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| 五、数据记录：  组号： 4 ；姓名 邓瑞霖  **表1 单臂电桥的数据记录（注：平均值取了绝对值）**   |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | | **砝码个数** | **0** | **1** | **2** | **3** | **4** | **5** | **6** | | **砝码质量 (g)** | 0 | 20 | 40 | 60 | 80 | 100 | 120 | | **上行** | 2.37 | 7.57 | 17.48 | 27.33 | 37.35 | 47.25 | 57.14 | | **下行** | 2.00 | 7.88 | 17.72 | 27.61 | 37.51 | 47.45 | 57.28 | | **平均** | 2.19 | 7.73 | 17.60 | 27.47 | 37.43 | 47.35 | 57.21 |   **表2 双臂电桥数据记录（注：平均值取了绝对值）**   |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | | **砝码个数** | **0** | **1** | **2** | **3** | **4** | **5** | **6** | | **砝码质量 (g)** | 0 | 20 | 40 | 60 | 80 | 100 | 120 | | **上行** | 11.5 | 27.2 | 44.6 | 61.9 | 79.3 | 96.8 | 114.1 | | **下行** | 11.3 | 27.2 | 44.5 | 61.9 | 79.3 | 96.7 | 114.1 | | **平均** | 11.4 | 27.2 | 44.6 | 61.9 | 79.3 | 96.8 | 114.1 |   **表3 全臂电桥数据记录（注：平均值取了绝对值）**   |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | | **砝码个数** | **0** | **1** | **2** | **3** | **4** | **5** | **6** | | **砝码质量 (g)** | 0 | 20 | 40 | 60 | 80 | 100 | 120 | | **上行** | 3.6 | 36.7 | 70.5 | 104.4 | 138.2 | 172.4 | 206.7 | | **下行** | 3.6 | 36.6 | 70.2 | 104.2 | 138.1 | 172.3 | 206.6 | | **平均** | 3.6 | 36.6. | 70.4 | 104.3 | 138.2 | 172.4 | 206.7 | |
| **六、数据处理**    由图可知，只把单臂接入应变片时，电桥的灵敏度约0.472 mV/g。电子秤的零点误差为-0.160 mV。    由图可知，把双臂接入应变片时，电桥的灵敏度约0.8607 mV/g，约为单臂电桥灵敏度的2倍。本次设计的电子秤的零点误差为10.543mV。    由图可知，全臂电桥的灵敏度1.7035 mV/g，约为单臂电桥灵敏度的4倍。本次设计的电子秤的零点误差为2.12 mV。 |
| **七、结果陈述：**  由数据分析可知，所有电桥实验中，放置砝码后，电桥输出电压ΔU发生明显变化。随着砝码个数的增加，ΔU的绝对值呈现出线性增长的趋势，单臂电桥电压每次大约变化9mv，双臂18~20mv，全臂约40mv，且各电桥的灵敏度比较：全臂电桥>双臂电桥>单臂电桥。 |
| **八、实验总结与思考题**  通过本次实验，我们成功实现了基于应变片的电子秤系统的设计，并掌握了应变片、电桥电路和差动放大器的工作原理及其在电子秤设计中的应用。实验结果表明，全臂电桥是设计高精度电子秤的理想选择。  **思考题：**  **1.导致电子秤非线性误差增大的可能因素：**   1. 应变片的非线性特性：应变片本身可能存在一定的非线性特性，导致输出电阻与外力之间不是完全线性关系。 2. 电桥电路的不平衡：电桥电路中的电阻值可能不是完全相等，导致电桥在平衡状态下仍存在一定的输出电压。 3. 温度影响：温度变化可能导致应变片和电阻的阻值发生变化，从而影响电桥的输出。 4. **消除误差的方法：** 5. 选择线性度好的应变片，尽量减小其非线性特性对测量结果的影响。 6. 精确调整电桥电路中的电阻值，确保电桥在平衡状态下输出电压接近零。 7. 采用温度补偿措施，如使用温度系数小的电阻材料或在电路中加入温度补偿电路，以减小温度变化对测量结果的影响。 8. **增加输出灵敏度的措施：** 9. 选择灵敏度高的应变片，以提高电桥电路对电阻变化的敏感性。 10. 增大电桥的供电电压，以提高输出电压的幅度。 11. 优化差动放大器的设计，提高其放大倍数和带宽，以更好地放大电桥的输出信号。 |
| 指导教师批阅意见： |
| 成绩评定：     |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | | **预习**  （20分） | **操作及记录**  （40分） | 数据处理与结果陈述30分 | 思考题  10分 | **报告整体**  **印 象** | **总分** | |  |  |  |  |  |  | |