```matlab
clc;
clear all;
close all;
```

Defining DH Parameters

```matlab
syms l1 l2 lb theta1 theta2 d3 ao
% Theta D A Alpha
l1_dh = [0 lb 0 0]
```

l1_dh = $\begin{bmatrix} 0 & lb & 0 & 0 \end{bmatrix}$

```matlab
l2_dh = [theta1 2*ao l1-2*ao 0]
```

l2_dh = $\begin{bmatrix} \theta_1 & 2\,ao & l_1 - 2\,ao & 0 \end{bmatrix}$

```matlab
l3_dh = [theta2 ao l2-ao 0]
```

l3_dh = $\begin{bmatrix} \theta_2 & ao & l_2 - ao & 0 \end{bmatrix}$

```matlab
l4_dh = [0 d3-ao ao 0]
```

l4_dh = $\begin{bmatrix} 0 & d_3 - ao & ao & 0 \end{bmatrix}$

Making Symbolic A Matrix

```matlab
syms theta d a alpha
A = [cos(theta) -sin(theta)*cos(alpha) sin(theta)*sin(alpha) a*cos(theta);
    sin(theta) cos(theta)*cos(alpha) -cos(theta)*sin(alpha) a*sin(theta);
    0 sin(alpha) cos(alpha) d;
    0 0 0 1]
```

A =

$$\begin{bmatrix} \cos(\theta) & -\cos(\alpha)\sin(\theta) & \sin(\alpha)\sin(\theta) & a\cos(\theta) \\ \sin(\theta) & \cos(\alpha)\cos(\theta) & -\sin(\alpha)\cos(\theta) & a\sin(\theta) \\ 0 & \sin(\alpha) & \cos(\alpha) & d \\ 0 & 0 & 0 & 1 \end{bmatrix}$$

```matlab
A1 = simplify(subs(A,[theta,d,a,alpha],l1_dh));
A2 = simplify(subs(A,[theta,d,a,alpha],l2_dh));
A3 = simplify(subs(A,[theta,d,a,alpha],l3_dh));
A4 = simplify(subs(A,[theta,d,a,alpha],l4_dh));
T = A1*A2*A3*A4;
T = simplify(subs(T,[l1,l2,lb,ao],[1,1,2,0.05]))
```

T =

$$
\begin{bmatrix}
\cos(\theta_2 + \theta_1) & -\sin(\theta_2 + \theta_1) & 0 & \cos(\theta_2 + \theta_1) + \dfrac{9\cos(\theta_1)}{10} \\[2mm]
\sin(\theta_2 + \theta_1) & \cos(\theta_2 + \theta_1) & 0 & \sin(\theta_2 + \theta_1) + \dfrac{9\sin(\theta_1)}{10} \\[2mm]
0 & 0 & 1 & \dfrac{21}{10} + d_3 \\[2mm]
0 & 0 & 0 & 1
\end{bmatrix}
$$

Modelling the Robot from DH Parameters

```
L(1)  =  Link(double(subs(l1_dh,[l1,l2,lb,theta1,theta2,d3,ao],[1,1,1,0,0,1.2,0.05])),'s
L(1).qlim = pi/180 * [-90 90];
L(2)  =  Link(double(subs(l2_dh,[l1,l2,lb,theta1,theta2,d3,ao],[1,1,1,0,0,1.2,0.05])),'s
L(2).qlim = pi/180 * [-90 90];
L(3)  =  Link(double(subs(l3_dh,[l1,l2,lb,theta1,theta2,d3,ao],[1,1,1,0,0,1.2,0.05])),'s
L(3).qlim = pi/180 * [-90 90];
L(4)  =  Link([double(subs(l4_dh,[l1,l2,lb,theta1,theta2,d3,ao],[1,1,1,0,0,1.2,0.05])),1
L(4).qlim = [0 2];
scara_robot = SerialLink(L);
scara_robot.name = 'SCARA Robot';
scara_robot.plot([0 0 0 0],'workspace',[-2 2 -2 2 0 2])
scara_robot.teach
```