The Choice of AC Electricity Bridge Adjustment Parameters

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Abstract
It is set forth that how to choose adjustment parameters in the plural plane coordinate figure by the relation of Electricity Bridge’s balance condition and adjustment parameters.

Keywords: Adjustment parameters, Choice, Balance

On the discussion of AC electricity bridge in some schoolbooks and correlated datum, it has been put forward that how to choose some quantities as adjustment parameters or the selected adjustment parameters from the observed quantities which have been discriminated reading. The new viewpoint is brought forward that how to choose the adjustment parameters by the point of view of adjustment velocity.

1. The Balance Condition of AC Electricity Bridge

The balance process of AC electricity bridge is decided by the change of eqn(1). Because $Z_1, Z_2, Z_3, Z_4$ are composed of resistance, capacitance and inductance which are parallel connection or in series, except the observed parameters, the others quantities can be regarded as adjustment parameters.

$$P = Z_2Z_3 - Z_1Z_4 = a + jb$$  \hspace{1cm} (1)

It is shown by eqn(1) that the two quantities at least are chosen as adjustment parameters for $a$ and $b=0$ together. If three or the more quantities are chosen, then adjustment times is nimiety, the balance process can be very much trouble. In the most things, two quantities are chosen as adjustment parameters.

The selections have more groups. Some groups can not attain the balance of electricity bridge; some groups may attain the aim, but nimiety. It is the best choice that not only some groups may attain the balance but also the adjustment times are few. The article will set forth how to choose correct adjustment parameters quickly through the frequent used AC electricity bridge.

2. The Quickly Chosen of AC Electricity Bridge Adjustment Parameters

At the balance point of electricity bridge, the relation of $a, b$ and adjustment parameters may be expressed by parallel beeline family[3]. The more nearly $90^\circ$ of two parameter beeline angle, the more quickly of balance speed. It can be shown that which parameter beeline are perpendicularity or parallelism one another. The best choice is two parameters of perpendicularity, not parallelism. Without parameters of perpendicularity, the best seemliness choice is two parameters which angle is rather big.

2.1 Capacitance Electricity Bridge

According to Fig.2, it is shown the expression formula of $a$ and $b$ are eqn(2) and eqn(3) separated by the eqn(1). The beelines of each parameters are shown in Fig.3. It is the best choice that $R_2$ and $C_2$ are adjustment parameters, as shown in Fig.3.

$$a = R_xR_3 - R_4R_2$$  \hspace{1cm} (2) 

$$b = \frac{R_4}{C_2\omega} - \frac{R_3}{C_1\omega}$$  \hspace{1cm} (3)

2.2 Inductance Compare Electricity Bridge

According to Fig.4, it is shown the expression formula of $a$ and $b$ are eqn(4) and eqn(5) separated by the eqn(1). The beelines of each parameters are shown in Fig.5. It is the best choice that $R_2$ and $L_2$ are adjustment parameters, as shown in Fig.5.

$$a = R_xR_3 - R_4R_2$$  \hspace{1cm} (4) 

$$b = L_3R_3\omega - L_2R_3\omega$$  \hspace{1cm} (5)

2.3 Schering Electricity Bridge

According to Fig.6, it is shown the expression formula of $a$ and $b$ are eqn(6) and eqn(7) separated by the eqn(1). The beelines of each parameters are shown in Fig.7. Because the angle of $R_3$ and $C_3$ is rather big, it is the best choice that $R_3$ and $C_3$ are...
adjustment parameters, as shown in Fig. 7.

\[
a = \frac{R_3 R_4}{1 + (R_3 C_3 \omega)^2} \left( \frac{R_4}{C_3 \omega} \right) \left( \frac{R_4}{1 + (R_3 C_3 \omega)^2} \right) \]

\[
b = \frac{R_3}{C_3 \omega} \left( \frac{R_4}{1 + (R_3 C_3 \omega)^2} \right) \left( \frac{R_4}{1 + (R_3 C_3 \omega)^2} \right)
\]

2.4 Maxwell Electricity Bridge
According to Fig. 8, it is shown the expression formula of \(a\) and \(b\) are eqn(8) and eqn(9) separated by the eqn(1). The beelines of each parameters are shown in Fig. 9. Because the angle of \(R_3\) and \(C_3\) is rather big, it is the best choice that \(R_3\) and \(C_3\) are adjustment parameters, as shown in Fig. 9.

\[
a = \frac{R_3 (R_3 + R C_3 \omega L_1)}{1 + (R C_3 \omega)^2} - \frac{R_4 R_4}{1 + (R C_3 \omega)^2} \]

\[
b = \frac{R_3 (L_1 \omega - R R C_3 \omega)}{1 + (R C_3 \omega)^2} \]

For the complex AC Electricity Bridge, it is difficult to ascertain the relation which \(a\) and \(b\) change with some parameter varying. At the time, it may be judged by the software of origin.

3. Conclusion
First, the each parameters are done in the coordinate chart of \(a\) and \(jb\), then according to the angle between the beelines, it is a convenience method to choose perpendicularity or bigger angle as the adjustment parameter.

References
Figure 1. Electricity Bridge Circuitry

Figure 2. Capacitance electricity bridge

Figure 3. The beeline chart of Capacitance electricity bridge parameter
Figure 4. Inductance Compare Electricity Bridge

Figure 5. The beeline chart of Inductance Compare bridge parameter

Figure 6. Schering Electricity Bridge
Figure 7. The beeline chart of Schering Electricity Bridge Parameter

Figure 8. Maxwell Electricity Bridge

Figure 9. The beeline chart of Maxwell Electricity Bridge Parameter