

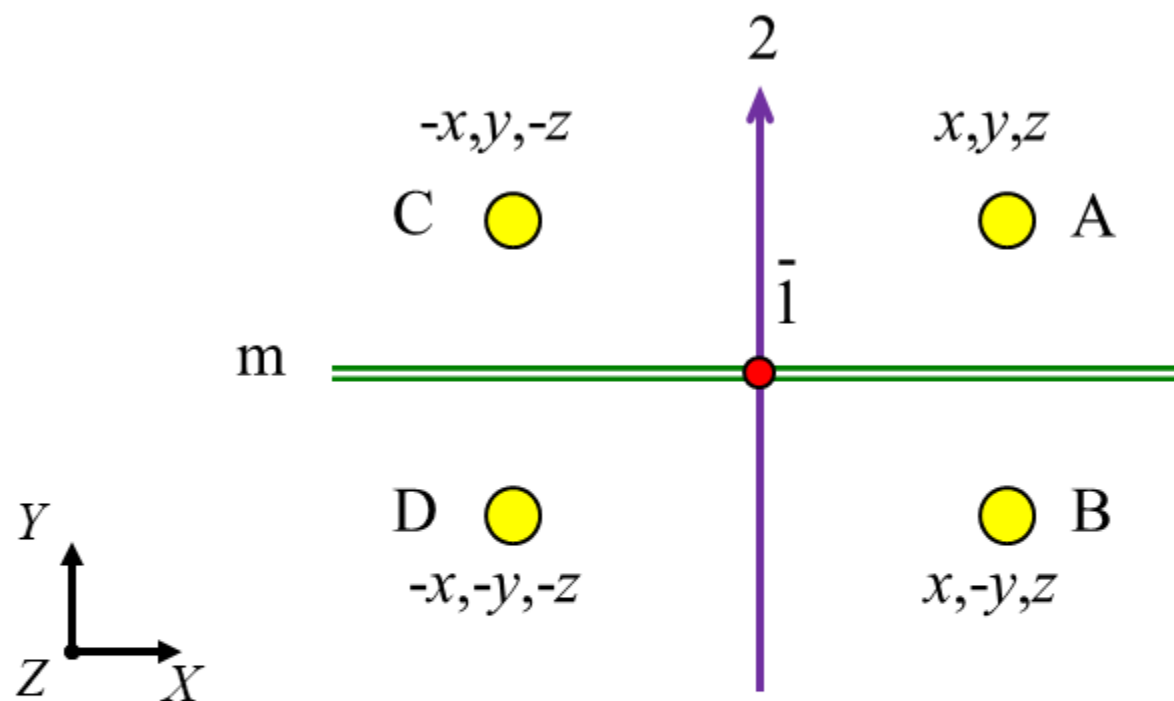
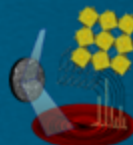
