

Phase
 Vector diagram of the bridge ^{shearing}
~~SUNDAY~~
 Let AC represent the
 voltage to the bridge.
 I_1 , I_2 , I_3 , I_4
 $I_2|_{OC2}$, $I_1|_{OC1}$
 $I_4R_3 = I_3|_{OC3} = I_1R_2$
2017

The diagram illustrates a bridge circuit with four nodes labeled A, B, C, and D. Node A is at the top left, node C is at the bottom right, node B is at the bottom center, and node D is at the bottom left. A horizontal line connects A and C, and a vertical line connects C and D. Currents are shown as vectors originating from node A: I_1 points upwards along the horizontal line, I_2 points downwards along the vertical line, and I_3 points upwards along the line from C to D. From node C, I_4 points upwards along the line from C to D. Arrows indicate the direction of current flow in each branch. At node A, there are two voltage drops: $I_2|_{OC2}$ pointing downwards along the vertical line, and $I_1|_{OC1}$ pointing downwards along the horizontal line. At node C, there is one voltage drop I_4R_3 pointing upwards along the line from C to D.

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MAR - 2017

M	T	W	T	F	S	S
1	2	3	4	5	6	7
8	9	10	11	12	13	14
15	16	17	18	19	20	21
22	23	24	25	26	27	28

The branch ABC is capacitive at the

current I_1 leads the applied voltage across line AE at some angle above AC at A. This is then the direction of the branch current I_1 . The pd across is $I_1/\omega C_1$ and is at right angle to I_1 . So draw a line perpendicular to AE in the clockwise direction. cut off a length $AO = I_1/\omega C_1$. Join O with C. Then OC represents the total voltage across τ_1 and R_2 since the current and voltage across a resistor are in the same phase. OC parallel to AE. cut off a length $OB = \sigma_1 I_1$. OB represents the voltage across τ_1 and BC represents the voltage across R_2 . Since B and D are at the same potential and so D also lies at B in the vector diagram. Join A B with B. Then AB is the total voltage across the capacitor C_1 and its innate resistance σ_1 . Let I_2 be the current through C_2 and I_4 be the current through R_3 . Then $DC = I_4 B = I_3 \frac{1}{\omega C_3}$ since current leads the emf in a capacitor. I_3 is perpendicular to BC or DC in the anticlockwise direction.

Power factor of $q = \cos \alpha = OB/AD$

S	M	T	W	T	F	S
30						1
2	3	4	5	6	7	8
9	10	11	12	13	14	15
16	17	18	19	20	21	22
23	24	25	26	27	28	29

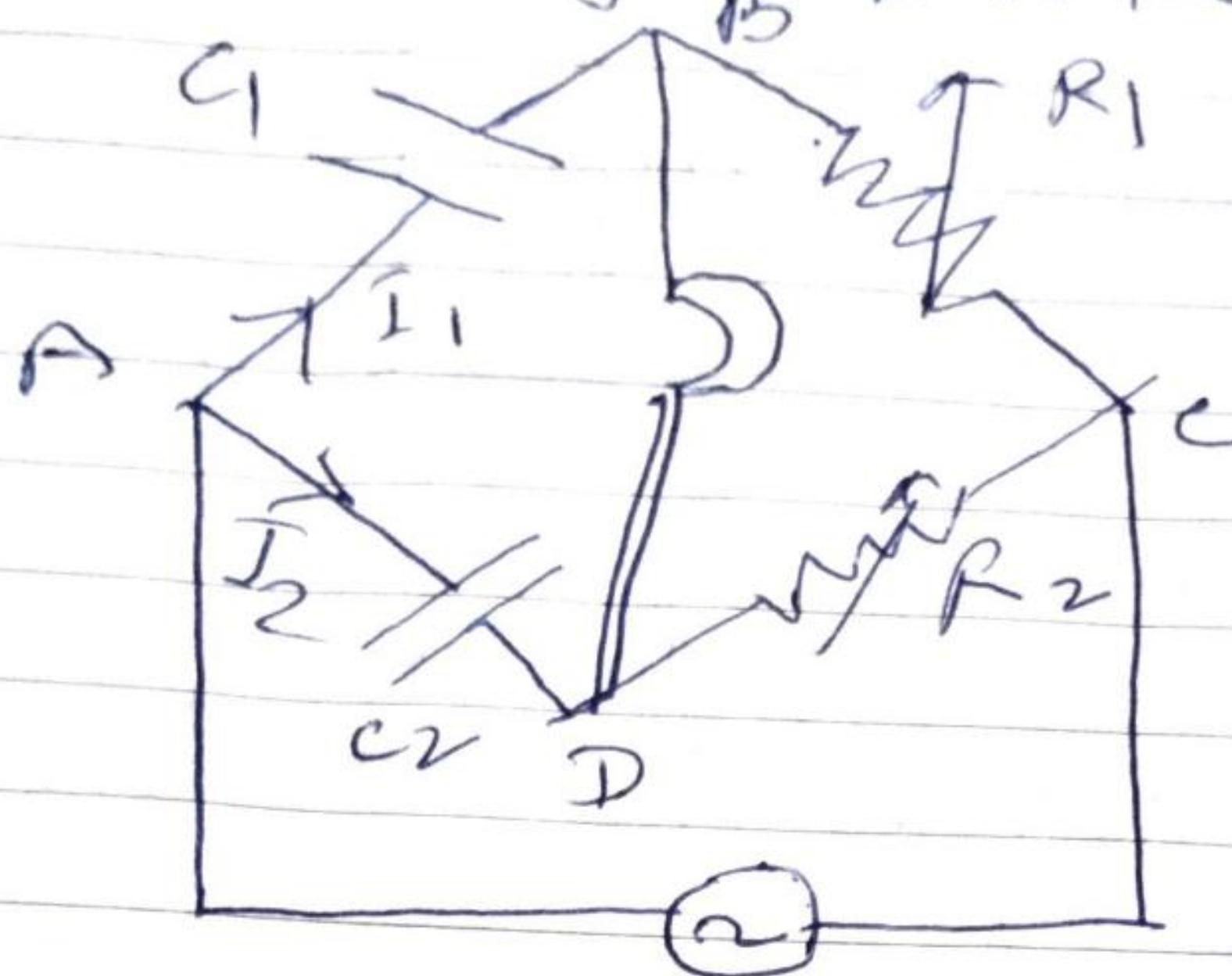
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De Sauty's bridge →



