VAJA 10: DUŠENO NIHANJE ELEKTRIČNEGA NIHAJNEGA KROGA

1. **NAMEN VAJE**

Namen naše vaje je določiti faktor dušenja v električnem nihajnem krogu.

1. **MATERIAL**

* Vir napetosti
* Tuljava
* Kondenzator

1. **POTEK VAJE**

Najprej smo zvezali med seboj tuljavo in kondenzator. Dobili smo električni nihajni krog. Potem smo na nihajni krog priključili še vir napetosti. Nato smo na kondenzatorju lahko videli gibanje elektrona v električnem nihajnem krogu. Giba se dušeno.



1. **ENAČBE IN OZNAKE**

Napetost:

|  |
| --- |
| Un= yn × 20 mV |

Un...................napetost določene meritve

yn...................amplituda določenega nihaja

čas:

|  |
| --- |
| tn= xn × 0,5 μs |

Tn................čas določenega nihaja

Xn................interval v katerem se pojavi določen nihaj

Faktor dušenja:

|  |  |  |
| --- | --- | --- |
| β= | Δ ln | Un |
| Uo |
| Δ t | |

β...............faktor dušenja

Uo.............začetna napetost

Δt.............sprememba časa med začetno in merjeno napetostjo

1. **MERJENJE**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Št.merjenje** | **yn (cm)** | **Un (mV)** |  | **xn (cm)** | **tn (μs)** |  |
| 0 | 4 | 80 | **Uo= 80 mV (1 ± 5%)** | 0 | 0 | **to= 0 s** |
| 1 | 3,5 | 70 | **U1= 70 mV (1 ± 6%)** | 0,6 | 0,3 | **t1= 0,3 s (1 ± 17%)** |
| 2 | 3,2 | 64 | **U2= 64 mV (1 ± 6%)** | 1,2 | 0,6 | **t2= 0,6 s (1 ± 8%)** |
| 3 | 2,8 | 56 | **U3= 56 mV (1 ± 7%)** | 1,8 | 0,9 | **t3= 0,9 s (1 ± 6%)** |
| 4 | 2,6 | 52 | **U4= 52 mV (1 ± 8%)** | 2,4 | 1,2 | **t4= 1,2 s (1 ± 4%)** |
| 5 | 2,4 | 48 | **U5= 48 mV (1 ± 8%)** | 3,0 | 1,5 | **t5= 1,5 s (1 ± 3%)** |
| 6 | 2,1 | 42 | **U6= 42 mV (1 ± 9%)** | 3,6 | 1,8 | **t6= 1,8 s (1 ± 3%)** |
| 7 | 2,0 | 40 | **U7= 40 mV (1 ± 10%)** | 4,2 | 2,1 | **t7= 2,1 s (1 ± 2%)** |
| 8 | 1,8 | 36 | **U8= 36 mV (1 ± 11%)** | 4,8 | 2,4 | **t8= 2,4 s (1 ± 2%)** |
| 9 | 1,6 | 32 | **U9= 32 mV (1 ± 13%)** | 5,4 | 2,7 | **t9= 2,7 s (1 ± 2%)** |
| 10 | 1,5 | 30 | **U10= 30 mV (1 ± 13%)** | 6,0 | 3,0 | **t10= 3,0 s (1 ± 2%)** |
| 11 | 1,3 | 26 | **U11= 26 mV (1 ± 15%)** | 6,6 | 3,3 | **t11= 3,3 s (1 ± 2%)** |
| 12 | 1,2 | 24 | **U12= 24 mV (1 ± 17%)** | 7,2 | 3,6 | **t12= 3,6 s (1 ± 1%)** |
| 13 | 1,1 | 22 | **U13= 22 mV (1 ± 18%)** | 7,8 | 3,9 | **t13= 3,9 s (1 ± 1%)** |
| 14 | 1,0 | 20 | **U14= 20 mV (1 ± 20%)** | 8,4 | 4,2 | **t14= 4,2 s (1 ± 1%)** |
| 15 | 0,9 | 18 | **U15= 18 mV (1 ± 22%)** | 9,0 | 4,5 | **t15= 4,5 s (1 ± 1%)** |
| 16 | 0,8 | 16 | **U16= 16 mV (1 ± 25%)** | 9,6 | 4,8 | **t16= 4,8 s (1 ± 1%)** |