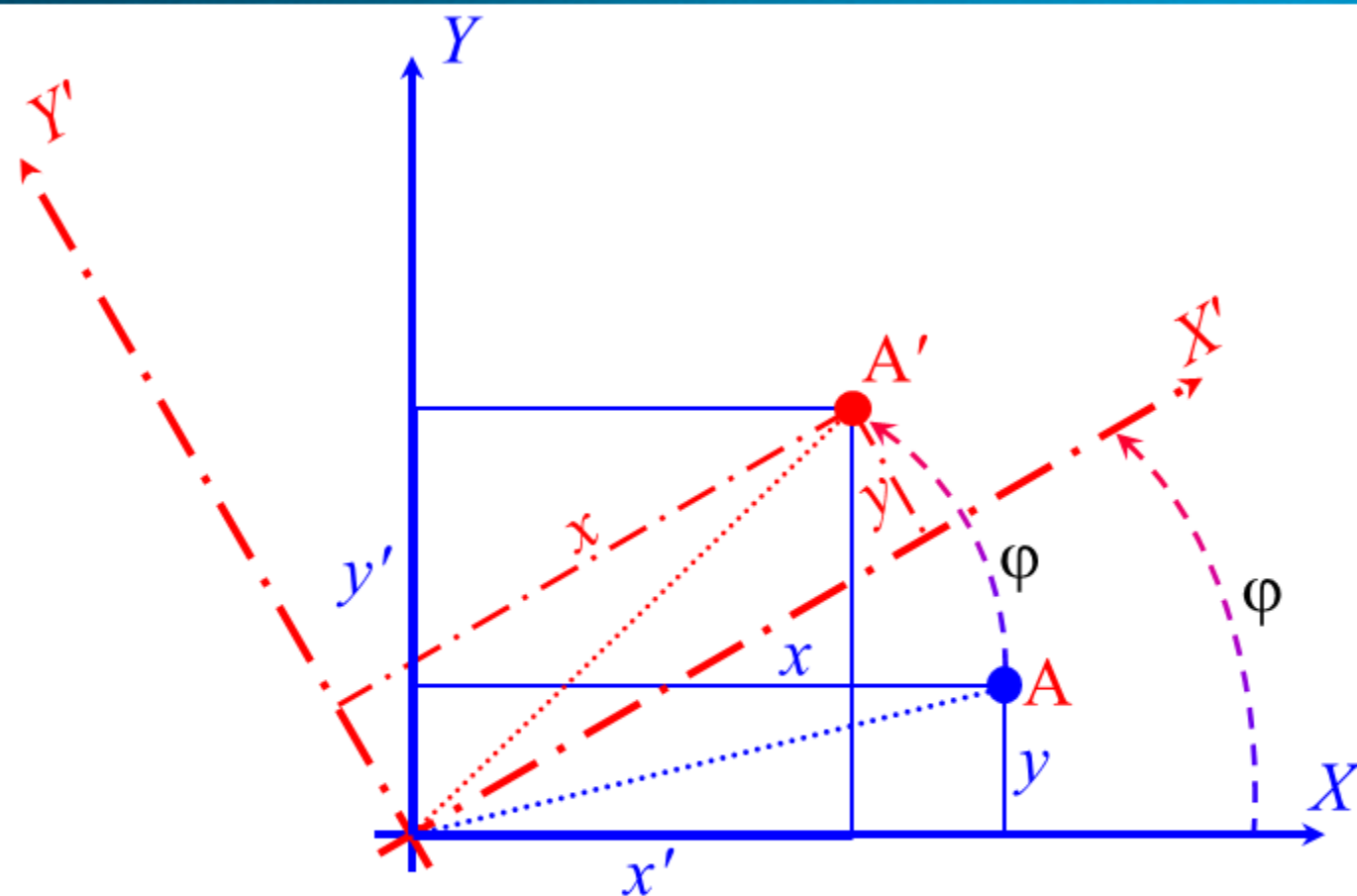
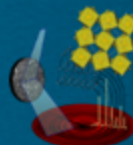


