***Зм****.*

***Арк.***

***№ докум.***

***Підп.***

***Дата***

***Арк.***

***5***

*4*

***ІАЛЦ.463626.004 ПЗ***

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  |  | ***Q3*** | | | |  |  | |  |  |  |
|  |  | ***Q1*** | |  |  | ***Q1*** | | |  |  | ***T4*** |
| ***Q4*** | ***Q2*** | ***-*** | ***-*** | ***-*** | ***-*** | ***-*** | | ***-*** | ***-*** | ***-*** |  |
| ***-*** | ***-*** | ***-*** | ***-*** | ***-*** | | ***-*** | ***-*** | ***-*** | ***X1*** |
|  | ***-*** | ***-*** | ***-*** | ***-*** | ***-*** | | ***-*** | ***1*** | ***1*** |
|  | ***-*** | ***-*** | ***-*** | ***-*** | ***-*** | | ***-*** | ***1*** | ***1*** |  |
|  | ***Q2*** | ***1*** | ***1*** | ***0*** | ***0*** | ***0*** | | ***0*** | ***0*** | ***0*** |  |
|  | ***0*** | ***0*** | ***0*** | ***0*** | ***0*** | | ***0*** | ***0*** | ***0*** | ***X1*** |
|  |  | ***0*** | ***0*** | ***0*** | ***0*** | ***0*** | | ***0*** | ***0*** | ***0*** |
|  |  | ***0*** | ***0*** | ***0*** | ***0*** | ***0*** | | ***0*** | ***0*** | ***0*** |  |
|  |  |  | ***X2*** | |  |  | | ***X2*** | |  |  |

***T4 = (Q3Q̅1) (Q̅4X1) (Q̅4Q̅2) (Q̅4Q̅3)***

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  |  | ***Q3*** | | | |  |  | |  |  |  |
|  |  | ***Q1*** | |  |  | ***Q1*** | | |  |  | ***T3*** |
| ***Q4*** | ***Q2*** | ***-*** | ***-*** | ***-*** | ***-*** | ***-*** | | ***-*** | ***-*** | ***-*** |  |
| ***-*** | ***-*** | ***-*** | ***-*** | ***-*** | | ***-*** | ***-*** | ***-*** | ***X1*** |
|  | ***-*** | ***-*** | ***-*** | ***-*** | ***-*** | | ***-*** | ***0*** | ***0*** |
|  | ***-*** | ***-*** | ***-*** | ***-*** | ***-*** | | ***-*** | ***0*** | ***0*** |  |
|  | ***Q2*** | ***1*** | ***1*** | ***0*** | ***0*** | ***1*** | | ***1*** | ***0*** | ***0*** |  |
|  | ***0*** | ***0*** | ***0*** | ***0*** | ***1*** | | ***1*** | ***0*** | ***0*** | ***X1*** |
|  |  | ***0*** | ***0*** | ***0*** | ***0*** | ***0*** | | ***0*** | ***0*** | ***0*** |
|  |  | ***0*** | ***0*** | ***0*** | ***0*** | ***0*** | | ***0*** | ***0*** | ***0*** |  |
|  |  |  | ***X2*** | |  |  | | ***X2*** | |  |  |

***T3 = (Q̅1) (Q̅4Q̅2) (Q3X1)***

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| ***Зм****.*  ***Арк.***  ***№ докум.***  ***Підп.***  ***Дата***  ***Арк.***  ***6***  *4*  ***ІАЛЦ.463626.004 ПЗ*** |  | ***Q3*** | | | |  |  | |  |  |  |
|  |  | ***Q1*** | |  |  | ***Q1*** | | |  |  | ***T2*** |
| ***Q4*** | ***Q2*** | ***-*** | ***-*** | ***-*** | ***-*** | ***-*** | | ***-*** | ***-*** | ***-*** |  |
| ***-*** | ***-*** | ***-*** | ***-*** | ***-*** | | ***-*** | ***-*** | ***-*** | ***X1*** |
|  | ***-*** | ***-*** | ***-*** | ***-*** | ***-*** | | ***-*** | ***0*** | ***0*** |
|  | ***-*** | ***-*** | ***-*** | ***-*** | ***-*** | | ***-*** | ***0*** | ***0*** |  |
|  | ***Q2*** | ***1*** | ***1*** | ***0*** | ***0*** | ***1*** | | ***1*** | ***0*** | ***0*** |  |
|  | ***0*** | ***0*** | ***0*** | ***0*** | ***0*** | | ***0*** | ***0*** | ***0*** | ***X1*** |
|  |  | ***1*** | ***1*** | ***0*** | ***0*** | ***1*** | | ***1*** | ***0*** | ***0*** |
|  |  | ***1*** | ***1*** | ***0*** | ***0*** | ***1*** | | ***1*** | ***0*** | ***0*** |  |
|  |  |  | ***X2*** | |  |  | | ***X2*** | |  |  |

