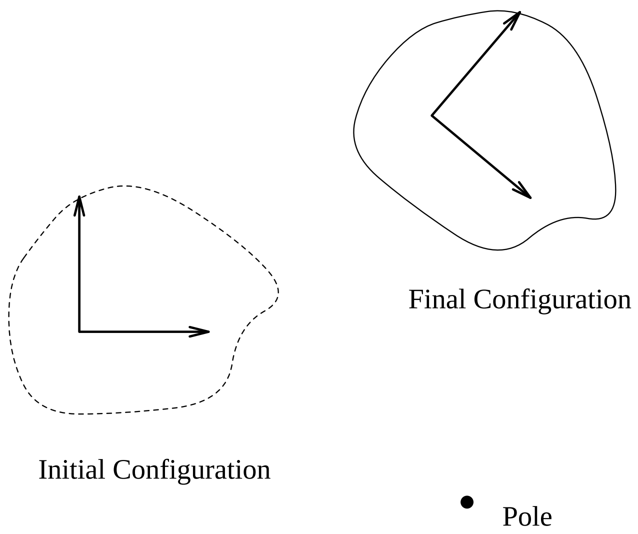
ME 115(a): Homework #1

(Due Thursday January 24, 2002)

Problem 1: In class, we reviewed the fact that every planar rigid body displacement can be thought of as equivalent to a translation, $\vec{d}$, and a rotation, which can be represented by a 2×2 rotation matrix R. However, there is another way to view planar displacements. Every planar rigid body displacement is *equivalent* to a rotation about a unique point in the plane, known as the pole (see Figure).



Given a displacement $D_1 = (\vec{d}, R)$,

- **(a)** Show that there exists a pole
- **(a)** Find an expression for the location of the pole.

(hint: show that there exists another viewing reference frame in which the given displacement appears to be a pure rotation).

Problem 2: You are given the following displacement: $D_1 = (x, y, \theta) = (1.5, 2.0, 45.0^o)$ Where is the pole of this displacement?

Problem 3: In class we used the particle nature of rigid bodies to "prove" that a planar rigid body has three degrees of freedom. Use the same idea to "prove" that a body undergoing spherical motion has three degrees of freedom.

Problem 4: Do problem 1 in chapter 2 of MLS