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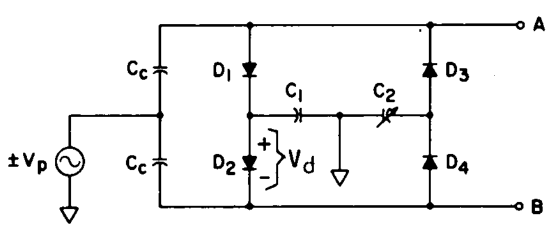
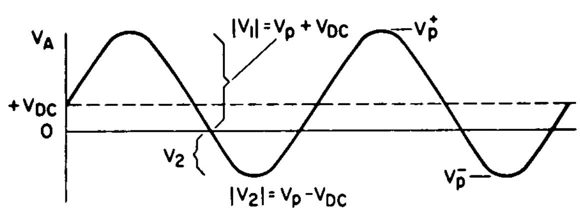
Diode-Quad Bridge for Reactive Transducers and FM Discriminators

A new diode-quad bridge circuit has been developed for use with pressure-sensitive capacitive transducers, liquid-level measuring devices, proximity deflection sensors, and inductive displacement sensors. It may also be used as an FM discriminator and as a universal impedance bridge.





The circuit in the diagram provides an improvement over other recently developed circuits in at least one of the following respects: (1) The output is relatively independent of excitation frequency; (2) The circuit sensitivity is greater and is independent of waveform; (3) The circuit performs equally well with either capacitive-, resistive-, or inductive-type transducers; (4) The transducer may be conveniently grounded; (5) The circuit also functions as a tuned frequency discriminator by combining series or parallel inductors with C_1 and C_2.

The diodes in the circuit perform as switches which conduct current in sequence. A typical input voltage waveform is also shown in the diagram; the waveform represents a sinusoidal excitation voltage and a positive DC output signal present on terminal A (the DC voltage at B is negative). Assuming that the capacitances of the coupling capacitors C_c are much greater than C_1 and C_2, and that the circuit is unloaded, diode D_1 conducts when the applied voltage is sufficient to produce a forward bias condition and charges C_1 to the peak value V_1 while removing a quantity of charge from C_c equal to V_1C_1. When the applied voltage decreases sufficiently, D_1 is turned off, and D_3 conducts as it becomes forward biased relative to the voltage on C_2; a peak value of V_2 is impressed on C_2 thereby replacing a quantity of charge on C_c equal to V_2C_2. The net effect is that it appears as though a differential charge exists on C_c that is proportional to the charges on C_1 and C_2. However, for steady-state conditions, the net transfer of charge from C_c is zero. Since the DC voltage component on C_c must then adjust to a level to satisfy the condition $Q_1 = Q_2$, it follows that $V_1C_1 = V_2C_2$. Also, it can be shown that the voltages between terminals A and B is

$$\left.\frac{V_{DC}}{V_p - V_d}\right|_{AB} = \frac{2(C_1 - C_2)}{C_1 + C_2};$$

the terms in the voltage transfer function are identified in the diagram.

Examination of the voltage transfer function suggests that if C_1 and C_2 are nearly equal and have identical temperature coefficients, temperature changes will be self-canceling in the capacitive functions of

(continued overleaf)

the circuit; however, the diodes can produce considerable drift in the output if the diode-quad is not constructed of temperature-matched components.

Alternative embodiments of the circuit shown in the diagram can be formed by substituting resistors or parallel- and series-resonant LC elements in place of C_1 and C_2, or other combinations of L, C, and R.

Note:

Requests for further information may be directed to:

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Patent status:

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