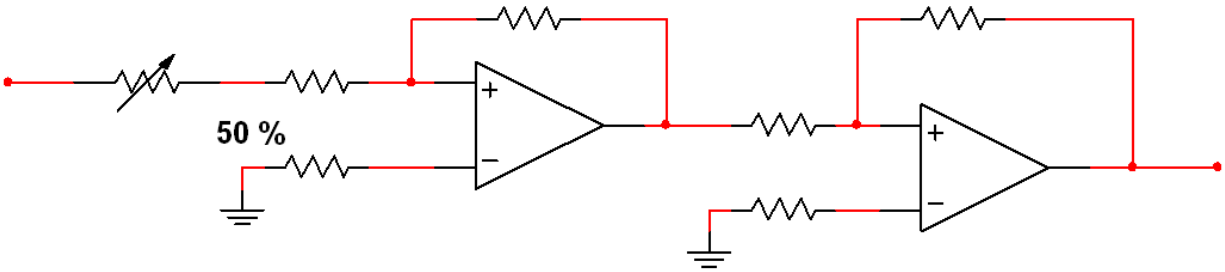
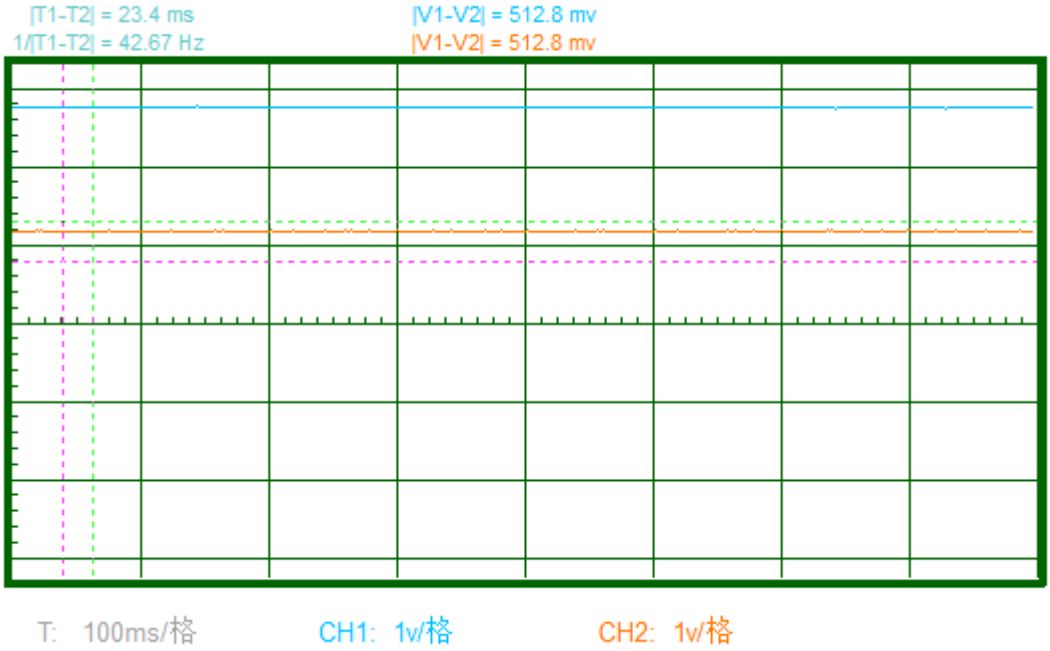
实验一 典型环节的模拟研究