1. **RAČUNANJE**



*računanje faktorja dušenja*

|  |  |  |
| --- | --- | --- |
| β= | Δ ln | Un |
| Uo |
| Δ t | |

|  |  |  |  |
| --- | --- | --- | --- |
| β= | Δ ln | 70 mV |  |
| 80 mV |  |
| 0,3 × 10-6 s | |  |
|  |
| β= | 4,5 × 105 Hz | |  |
| **β=** | **4,5 × 105 Hz** | | **(1 ± 28%)** |

1. Uo= 80 mV (1 ± 5%)

U1= 70 mV (1 ± 6%)

Δt= 0,3 μs (1 ± 17%)

|  |  |  |  |
| --- | --- | --- | --- |
| β= | Δ ln | 64 mV |  |
| 80 mV |  |
| 0,6 × 10-6 s | |  |
|  |
| β= | 3,7 × 105 Hz | |  |
| **β=** | **3,7 × 105 Hz** | | **(1 ± 19%)** |

2. Uo= 80 mV (1 ± 5%)

U2= 64 mV (1 ± 6%)

Δt= 0,6 μs (1 ± 8%)

|  |  |  |  |
| --- | --- | --- | --- |
| β= | Δ ln | 56 mV |  |
| 80 mV |  |
| 0,9 × 10-6 s | |  |
|  |
| β= | 4 × 105 Hz | |  |
| **β=** | **4 × 105 Hz** | | **(1 ± 18%)** |

3. Uo= 80 mV (1 ± 5%)

U3= 56 mV (1 ± 7%)

Δt= 0,9 μs (1 ± 6%)

|  |  |  |  |
| --- | --- | --- | --- |
| β= | Δ ln | 52 mV |  |
| 80 mV |  |
| 1,2 × 10-6 s | |  |
|  |
| β= | 3,6 × 105 Hz | |  |
| **β=** | **3,6 × 105 Hz** | | **(1 ± 17%)** |

4. Uo= 80 mV (1 ± 5%)

U4= 52 mV (1 ± 8%)

Δt= 1,2 μs (1 ± 4%)

|  |  |  |  |
| --- | --- | --- | --- |
| β= | Δ ln | 48 mV |  |
| 80 mV |  |
| 1,5 × 10-6 s | |  |
|  |
| β= | 3,4 × 105 Hz | |  |
| **β=** | **3,4 × 105 Hz** | | **(1 ± 16%)** |

5. Uo= 80 mV (1 ± 5%)

U5= 48 mV (1 ± 8%)

Δt= 1,5 μs (1 ± 3%)

|  |  |  |  |
| --- | --- | --- | --- |
| β= | Δ ln | 42 mV |  |
| 80 mV |  |
| 1,8 × 10-6 s | |  |
|  |
| β= | 3,6 × 105 Hz | |  |
| **β=** | **3,6 × 105 Hz** | | **(1 ± 17%)** |

6. Uo= 80 mV (1 ± 5%)

U6= 42 mV (1 ± 9%)

Δt= 1,8 μs (1 ± 3%)

|  |  |  |  |
| --- | --- | --- | --- |
| β= | Δ ln | 40 mV |  |
| 80 mV |  |
| 2,1 × 10-6 s | |  |
|  |
| β= | 3,3 × 105 Hz | |  |
| **β=** | **3,3 × 105 Hz** | | **(1 ± 17%)** |

7. Uo= 80 mV (1 ± 5%)

U7= 40 mV (1 ± 10%)

Δt= 2,1 μs (1 ± 2%)

|  |  |  |  |
| --- | --- | --- | --- |
| β= | Δ ln | 36 mV |  |
| 80 mV |  |
| 2,4 × 10-6 s | |  |
|  |
| β= | 3,3 × 105 Hz | |  |
| **β=** | **3,3 × 105 Hz** | | **(1 ± 18%)** |

8. Uo= 80 mV (1 ± 5%)

U8= 36 mV (1 ± 11%)