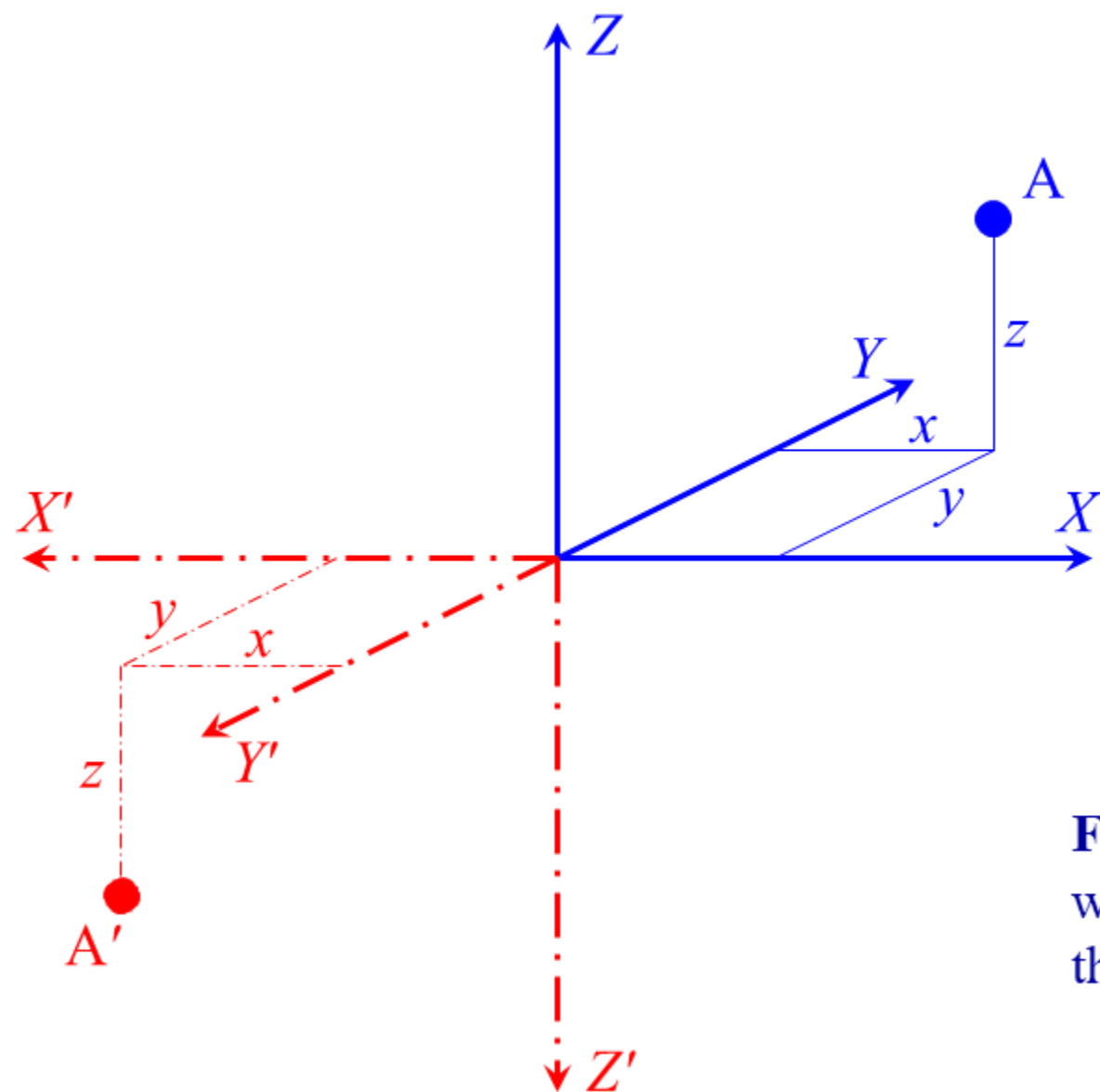
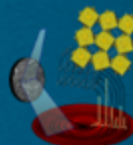
Figure 4.1. Symmetry elements and symbolic description of symmetry operations in the point group symmetry $2/m$. Here, the origin of the coordinate system coincides with the center of inversion.