- 比例环节
  - 模拟电路



  - 响应曲线



  - 结果分析

    $U_i(t) = 2.8(t), U_o(t) = 1.2(t)$

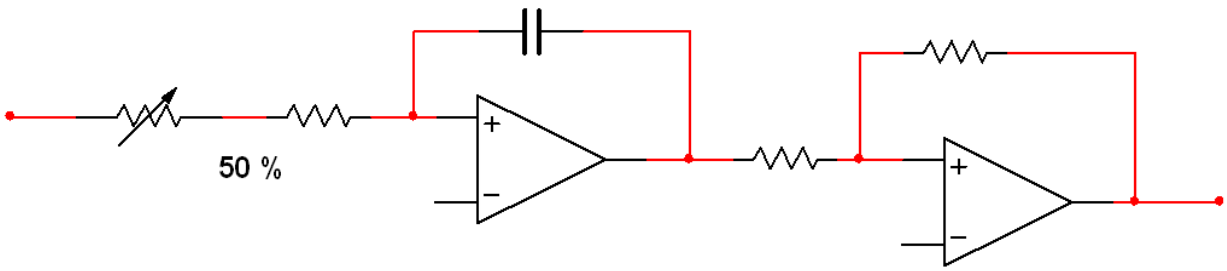
    $R_0 = 22.62k\Omega, R_1 = 10k\Omega$

    $K = \frac{R_1}{R_0} = \frac{10}{22.62} = 0.442$

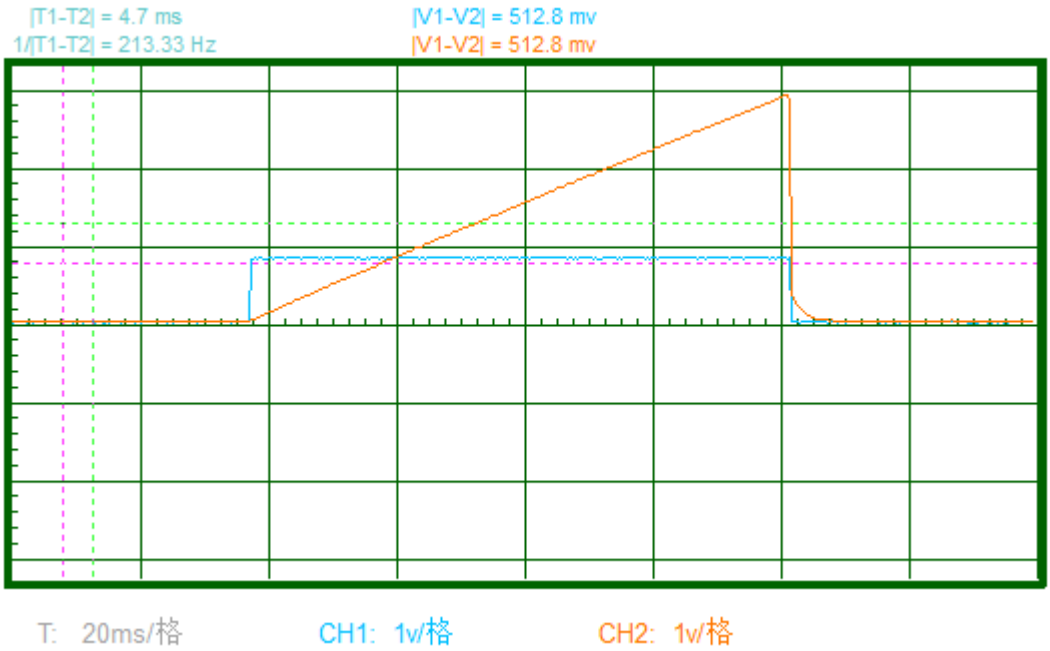
    $\frac{U_o}{U_i} = \frac{1.2}{2.8} = 0.428$

