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College Heights Blvd., Mathematics Department, Bowling Green, KY 42101-1078. *Wave Scattering
in In-homogeneous Strings*

Consider two semi-infinite strings with densities ρ_1, ρ_2 , joined together at the origin O . The corresponding wave speeds along the two pieces are c_1 and c_2 , respectively. An incoming wave $f(x - c_1t)$, where $f(x) = 0, x > 0$, will be scattered to partly reflected and partly outgoing at the interface O . Let the resulting wave $u(x, t)$ satisfy, $u_{tt} - c^2(x)u_{xx} = 0, (x, t) \in R \times (0, \infty)$, where $c(x) = c_1, x < 0$ and $c(x) = c_2, x > 0$. Under the condition, $u_x(x, t)$ continuous everywhere, and the initial conditions, $u(x, 0) = f(x)$, and $u_t(x, 0) = -c_1f'(x)$, the solution is known to be,

$$u(x, t) = f(x - c_1t) + \frac{c_2 - c_1}{c_2 + c_1}f(-x - c_1t), \quad x < 0,$$

$$u(x, t) = \frac{2c_2}{c_2 + c_1}f\left(\frac{c_1}{c_2}(x - c_2t)\right), \quad x > 0.$$

Now, consider a string made of three pieces in the intervals $(-\infty, 0)$, $(0, \sigma)$, and (σ, ∞) . We study the behavior of an incoming wave $f(x - c_1t)$, where $f(x) = 0, x > 0$, at the interfaces, under similar conditions as above. (Received September 17, 2007)