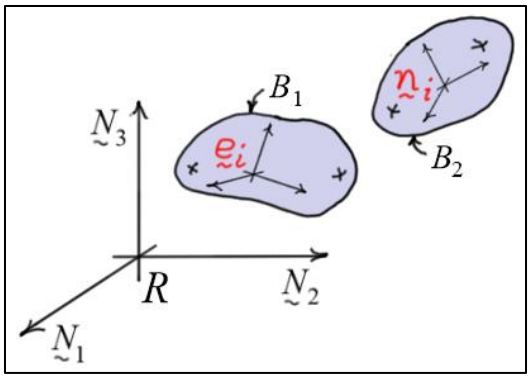
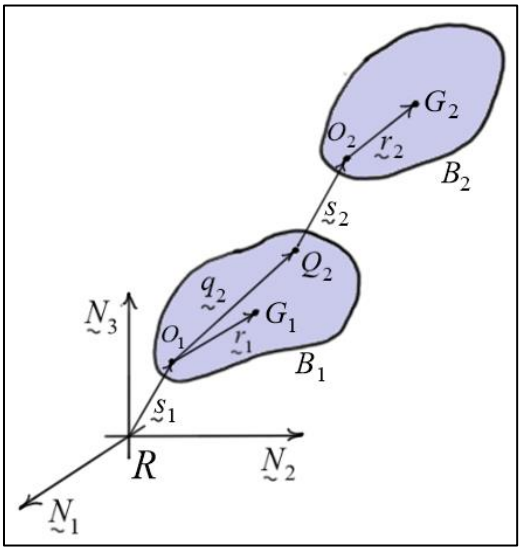
ME 6590 Multibody Dynamics
Exercises #3

1. A two-body system is shown in the two figures. The orientations of the bodies are specified relative to the inertial frame R (***absolute angles***) using 3-2-1 body-fixed rotation sequences. The angles for B_1 and B_2 are θ_{1i} and θ_{2i} $(i=1,2,3)$, respectively. The positions of the bodies are to be specified using ***relative coordinates***. The position of body B_1 is given relative to R and the position of B_2 is given relative to body B_1 as shown in the second figure. The vectors $\underset{\sim}{s}_1$ and $\underset{\sim}{s}_2$ represent translation vectors of the bodies. The position vectors $\underset{\sim}{r}_1$ and $\underset{\sim}{q}_2$ are fixed in B_1 and the position vector $\underset{\sim}{r}_2$ is fixed in B_2.

   Find $\{a_{G_2}\}$ the inertial components of the acceleration of G_2 the mass-center of B_2. Express the results in matrix-vector form using body-fixed angular velocity components. As in Exercises #2, use the components of $\{\dot{s}_1\}$, $\{\dot{s}'_2\}$, $\{\dot{\theta}_1\}$, and $\{\dot{\theta}_2\}$ as the generalized speeds.





2. Given the same set-up as above, find $\{a_{G_3}\}$ the inertial components of the acceleration of G_3 the mass-center of body 3 of the multibody system shown. Express the results in matrix-vector form using the body-fixed angular velocity components. As in Exercises #2.1, use the components of $\{\dot{s}_1\}$, $\{\dot{s}'_2\}$, $\{\dot{s}'_3\}$, $\{\dot{\theta}_1\}$, $\{\dot{\theta}_2\}$, and $\{\dot{\theta}_3\}$ as the generalized speeds.