Δt= 2,4 μs (1 ± 2%)

|  |  |  |  |
| --- | --- | --- | --- |
| β= | Δ ln | 32 mV |  |
| 80 mV |  |
| 2,7 × 10-6 s | |  |
|  |
| β= | 3,4 × 105 Hz | |  |
| **β=** | **3,4 × 105 Hz** | | **(1 ± 20%)** |

9. Uo= 80 mV (1 ± 5%)

U9= 32 mV (1 ± 13%)

Δt= 2,7 μs (1 ± 2%)

|  |  |  |  |
| --- | --- | --- | --- |
| β= | Δ ln | 30 mV |  |
| 80 mV |  |
| 3,0 × 10-6 s | |  |
|  |
| β= | 3,2 × 105 Hz | |  |
| **β=** | **3,2 × 105 Hz** | | **(1 ± 20%)** |

10. Uo= 80 mV (1 ± 5%)

U10= 30 mV (1 ±13%)

Δt= 3,0 μs (1 ± 2%)

|  |  |  |  |
| --- | --- | --- | --- |
| β= | Δ ln | 26 mV |  |
| 80 mV |  |
| 3,3 × 10-6 s | |  |
|  |
| β= | 3,4 × 105 Hz | |  |
| **β=** | **3,4 × 105 Hz** | | **(1 ± 22%)** |

11. Uo= 80 mV (1 ± 5%)

U11= 26 mV (1 ±15%)

Δt= 3,3 μs (1 ± 2%)

|  |  |  |  |
| --- | --- | --- | --- |
| β= | Δ ln | 24 mV |  |
| 80 mV |  |
| 3,6 × 10-6 s | |  |
|  |
| β= | 3,3 × 105 Hz | |  |
| **β=** | **3,3 × 105 Hz** | | **(1 ± 23%)** |

12. Uo= 80 mV (1 ± 5%)

U12= 24 mV (1 ±17%)

Δt= 3,6 μs (1 ± 1%)

|  |  |  |  |
| --- | --- | --- | --- |
| β= | Δ ln | 22 mV |  |
| 80 mV |  |
| 3,9 × 10-6 s | |  |
|  |
| β= | 3,3 × 105 Hz | |  |
| **β=** | **3,3 × 105 Hz** | | **(1 ± 24%)** |

13. Uo= 80 mV (1 ± 5%)

U13= 22 mV (1 ±18%)

Δt= 3,9 μs (1 ± 1%)

|  |  |  |  |
| --- | --- | --- | --- |
| β= | Δ ln | 20 mV |  |
| 80 mV |  |
| 4,2 × 10-6 s | |  |
|  |
| β= | 3,3 × 105 Hz | |  |
| **β=** | **3,3 × 105 Hz** | | **(1 ± 26%)** |

14. Uo= 80 mV (1 ± 5%)

U14= 20 mV (1 ±20%)

Δt= 4,2 μs (1 ± 1%)

|  |  |  |  |
| --- | --- | --- | --- |
| β= | Δ ln | 18 mV |  |
| 80 mV |  |
| 4,5 × 10-6 s | |  |
|  |
| β= | 3,3 × 105 Hz | |  |
| **β=** | **3,3 × 105 Hz** | | **(1 ± 28%)** |

15. Uo= 80 mV (1 ± 5%)

U15= 18 mV (1 ±22%)

Δt= 4,5 μs (1 ± 1%)

|  |  |  |  |
| --- | --- | --- | --- |
| β= | Δ ln | 16 mV |  |
| 80 mV |  |
| 4,8 × 10-6 s | |  |
|  |
| β= | 3,3 × 105 Hz | |  |
| **β=** | **3,3 × 105 Hz** | | **(1 ± 31%)** |

16. Uo= 80 mV (1 ± 5%)

U16= 16 mV (1 ±25%)

Δt= 4,8 μs (1 ± 1%)

1. **KOMENTAR**
   * Napetost v odvisnosti od časa pada eksponentno
   * Največji faktor dušenja nastane pri prvem nihaju
   * Proti koncu nihanja se dušenje umiri in je faktor dušenja non stop enak