Eq. 4.1.

$$\begin{aligned}x' &= x \cos \varphi - y \sin \varphi \\y' &= x \sin \varphi + y \cos \varphi \\z' &= z\end{aligned}$$

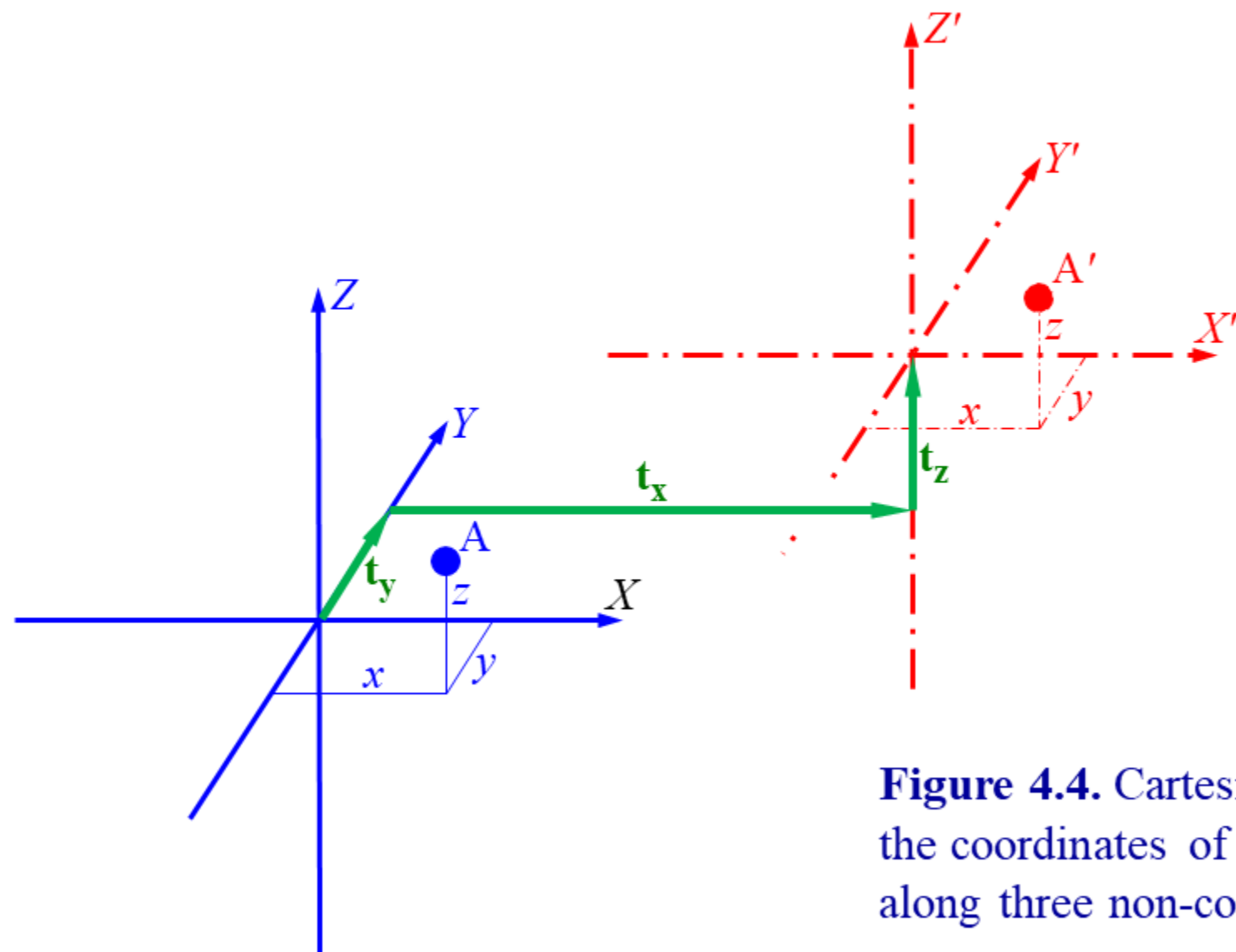
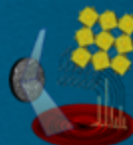
Figure 4.2. Cartesian bases XYZ and $X'Y'Z'$ (both Z and Z' are perpendicular to the plane of the projection) in which the coordinates of the point are invariant to the rotation around Z by angle φ .



Eq. 4.1.

$$\begin{aligned}x' &= -x \\y' &= -y \\z' &= -z\end{aligned}$$

Figure 4.3. Cartesian bases XYZ and $X'Y'Z'$ in which the coordinates of the point are invariant to the inversion through the origin of coordinates.



Eq. 4.9.

$$\begin{aligned}x' &= x + t_x \\y' &= y + t_y \\z' &= z + t_z\end{aligned}$$

Figure 4.4. Cartesian bases XYZ and $X'Y'Z'$ in which the coordinates of the point are invariant to translations along three non-coplanar vectors $\mathbf{t}_x$, $\mathbf{t}_y$ and $\mathbf{t}_z$.

