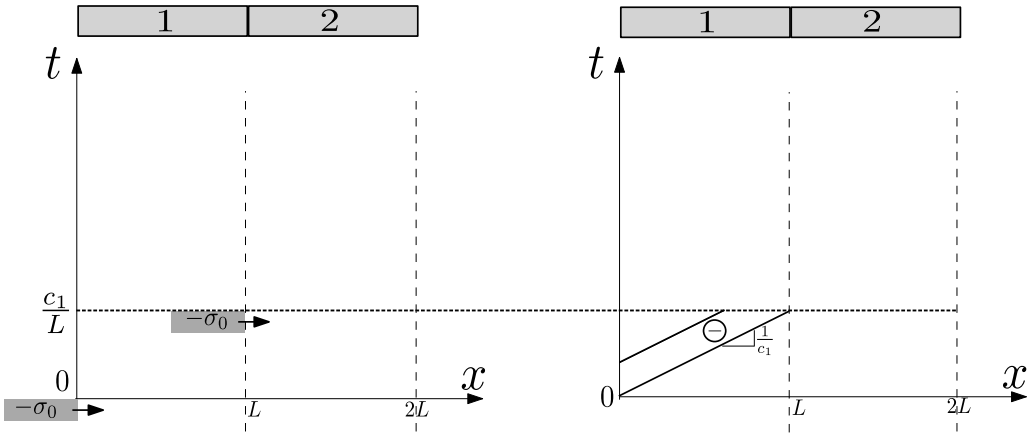

Figure 1: Continue this diagram of characteristics associated to stress diagram.