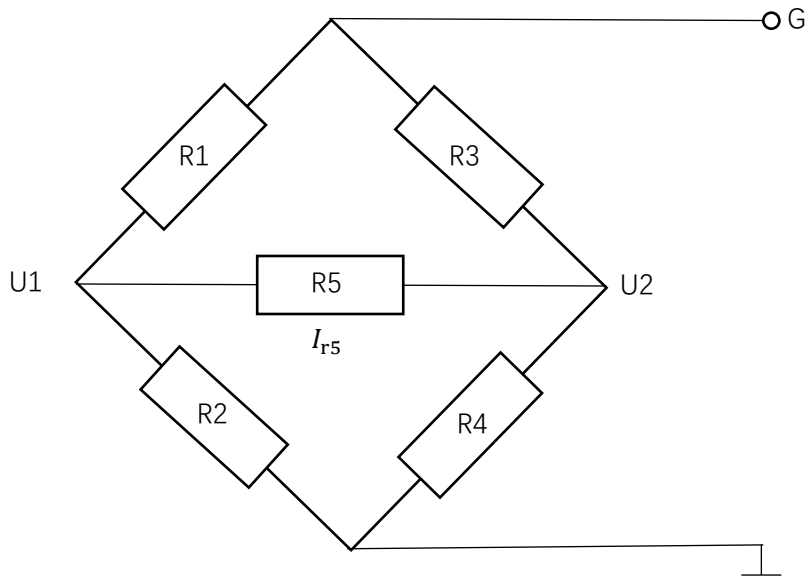

电阻R_5中的电流等于R_1R_2的电流差，也等于R_3R_4的电流差：等式（一）

$$I_{r5}=\frac{G-U_1}{R_1}-\frac{U_1}{R_2}=\frac{U_2}{R_4}-\frac{G-U_2}{R_3}=\frac{U_1-U_2}{R_5}$$

求解得：

$$I_{r5}=\frac{R_2R_3-R_1R_4}{R_1R_2R_3+R_1R_2R_4+R_1R_3R_4+R_1R_3R_5+R_1R_4R_5+R_2R_3R_4+R_2R_3R_5+R_2R_4R_5}$$

$$U_1=\frac{R_1R_2R_4+R_2R_3R_4+R_2R_4R_5+R_2R_3R_5}{R_1R_2R_3+R_1R_2R_4+R_1R_3R_4+R_1R_3R_5+R_1R_4R_5+R_2R_3R_4+R_2R_3R_5+R_2R_4R_5}$$

$$U_2=\frac{R_1R_2R_4+R_2R_3R_4+R_2R_4R_5+R_1R_4R_5}{R_1R_2R_3+R_1R_2R_4+R_1R_3R_4+R_1R_3R_5+R_1R_4R_5+R_2R_3R_4+R_2R_3R_5+R_2R_4R_5}$$

等式（一）变形：等式（二）

$$I_{r5}=\frac{G}{R_1}-U_1\left(\frac{1}{R_1}+\frac{1}{R_2}\right)=-\frac{G}{R_3}+U_2\left(\frac{1}{R_3}+\frac{1}{R_4}\right)=\frac{U_1-U_2}{R_5}$$

$$G\left(\frac{1}{R_1}+\frac{1}{R_3}\right)=U_1\left(\frac{1}{R_1}+\frac{1}{R_2}\right)+U_2\left(\frac{1}{R_3}+\frac{1}{R_4}\right)$$

电阻R_5不接入电桥时的电压为：

$$U_1'=\frac{GR_2}{R_1+R_2}\qquad U_2'=\frac{GR_4}{R_3+R_4}\qquad \mathrm{G}=\frac{U_1'(R_1+R_2)}{R_2}=\frac{U_2'(R_3+R_4)}{R_4}$$

代入等式（一）：

$$I_{r5}=(U_1'-U_1)\left(\frac{1}{R_1}+\frac{1}{R_2}\right)=-(U_2'-U_2)\left(\frac{1}{R_3}+\frac{1}{R_4}\right)=\frac{U_1-U_2}{R_5}$$

有电压差值的比例关系：

$$\frac{(U_2'-U_2)}{(U_1'-U_1)}=-\frac{\left(\frac{1}{R_1}+\frac{1}{R_2}\right)}{\left(\frac{1}{R_3}+\frac{1}{R_4}\right)}=-\frac{\frac{1}{\left(\frac{1}{R_3}+\frac{1}{R_4}\right)}}{\frac{1}{\left(\frac{1}{R_1}+\frac{1}{R_2}\right)}}$$

再看U_1通过电容接入交流信号ΔU_1时的情况：

$$I_{r5}''=\frac{G-(U_1+\Delta U_1)}{R_1}-\frac{(U_1+\Delta U_1)}{R_2}=\frac{(U_2+\Delta U_2)}{R_4}-\frac{G-(U_2+\Delta U_2)}{R_3}$$

$$=\frac{(U_1+\Delta U_1)-(U_2+\Delta U_2)}{R_5}$$

$$G\left(\frac{1}{R_1}+\frac{1}{R_3}\right)=U_1\left(\frac{1}{R_1}+\frac{1}{R_2}\right)+U_2\left(\frac{1}{R_3}+\frac{1}{R_4}\right)+\Delta U_1\left(\frac{1}{R_1}+\frac{1}{R_2}\right)+\Delta U_2\left(\frac{1}{R_3}+\frac{1}{R_4}\right)$$

$$\frac{\Delta U_2}{\Delta U_1}=-\frac{\left(\frac{1}{R_1}+\frac{1}{R_2}\right)}{\left(\frac{1}{R_3}+\frac{1}{R_4}\right)}=-\frac{\frac{1}{\left(\frac{1}{R_3}+\frac{1}{R_4}\right)}}{\frac{1}{\left(\frac{1}{R_1}+\frac{1}{R_2}\right)}}$$

ΔU_2与ΔU_1方向相反，它们的比值为R_3R_4并联电阻与R_1R_2并联电阻的阻值之比。如果$R_1=1M\Omega$，$R_2=2M\Omega$，$R_3=20M\Omega$，$R_4=10M\Omega$，R_3R_4端对R_1R_2端有 10 倍的电压放大。