    K与$\frac{U_o}{U_i}$很接近，结果正确

- 积分环节
  - 模拟电路



- 响应曲线



- 结果分析

  $U_i = 0.9(t), U_o = 39.8t$

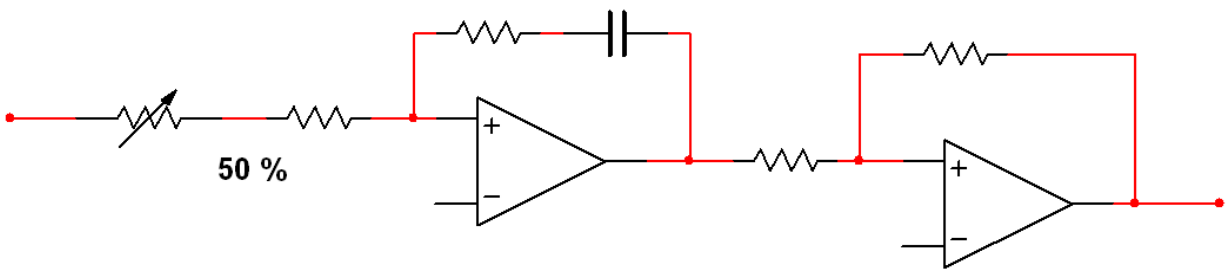
  $R_0 = 22.62k\Omega, C = 1uF$

  $T = R_0C = 0.02262$

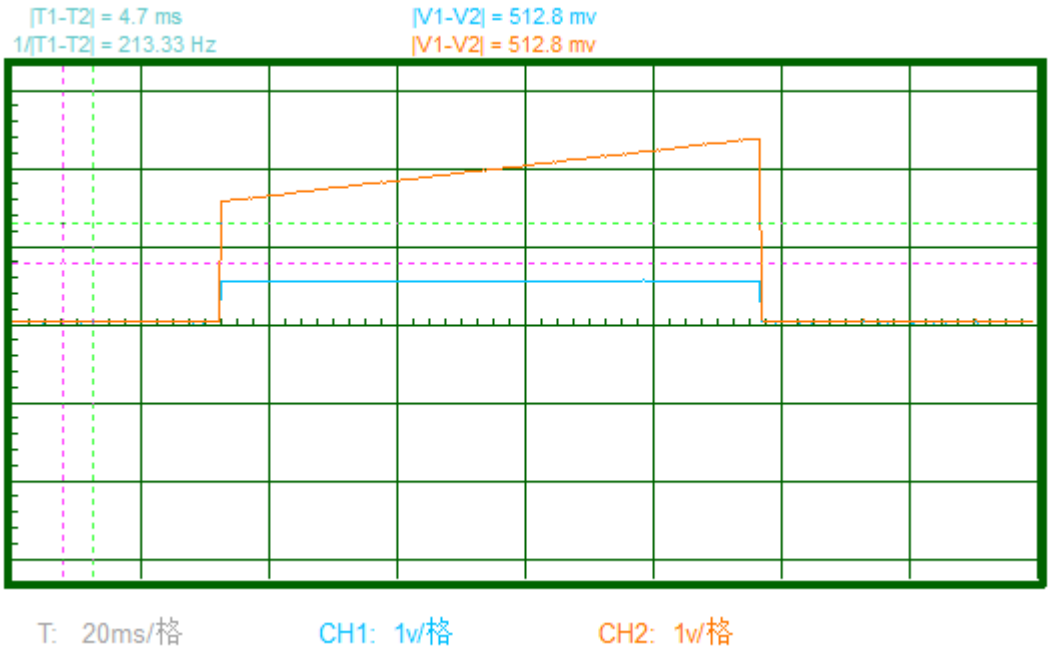
  $\frac{A}{T} = 39.78$

  39.78与39.8接近，结果正确

- 比例积分环节
  - 模拟电路



  - 响应曲线



