

Appendix D

Group Theory

D.1 Transformation Groups

D.2 Rotations

There are many important symmetry concepts that play an important part in field physics. In this appendix, we will discuss rotations as a particularly important example. These will serve as a basis for the description of the relevant concepts from group theory that obviously are more general than just this application. The advantage of this approach is that use of a realistic example makes it easy to interpret the abstract ideas that are the basis for the many powerful results of the general approach of group theory.

In the most complete sense a body composed of N mass points can have at most $3N$ degrees of freedom. Any change in the body would require the specification of the this many parameters to describe the change. in the case of a rigid body, this number is greatly reduced by the requirement of rigidity, all separations remain unchanged by the motion. Consider a rigid three frame, composed of three mutually orthogonal basis vectors \hat{x} , \hat{y} , and \hat{z} . This frame in any other arbitrary configuration but still preserving the orthogonality is shown in Figure ??

D.3 Lorentz Transformations