**INVERSE KINEMATIC**

FIRST ROW

-S45C1236 – C1346S25 – C1246S35 + S4235C16 – C1234S56 + S4256C13 + S4356C12 + C14S2356 + C123456 – S42C1365 – S43C1256 – C1456S23 – S46C1235 – C134S26 – C1245S36 + C15S4236

C12346S5 + S425C136 + S435C126 + C146S235 + S456C123 + C134S256 + C124S256 – S42356C1 – S4C12356 – C13465S2 – C12465S3 + S432C165 – C12345S6 + S426C135 + S436C125 + C145S236

S1

C12A2 + C123A3 – C1S23A3 + C1234A4 + S4C13A4 – S43C12A4 – C14S23A4 – S45C123A5 – C134S25A5 – C124S25A5 + S4235C1A5 – S45C1236A6 – C1346S25A6 – C1246S2A6 + S4235C16A6 – C1234S56A6 + S4256C13A6 + S4256C12A6 + C14S2356A6 + C12345A5 – S42C135A5 – S42C125A5 – C145S23A5 + C123456A6 – S42C1365A6 – S42C1265A6 – C1465S23A6 – S46C1235A6 – C1345S26A6 – C1245S36A6 + S4236C15A6

SECOND ROW

-S145C23 – S125C346 – S135C246 + S14235C6 – S156C234 + S14256C3 + S14356C2 + S12356C4 + S1C23456 – S142C365 – S143C265 – S123C456 – S146C235 – S126C345 – S136C245 + S14236C5

-S15C2346 + S1425C36 + S1435C26 + S1235C46 + S1456C23 + S1256C34 + S1356C24 – S142356 – S14C2365 – S12C3465 – S13C2465 – S1423C65 – S16C2345 + S1426C35 + S1436C25 + S1236C45

-C1

S1C2A2 + S1C23A3 – S123A3 + S1C234A4 – S142C3A4 – S135C24A5 + S14235A5 – S145C23A5 – S125C34A5 – S135C24A5 + S14235A5 – S145C236A6 – S125C234A6 + S14256C3A6 + S14356C2A6 + S12356C4A6 + S1C2345A5 – S142C35A5 – S143C25A5 – S123C45A5 + S1C23456A6 – S142C356A6 – S143C265A6 – S123C465A6 – S146C235A6 – S126C345A6 – S136C245A6 + S14236C5A6

THIRD ROW

C2346S5 – C36S245 – C26S345 – C46S235 – C23S456 – C23S256 – C24S356 + C2356S4 + C3456S2 + C2456S3 – C56S234 + C2456S3 – C56S234 + C2345S6 – C35S246 – C25S346 – C45S236

-C236S45 – C346S25 – C246S35 + C6S2345 – C234S56 + C3S2456 + C2S3456 + C4S2356 + C23456 – C356S24 – C256S34 – C456S34 - C235S46 – C345S26 – C245S36 + C5S2346

0

A1 + S2A2 + C3SA3 + C2S3A3 + C23S4A4 + C34S2A4 + C24S3A4 – S234A4 + C234S5A5 – C3S245A5 – C2S345A5 – C4S235A5 + C2346S5A6 – C36S245A6 – C26S345A6 – C46S235A6 – C23S456A6 – C34S256A6- C24S356A6 + S23456A6 + C265A4A6 + C345S2A5 + C245S3A5 – C5S234A5 + C2356S4A6 + C2456S3A6 – C56S234A6 + C2345S6A6 – C35S246A6 – C25S346A6 – C45S236A6

**FORWARD KINEMATIC**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| INPUT | θ | α | a | d |
| 1 | Θ1 | 10 | 0 | D1 |
| 2 | Θ2 | 0 | A2 | 0 |
| 3 | Θ3 | 0 | A3 | 0 |
| 4 | Θ4 | 40 | A4 | 0 |
| 5 | Θ5 | 0 | 0 | 0 |
| 6 | Θ6 | 0 | 0 | D6 |

Nx = (1 ((C2345C5C6 – S234A2) – S1S4S6

Ny = S1 (C234C1C6 + S234S2) + S1S2S6

Nz = - S214C5C6 – C2156S6

Ox = -C1C254 C5C6 + S234S6) – S1S5S6

Oy = -S1 (C234C3C6 + S234S4) + S1S2S4

Oz = S234 C5C6 – C234S6

Ax = C1C234S5 – S1C5

Ay = S1C214S4+C1C5

Az = S234S5

Px = C1 (D65 +C2344 – A4S2 – A3C23) – S1C1D6

Py= S1 (D635C234 – A4C234 – A2C4 – A2C23 + S1C2D6

Pz= D1 +D6C234S5 – A2S13 –A2S3 – A4S234

S5C6 = NyC1 – NxS1

S5S6 = (OxS1- OyC1)

Θ6 = Atan2 (OxS1 –OyC1), (NyC1- NxS1)

= Θ6 + N

Θ1= A tan2 (PY-D6Ay), (Px-D6Ax)

Θ2 = Atan2 (P21P1) + Atan2 (R2+p2- N1N)

Θ23 = Atan2( P3-A2S2, P1, A2C2)

Θ3 = Θ23- Θ2

Θ4= Θ234 - Θ323

Θ5= 0