***T2 = (Q̅1) (Q2X1)***

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  |  | ***Q3*** | | | |  |  | |  |  |  |
|  |  | ***Q1*** | |  |  | ***Q1*** | | |  |  | ***T1*** |
| ***Q4*** | ***Q2*** | ***-*** | ***-*** | ***-*** | ***-*** | ***-*** | | ***-*** | ***-*** | ***-*** |  |
| ***-*** | ***-*** | ***-*** | ***-*** | ***-*** | | ***-*** | ***-*** | ***-*** | ***X1*** |
|  | ***-*** | ***-*** | ***-*** | ***-*** | ***-*** | | ***-*** | ***0*** | ***0*** |
|  | ***-*** | ***-*** | ***-*** | ***-*** | ***-*** | | ***-*** | ***0*** | ***0*** |  |
|  | ***Q2*** | ***1*** | ***1*** | ***1*** | ***1*** | ***1*** | | ***1*** | ***1*** | ***1*** |  |
|  | ***0*** | ***0*** | ***1*** | ***1*** | ***1*** | | ***1*** | ***1*** | ***1*** | ***X1*** |
|  |  | ***0*** | ***0*** | ***1*** | ***1*** | ***1*** | | ***1*** | ***1*** | ***1*** |
|  |  | ***0*** | ***0*** | ***1*** | ***1*** | ***0*** | | ***0*** | ***1*** | ***1*** |  |
|  |  |  | ***X2*** | |  |  | | ***X2*** | |  |  |

***T1 = (Q4) (Q̅2Q1X̅1) (Q3Q1X1)***

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | ***Q3*** | |  |  | ***Y1*** |
| ***Q4*** | ***-*** | ***-*** | ***-*** | ***0*** |  |
| ***-*** | ***-*** | ***-*** | ***-*** | ***Q2*** |
|  | ***0*** | ***1*** | ***0*** | ***0*** |
|  | ***0*** | ***0*** | ***0*** | ***0*** |  |
|  |  | ***Q1*** | |  |  |

***Y1 = (Q̅3) (Q̅1) (Q̅4Q̅2)***

***Зм****.*

***Арк.***

***№ докум.***

***Підп.***

***Дата***

***Арк.***

***7***

*4*

***ІАЛЦ.463626.004 ПЗ***

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | ***Q3*** | |  |  | ***Y2*** |
| ***Q4*** | ***-*** | ***-*** | ***-*** | ***1*** |  |
| ***-*** | ***-*** | ***-*** | ***-*** | ***Q2*** |
|  | ***0*** | ***0*** | ***0*** | ***1*** |
|  | ***0*** | ***0*** | ***1*** | ***0*** |  |
|  |  | ***Q1*** | |  |  |

***Y2 = (Q3) (Q2Q1) (Q̅4Q̅2Q̅1)***

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | ***Q3*** | |  |  | ***Y3*** |
| ***Q4*** | ***-*** | ***-*** | ***-*** | ***0*** |  |
| ***-*** | ***-*** | ***-*** | ***-*** | ***Q2*** |
|  | ***1*** | ***1*** | ***0*** | ***0*** |
|  | ***0*** | ***0*** | ***0*** | ***0*** |  |
|  |  | ***Q1*** | |  |  |

***Y3 = (Q̅3) (Q̅2)***

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | ***Q3*** | |  |  | ***Y4*** |
| ***Q4*** | ***-*** | ***-*** | ***-*** | ***0*** |  |
| ***-*** | ***-*** | ***-*** | ***-*** | ***Q2*** |
|  | ***1*** | ***0*** | ***0*** | ***0*** |
|  | ***0*** | ***0*** | ***0*** | ***0*** |  |
|  |  | ***Q1*** | |  |  |