- 结果分析

  $U_i = 0.5, U_o = 1.6 + 9.75t$

  $R_0 = 54k\Omega, R_1 = 180k\Omega, C = 1uF, A = 0.5$

  $K = \frac{R_1}{R_0} = \frac{180}{54} = 3.33$

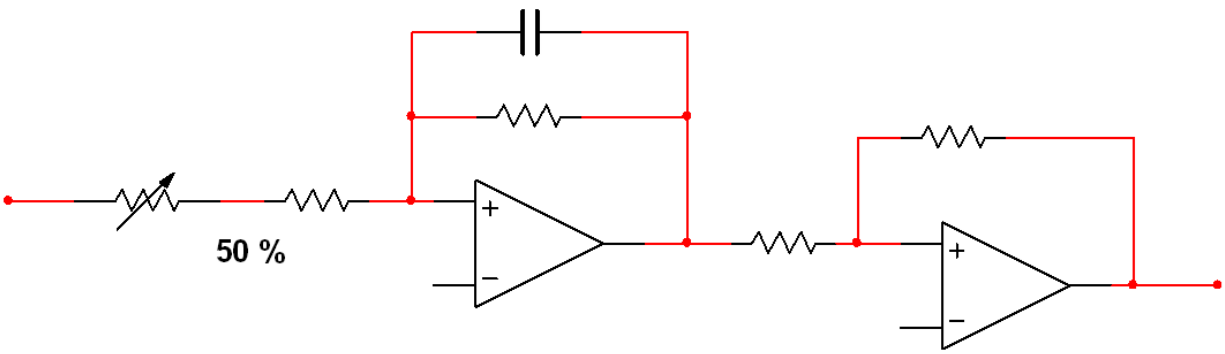
  $T = R_0 C = 0.054$

  $AK = 0.5 * 3.33 = 1.65$

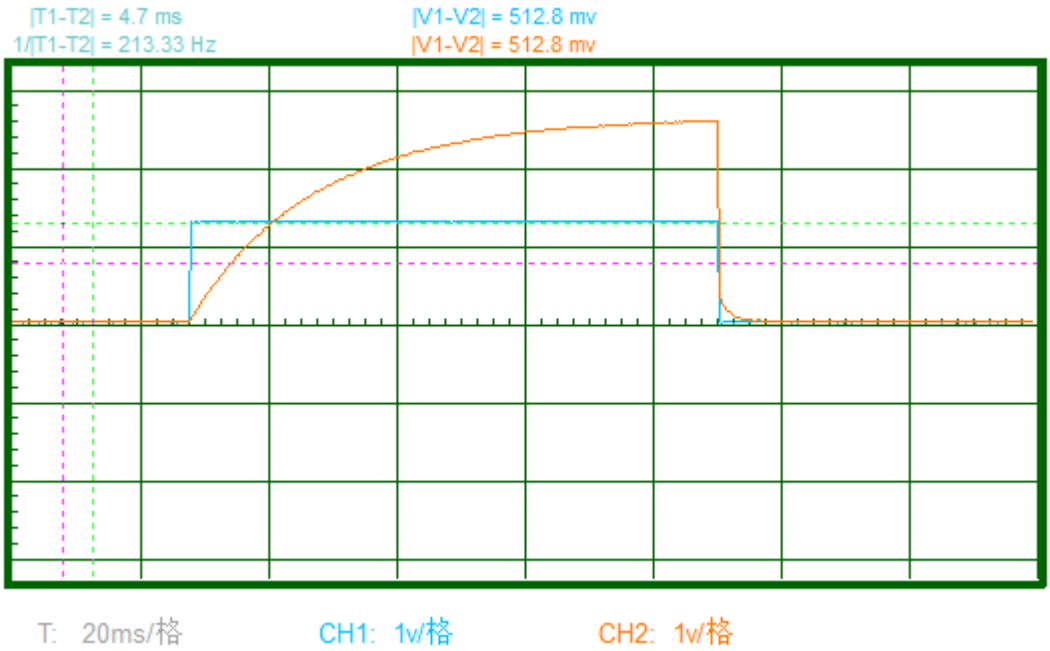
  $\frac{A}{T} = \frac{0.5}{0.054} = 9.259$

