

Exercise 4.6 Determine the space frame screw axes \mathcal{S}_i for the WAM robot in Figure 4.8.

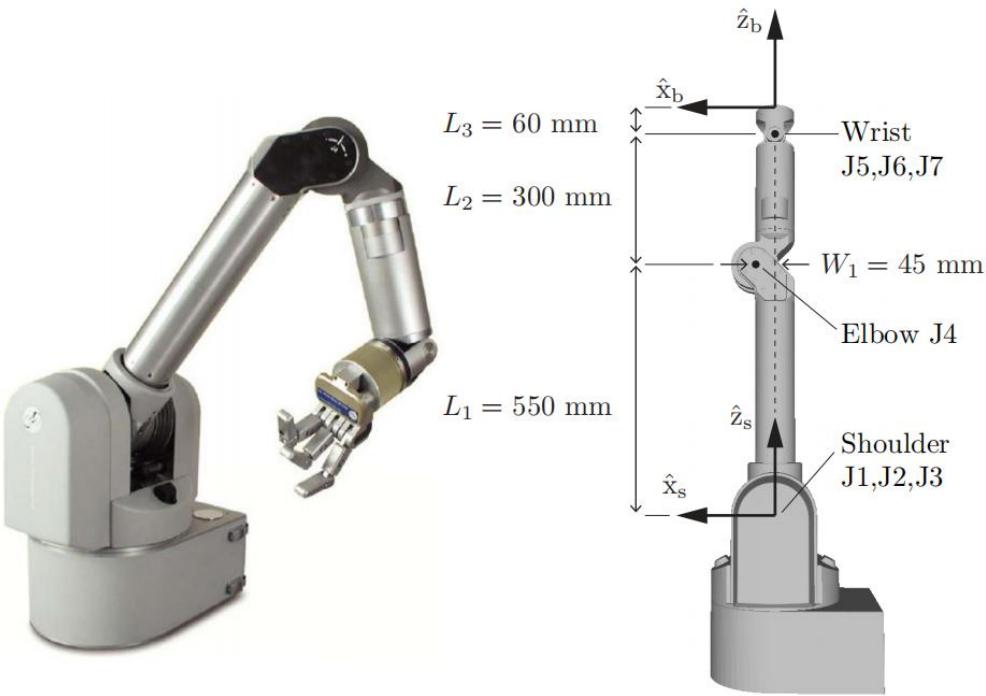


Figure 4.8: Barrett Technology's WAM 7R robot arm at its zero configuration (right). At the zero configuration, axes 1, 3, 5, and 7 are along \hat{z}_s and axes 2, 4, and 6 are aligned with \hat{y}_s out of the page. Positive rotations are given by the right-hand rule. Axes 1, 2, and 3 intersect at the origin of $\{s\}$ and axes 5, 6, and 7 intersect at a point 60mm from $\{b\}$. The zero configuration is singular, as discussed in Section 5.3.

Note: in modern robotics, body screw axis \mathcal{B}_i means the screw axis of joint i expressed in frame b, i.e. ${}^b\mathcal{S}_i$ in our notation.

Exercise 4.9 The spatial RRPPRR open chain of Figure 4.15 is shown in its zero position. Determine the end-effector zero position configuration M , the screw axes \mathcal{S}_i in $\{0\}$, and the screw axes \mathcal{B}_i in $\{b\}$.

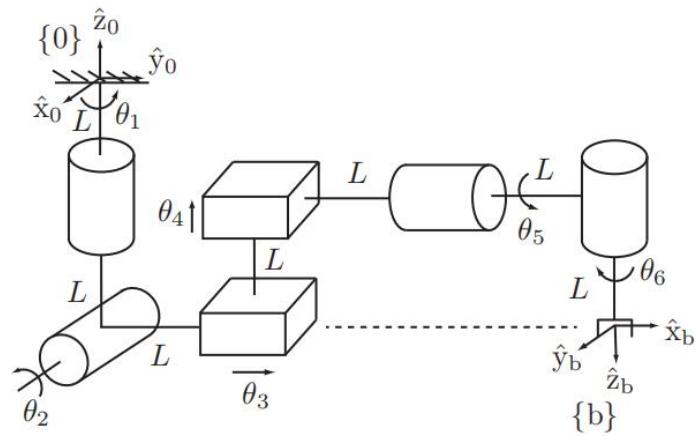


Figure 4.15: A spatial RRPPRR open chain with prescribed fixed and end-effector frames.

Exercise 5.8 The RPR robot of Figure 5.20 is shown in its zero position. The fixed and end-effector frames are respectively denoted $\{s\}$ and $\{b\}$.

- (a) Find the space Jacobian $J_s(\theta)$ for arbitrary configurations $\theta \in \mathbb{R}^3$.

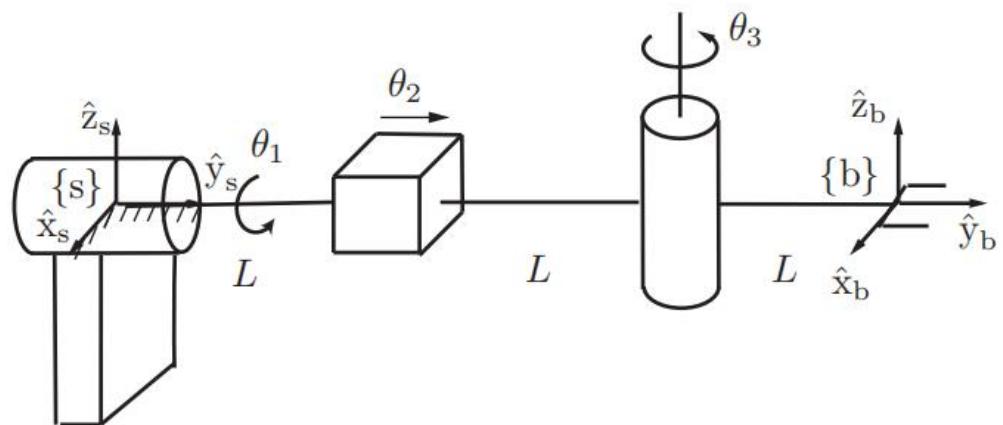


Figure 5.20: RPR robot.