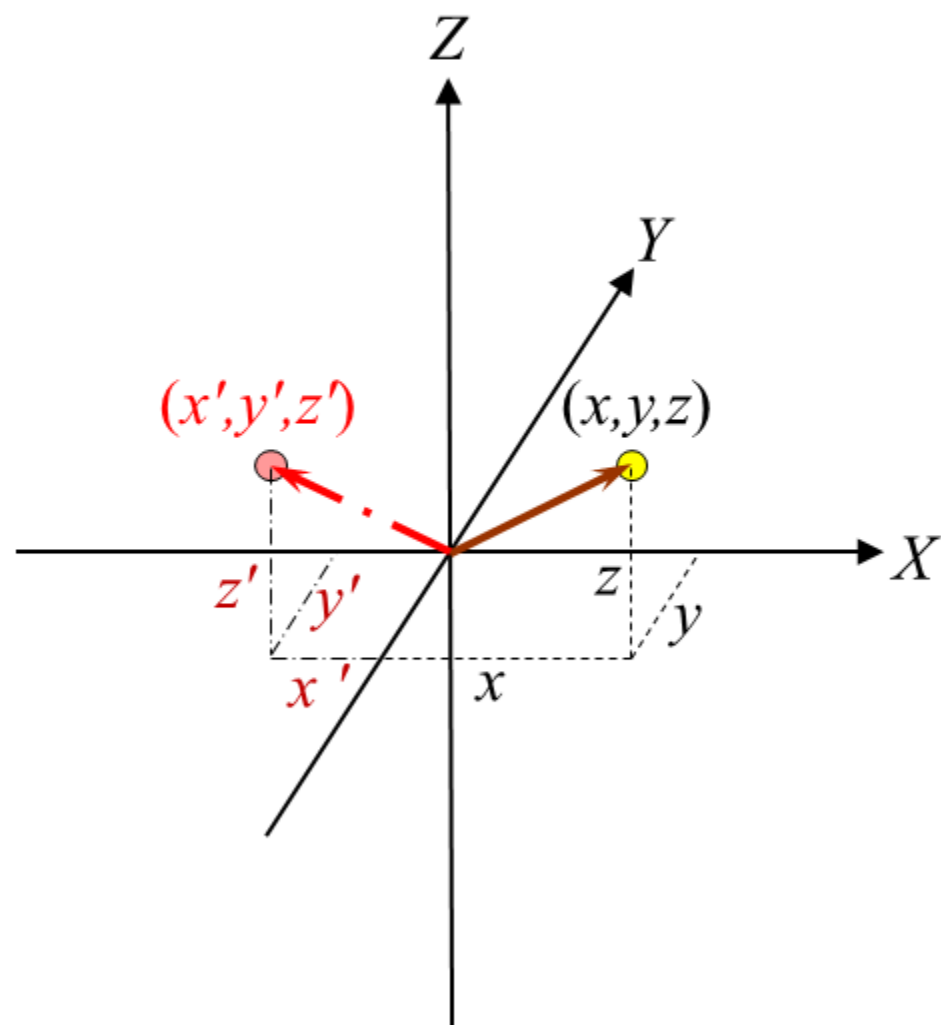
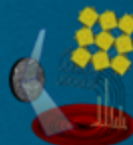
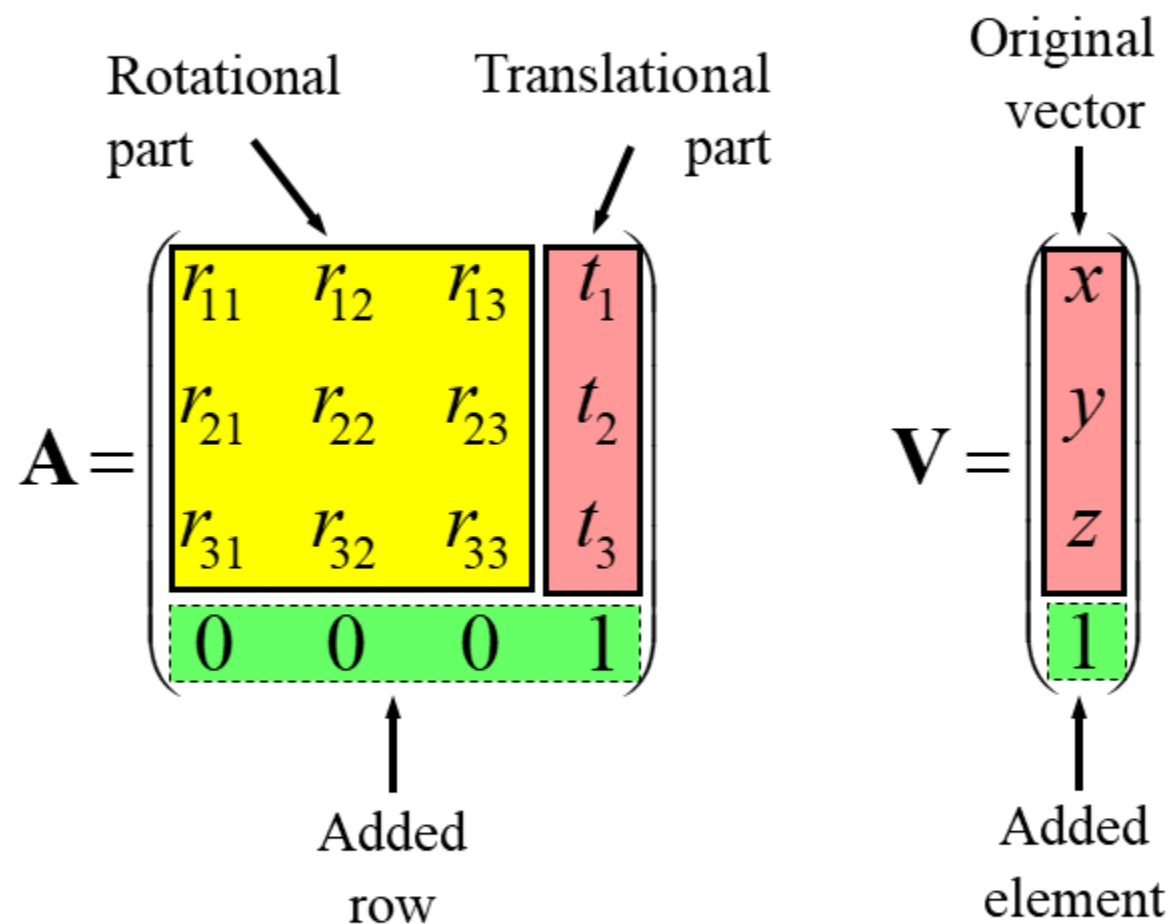
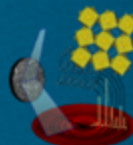


Figure 4.5. The point with the coordinates x, y, z represented by the vector (x, y, z) and the second, symmetrically equivalent, point with the coordinates x', y', z' represented by the vector (x', y', z') , which has the same length as the original vector (x, y, z) .



Eq. 4.29

$$\mathbf{V}' = \begin{pmatrix} r_{11} & r_{12} & r_{13} & t_1 \\ r_{21} & r_{22} & r_{23} & t_2 \\ r_{31} & r_{32} & r_{33} & t_3 \\ 0 & 0 & 0 & 1 \end{pmatrix} \begin{pmatrix} x \\ y \\ z \\ 1 \end{pmatrix}$$

Figure 4.6. The augmented 4×4 matrix, which combines both the rotational and translational parts as indicated, respectively, by yellow and pink boxes, and the added row highlighted by the green box (*left*).

The corresponding modification of the original vector to ensure their compatibility in the matrix-vector multiplication (*right*).