  数据接近，结果正确

- 惯性环节
  - 模拟电路



  - 响应曲线



- 结果分析

  $U_i = 1.3(t), U_o(\infty) = 2.85$

  $R_0 = 10k\Omega, R_1 = 20k\Omega, C = 1uF$

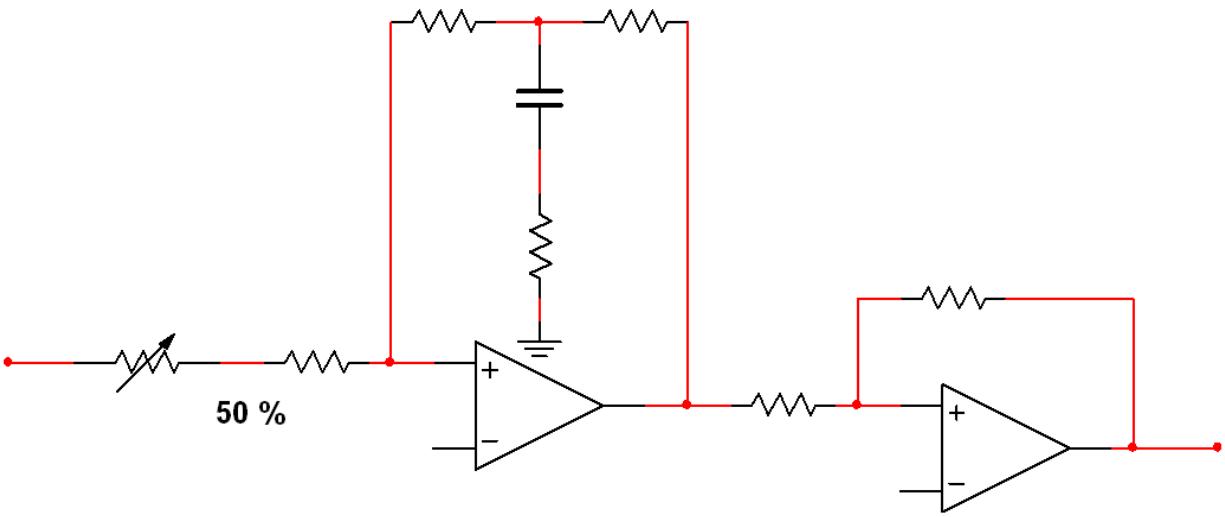
  $K = \frac{R_1}{R_0} = 2$

  $T = R_0 C = 0.02$

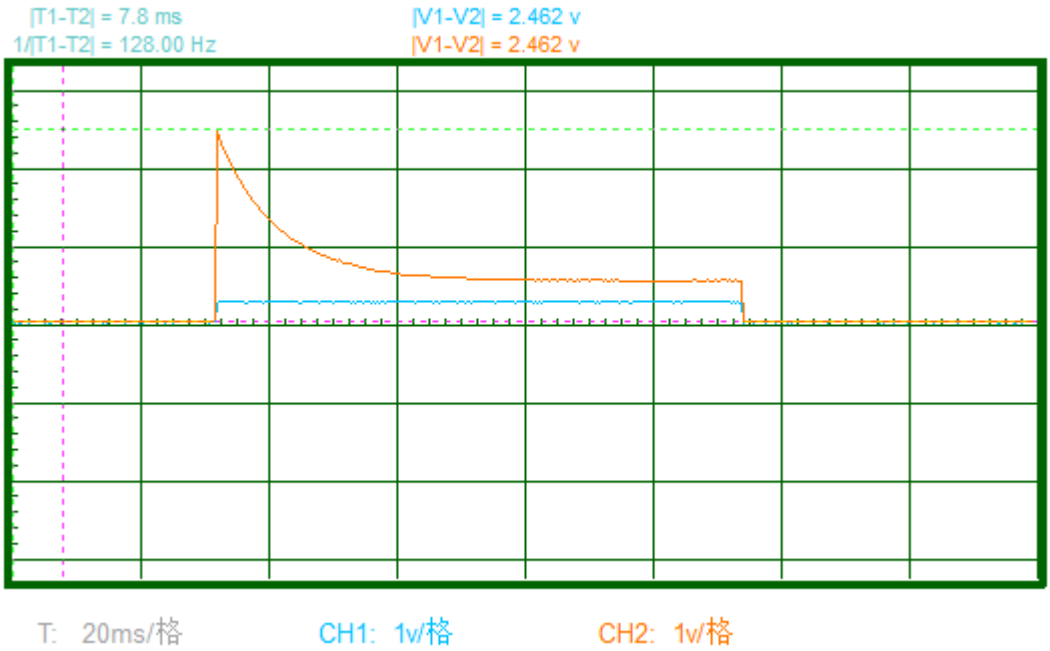
  $\frac{U_0(\infty)}{U_i} = \frac{2.85}{1.3} = 2.19$

  数据接近，结果正确

- 比例微分环节
  - 模拟电路



  - 响应曲线



- 结果分析

  $U_o(0) = 2.462, U_o(\infty) = 0.6, U_i = 0.3$

  $R_0 = R_1 = R_2 = 100k\Omega, R_3 = 10k\Omega, C = 1uF$

  $\frac{R_1+R_2}{R_0} = 2$

  $\frac{R_1R_2}{R_0R_3} = 10$

  $\frac{0.6}{0.3} = 2, \frac{2.462}{0.3} = 8.2$

  峰值倍数误差略大，稳定状态结果准确