

Question Set 4

CS 420

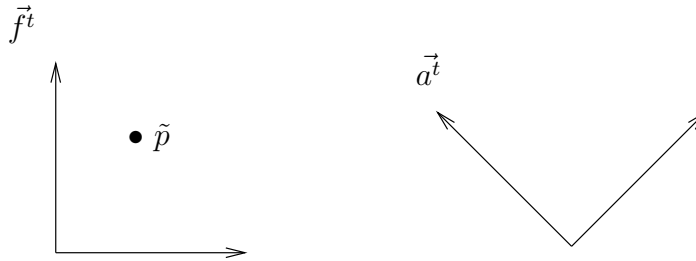
Chapter 4

1. Let

$$S = \begin{bmatrix} 0.5 & 0 & 0 & 0 \\ 0 & 0.5 & 0 & 0 \\ 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 1 \end{bmatrix}$$

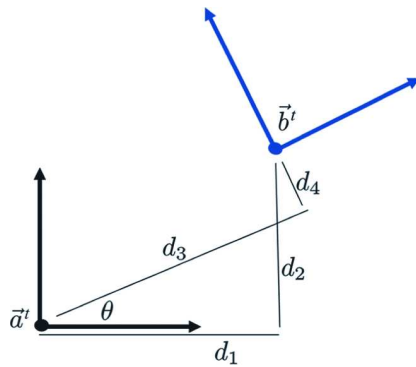
What transformation is accomplished by this matrix?

2. Consider S from the previous problem.



- (a) Describe $\tilde{p} = \vec{f}^t \mathbf{c} \Rightarrow \vec{f}^t S \mathbf{c}$ and draw the transformed point.
- (b) Describe $\tilde{p} = \vec{a}^t \mathbf{c} \Rightarrow \vec{a}^t S \mathbf{c}$ and draw the transformed point.
3. Let $\tilde{q} = \vec{f}^t \mathbf{c}$ and $\vec{a}^t = \vec{f}^t A$. What are \tilde{q} 's coordinates with respect to \vec{a}^t ?
4. State the “left of” rule and illustrate it with an example.
5. Using the definitions of Section 4.2, draw two different sketches illustrating the transformation $\vec{f}^t \Rightarrow \vec{f}^t RT$.
6. Suppose \vec{f}^t is an orthonormal frame, and we apply the transformation $\vec{f}^t \Rightarrow \vec{f}^t ST$ where S is a matrix that applies a uniform scale by a factor of 2, and T translates by 1 along the x axis. How far does the frame’s origin move, measured in the original units of \vec{f}^t ?

7. Consider the following two orthonormal frames \vec{a}^t and \vec{b}^t

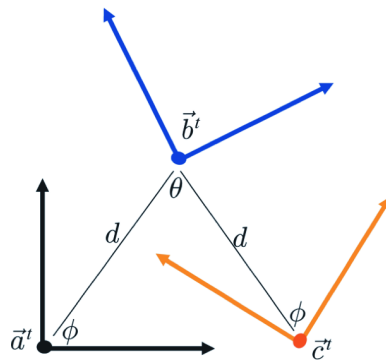


with distances given by the positive quantities d_i .

- (a) What are the matrices R and T such that $\vec{b}^t = \vec{a}^t T R$?
 (b) What are the matrices R and T such that $\vec{b}^t = \vec{a}^t R T$?

Your answers should not contain trigonometric terms in the matrix T .

8. Consider the following three frames.



Let $\vec{b}^t = \vec{a}^t N$ and $\vec{c}^t = \vec{a}^t M$. Express the matrix M in terms of N and θ .