For this bridge AB arm of the bridge is a perfect capacitor of capacitance C_1 , BC arm is a pure resistance R_1 . CD arm is also a pure resistance and DA arm is a capacitor of capacitance C_2 .

$$Z_1 = \frac{1}{j\omega C_1} \quad Z_2 = R_1$$

$$Z_3 = \frac{1}{j\omega C_2} \quad Z_4 = R_2$$

Balancing condition

$$\frac{Z_1}{Z_2} = \frac{Z_3}{Z_4}$$

$$\frac{\frac{1}{j\omega C_1}}{R_1} = \frac{\frac{1}{j\omega C_2}}{R_2}$$

$$\frac{1}{R_1 C_1} = \frac{1}{R_2 C_2}$$

2017

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MAR - 2017

M	T	W	T	F	S
6	7	8	9	10	11
13	14	15	16	17	18
20	21	22	23	24	25
27	28	29	30	31	1

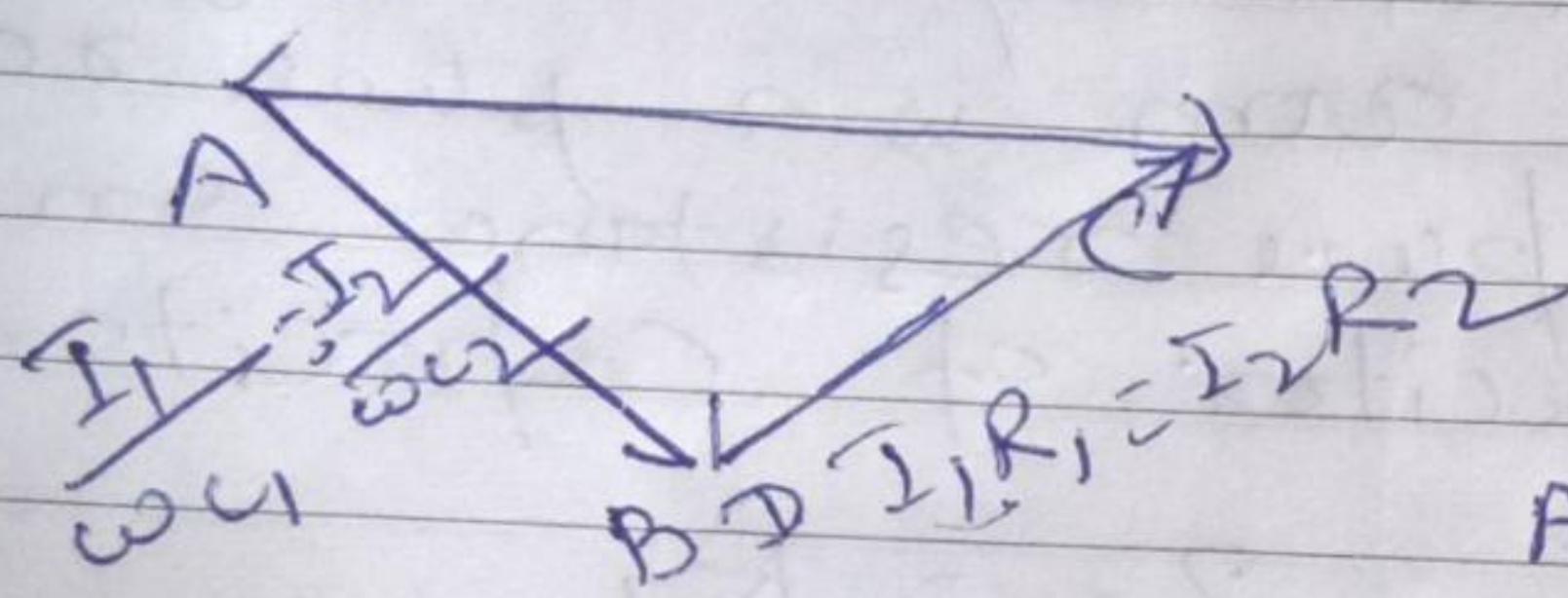
$$R_1 C_1 = R_2 C_2$$

$$\frac{C_1}{C_2} = \frac{R_2}{R_1}$$

¹¹ This bridge is suitable for ~~condenser~~
¹² too capacitances in terms of two
¹³ non-inductive resistances.

Vector diagram of the bridge →

E, I_1, I_2



AC represent the applied pd to the bridge. since the two

branches are capacitive, the currents through them lead the emf by some angle. So draw a line AE at some angle above AC at A. This is then the direction of the branch current I_1 . pd across $C_1 = I_1 / \omega C_1$. Draw a line perpendicular to AE in the clockwise direction. cut off a length $AB = I_1 / \omega C_1$. Join B with C then $B = \text{pd across } R_1$ since in a resistor pd is in phase with the current. ²⁰¹⁷ BC must be parallel to AE. At balance conditions D are at the same potential.