***Y4 = (Q̅2) (Q̅3) (Q1)***

***2.6. Побудова схеми автомата в заданому базисі***

***Отриманих після мінімізації даних достатньо для побудови***

***комбінаційних схем функцій збудження тригерів і функцій сигналів***

***виходів, таким чином, і всієї комбінаційної схеми. Автомат будуємо на***

***T-тригерах. Автомат є синхронним, так як його роботу синхронізує***

***генератор, а T-тригер керований перепадом сигналу.***

***3. Синтез комбінаційних схем***

***Зм****.*

***Арк.***

***№ докум.***

***Підп.***

***Дата***

***Арк.***

***8***

*4*

***ІАЛЦ.463626.004 ПЗ***

***3.1. Представлення функції f4 в канонічних формах алгебр***

***Буля, Шеффера, Пірса та Жегалкіна***

***Алгебра Буля {І, АБО, НЕ}***

***f4ДДНФ= (X̅4X̅3X̅2X1) v (X̅4X̅3X2X1) v (X̅4X̅3X2X̅1) v (X̅4X3X2X1) v (X4X̅3X̅2X1) v (X4X̅3X2X1) v (X4X3X̅2X̅1) v (X4X3X̅2X1) v (X4X3X2X1)***

***f4ДКНФ= (X̅4vX̅3vX̅2vX̅1) ∙ (X̅4vX3vX̅2vX̅1) ∙ (X̅4vX3vX̅2vX1) ∙ (X̅4vX3vX2vX̅1) ∙ (X4vX̅3vX̅2vX̅1) ∙ (X4vX̅3vX2vX̅1) ∙ (X4vX3vX2vX̅1)***

***Алгебра Шеффера {І-НЕ}***

***f4 = ((X4/X4)(X3/X3)(X2/X2)(X1))/((X4/X4)(X3/X3)(X2)(X1))/((X4/X4)(X3/X3)***

***(X2)(X1/X1))/((X4/X4)(X3)(X2)(X1))/((X4)(X3/X3)(X2/X2)(X1))/((X4)(X3/X3)(X2)***

***(X1))/((X4)(X3)(X2/X2)(X1/X1))/((X4)(X3)(X2/X2)(X1))/((X4)(X3)(X2)(X1))***

***Алгебра Пірса {АБО-НЕ}  
 f4 = ((X4↓X4)↓(X3↓X3)↓(X2↓X2) ↓(X1↓X1))↓((X4↓X4)↓(X3)↓(X2↓X2)↓(X1↓X1))  
↓((X4↓X4)↓(X3)↓( X2↓X2)↓(X1))↓((X4↓X4)↓(X3)↓(X2)↓(X1))↓((X4)↓(X3) ↓(X2)↓(X1↓X1))↓((X4↓X4)(X3)(X2)(X1↓X1))↓((X4)(X3↓X3)(X2)(X1↓X1)).   
Алгебра Жегалкіна {ВИКЛЮЧНЕ АБО, І, const 1}***

***f4 = (X4⊕1)(X3⊕1)(X2⊕1)(X1)⊕(X4⊕1)(X3⊕1)(X2)(X1)  
⊕(X4⊕1)(X3⊕1)(X2)(X1⊕1)⊕(X4⊕1)(X3)(X2)(X1)⊕(X4)(X3⊕1)(X2⊕1)(X1) ⊕(X4)(X3⊕1)(X2)(X1)⊕(X4)(X3)(X2⊕1)(X1⊕1)⊕(X4)(X3)(X2⊕1)(X1) ⊕(X4)(X3)(X2)(X1) = X4X3X2X1⊕X3X1⊕X1⊕X4X2⊕X3X2⊕X2X1⊕X2⊕***

***X4X2X1⊕X4X3X2⊕X4X3⊕X4X3X1***

***3.2. Визначення належності функції f4 до п’яти передцповних***

***класів***

* ***f(1111) = 1 => функція зберігає одиницю***
* ***f(0000) = 0 => функція зберігає нуль***
* ***f(0011) = f(1100) = однакові=> функція не самодвоїста***
* ***f(0001) > f(1110) => функція не монотонна***

***функція нелінійна, оскільки її поліном Жегалкіна нелінійний***