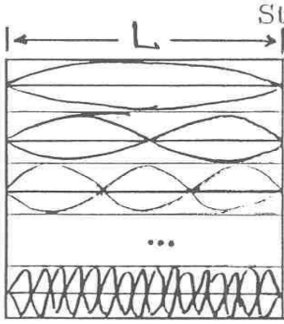
Resonant Frequencies for Standing Waves on a String of Length, L: $f_n = v/\lambda_n$

Transverse displacement nodes $\sin(2\pi x/\lambda) = 0$ at $x = 0$ and $x = L$ (endpoints of string).

Standing wave patterns – "normal modes"



	1st harm.	$L = \frac{1\lambda_1}{2}$	$\lambda_1 = \frac{2}{1} L$	$f_1 = \frac{1V_x}{2L} = 1\ f_1$
	2nd harm.	$L = \frac{2\lambda_2}{2}$	$\lambda_2 = \frac{2}{2} L$	$f_2 = \frac{2V_x}{2L} = 2\ f_1$
	3rd harm.	$L = \frac{3\lambda_3}{2}$	$\lambda_3 = \frac{2}{3} L$	$f_3 = \frac{3V_x}{2L} = 3\ f_1$
...	...	...	...	...
	nth harm.	$L = \frac{n\lambda_n}{2}$	$\lambda_n = \frac{2}{n} L$	$f_n = \frac{nV_x}{2L} = n\ f_1$

Note: 1^{st} harmonic (n = 1) also known as the Fundamental
2^{nd} harmonic (n = 2) also known as the 1^{st} Overtone
3^{rd} harmonic (n = 3) also known as the 2^{nd} Overtone

etc.

$$f_n = n\frac{v}{2L} = nf_1\ ; \qquad f_1 = \frac{v}{2L}$$

$$\lambda_n = \frac{2L}{n} = \frac{\lambda_1}{n}; \qquad n = 1, 2, 3, \ldots$$

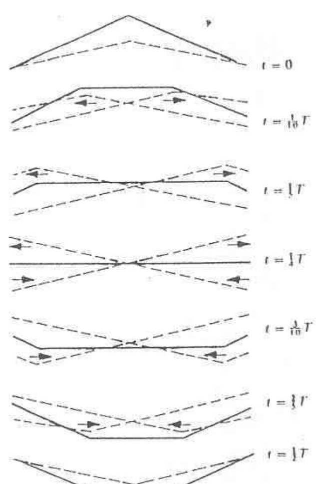


FIGURE 2.6. Time analysis of the motion of a string plucked at its midpoint through one half cycle. Motion can be thought of as due to two pulses traveling in opposite directions.