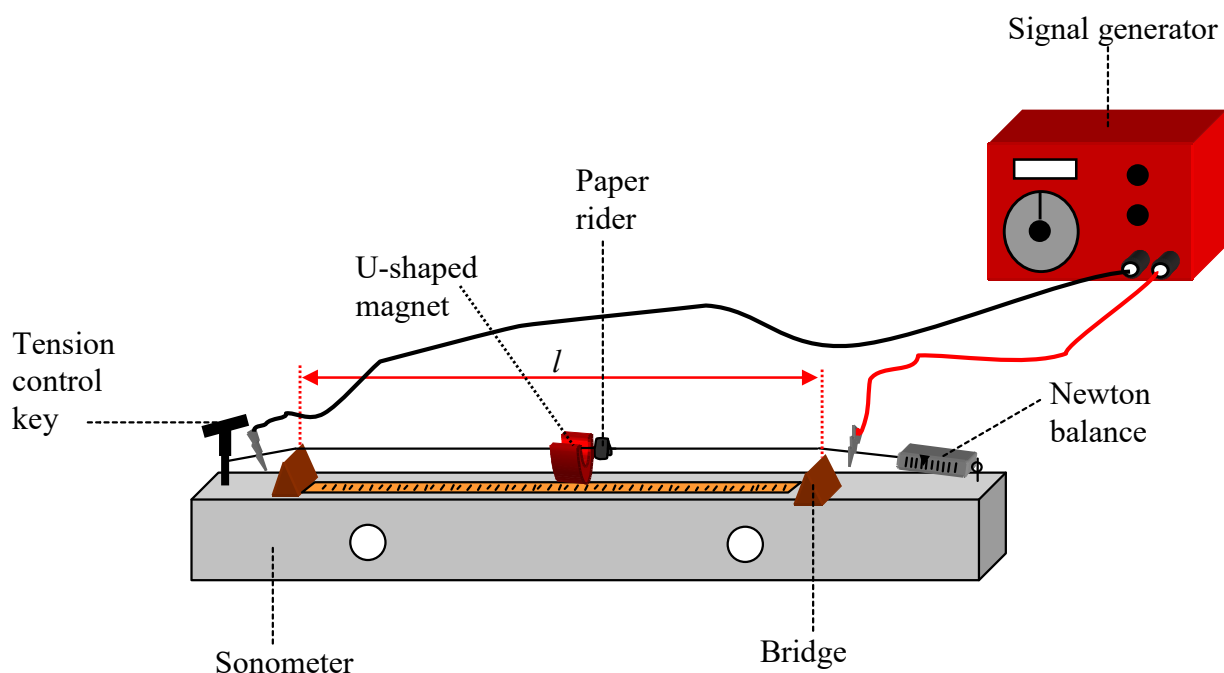


INVESTIGATION OF THE VARIATION OF FUNDAMENTAL FREQUENCY OF A STRETCHED STRING WITH LENGTH

Apparatus

Signal generator, U-magnet, sonometer with a newton balance or tensionometer (0 to 50 N) and tension key.

Safety note: Wear safety goggles in case the sonometer wire snaps.



Procedure

1. Place the sonometer wire between the poles of the U-magnet, positioned midway between the bridges.
2. Fix the tension at a constant value (e.g. 20 N), using the tension control key.
3. Place the bridges as far apart as possible and measure the length of the wire l between the bridges with a metre stick.
4. Slowly increase the applied a.c. frequency from 0 Hz, until the wire vibrates.
5. Note the value of this frequency when the vibration is at its maximum.
6. Reduce the length of the wire, by sliding one bridge towards the other one. Reposition the magnet midway between the bridge supports and measure the fundamental frequency for that length.
7. Repeat this procedure for different lengths of wire and measure the corresponding fundamental frequencies.
8. Record the measurements in a table.
9. Plot a graph of frequency f against inverse of length $\frac{1}{l}$.

Results

f/Hz	l/m	$\frac{1}{l}/\text{m}^{-1}$

Conclusion

A straight line through the origin will verify that frequency f is inversely proportional to the length l .

Notes

If the frequency cannot be read with reasonable accuracy from the signal generator, use a multimeter with a suitable frequency scale. Connect it across the signal generator.

Use the amplitude control on the signal generator to adjust the current flowing through the wire, to prevent overheating.

Keep the paper rider as light as possible. Use a small piece of cellotape to hold the paper in the form of a loop. This allows the rider to sit loosely on the wire without falling off. The movement of the paper is then easier to see and hence the position of resonance is easier to identify.

A short length of drinking straw can also be used as a very light rider. Slit the straw length-wise first; cut off a 0.5 cm piece and slip it onto the string. This rider can be moved along the string to detect the positions of nodes and antinodes when the string is vibrating at resonance.

A set of tuning forks may be used as an alternative to the signal generator and magnet.

Use the low impedance output of the signal generator.

A guitar string may be used instead of the sonometer wire.