Ribbon cable makes coils for printed-circuit boards

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A microhenry inductor loop made from flexible ribbon cable is easy to mount on printed-circuit boards, and its inductance value is easy to control. This loop is a cross between the familiar wire-coil inductor and a printed-circuit inductor. Since the ribbon-cable loop is three-dimensional, a larger amount of inductance is possible for a given area than a printed-circuit coil can provide. Moreover, the ribbon inductor is much easier to manufacture and control than the usual wire-coil inductor.

Figure 1 illustrates the technique of bending the flexible cable into a semicircle and soldering the ends into a pc board so that the conductors interconnect to form a multiturn coil with a "D" cross section.

The inductance of a "D" cross-section coil may be calculated from the formula for a circular coil, with the effective radius of the "D" coil substituted for the actual radius of a circle. For a single-layer n-turn circular coil with radius a and length l, the inductance in microhenries is

$$L = n^2a^2/(9a+10l)$$

where a and l are in inches.

For a "D" coil with the dimensions shown in Fig. 2, the effective circumference, C, is the length of the ribbon cable, B, plus the pc-board spacing, S. The effective radius can be calculated from

$$r_{eff} = C/2\pi = (B+S)/2\pi$$

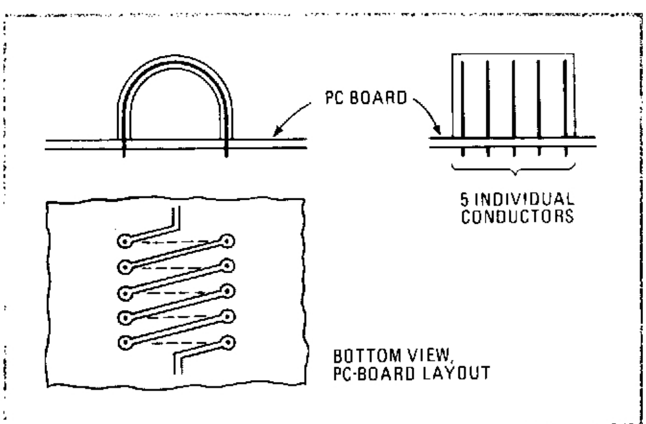
Thus, the inductance in microhenries of the coil made with ribbon cable is

$$L = n^2[(B+S)/2\pi]^2/[9(B+S)/2\pi + 10l]$$

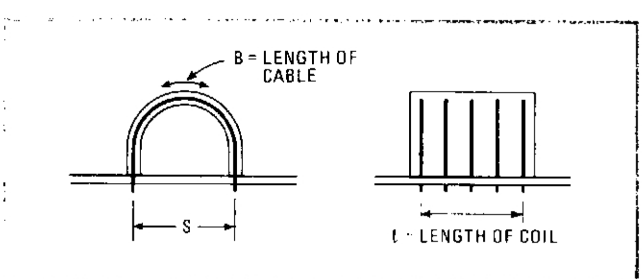
where all dimensions are in inches.

The measured and calculated inductances of an actual "D" coil are plotted versus the length (l) of the coil in Fig. 3. The coil for this test was made of a 2-inch length of Ansley Flexstrip with a pc-board spacing of 1.75 in. With 10 conductive strips per inch, the Flexstrip forms a coil with 10 turns per inch. The calculated values of inductance proved to be close to the measured values over a range of coil lengths from 0.5 to 3.0 in. (n= 5 to n = 30).

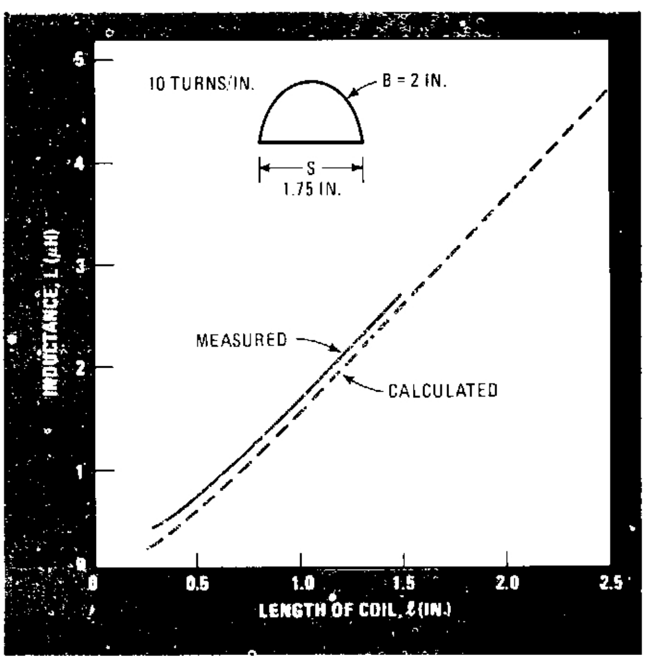
Since flexible cable of this type can be purchased in precut sizes, the manufacture of highly repeatable inductors can be simplified. An impedance transformer can be made by adding a second coil inside the first. A



1. Loops good. Flexible ribbon cable is mounted on printed-circuit board, with individual conductors cross-connected in series, to form an inductance coil. One loop can be nested inside another to form a transformer, and individual turns of the loop can be tapped. These coils have the amounts of inductance needed for rf tuning.



2. Sizing it up. Definitions of dimensions used in text are illustrated. A given ribbon has a fixed number of conductors per inch of ribbon width (coil length), so n and l are equivalent quantities.



3. Microhenries. Inductance of ribbon-cable inductor is shown as a function of coil length, l. Since ribbon has 10 conductors per inch of width (coil length), abscissa represents 0 to 25 turns.

multiple tapped inductor is easily formed by bringing out any of the turns on the printed-circuit board. Since ... is terminated on the board, other electrical components may be wired with the coil. For example, capacitors may be paralleled with the coil to form tuned rf circuits. □