Let there be three right-handed coordinate frames: an inertial frame, with origin at the Didymos system barycenter and X,Y,Z unit vectors aligned with the ICRF, and the two body-fixed frames, each with origin at their body's center of mass and with their x,y,z unit vectors aligned to their body's principal axes. Hereafter, a statement such as "rotation matrix mapping a vector from ABC frame to DEF frame" means the rotation matrix is multiplied on the left with a (column-wise) vector coordinated in the ABC frame to give the same vector coordinated in the DEF frame. Throughout the following, let the subscript $_A$ denote the primary and the subscript $_B$ denote the secondary. First, define these scalar quantities:

- m_A = mass of primary
- m_B = mass of secondary
- $\mu = \frac{m_A}{m_A + m_B}$ = fraction of whole system mass that is in primary, close to 1
- $m = \frac{m_A\, m_B}{m_A + m_B}$ = mutual dynamics mass parameter for the system

Next, define these absolute position, velocity, attitude, and angular velocity configuration states:

- $\mathbf{r}_A$ = position vector of primary center of mass w.r.t. barycenter, coordinated in inertial frame
- $\mathbf{r}_B$ = position vector of secondary center of mass w.r.t. barycenter, coordinated in inertial frame
- $\mathbf{v}_A$ = velocity vector of primary center of mass w.r.t. barycenter, coordinated in inertial frame
- $\mathbf{v}_B$ = velocity vector of secondary center of mass w.r.t. barycenter, coordinated in inertial frame
- R_A = primary attitude, rotation matrix mapping a vector from primary body frame to inertial frame
- R_B = secondary attitude, rotation matrix mapping vector from secondary body frame to inertial frame
- $\boldsymbol{\omega}_A$ = angular velocity vector of primary coordinated in its own frame
- $\boldsymbol{\omega}_B$ = angular velocity vector of secondary coordinated in its own frame

These are to be related to reduced/relative momenta states specified in the previous "Content Description" document, $\mathbf{X} = \{\mathbf{r}, \mathbf{p}, \boldsymbol{\Gamma}_A, \boldsymbol{\Gamma}_B, R, R_A\}$, wherein:

- $\mathbf{r}$ = relative position of secondary with respect to primary, coordinated in primary body frame
- $\mathbf{p}$ = relative linear momentum, coordinated in primary body frame
- $\boldsymbol{\Gamma}_A$ = angular momentum of primary, coordinated in primary body frame
- $\boldsymbol{\Gamma}_B$ = angular momentum of secondary, coordinated in primary body frame
- R = relative attitude rotation matrix mapping from secondary body frame to primary body frame

Then the relations are simply:

$$\mathbf{r} = R_A^T\,(\mathbf{r}_B - \mathbf{r}_A) \qquad \iff \qquad \begin{cases} \mathbf{r}_A = (-1+\mu) R_A \mathbf{r} \\ \mathbf{r}_B = \mu R_A \mathbf{r} \end{cases} \tag{1}$$

$$\mathbf{p} = m\,\mathbf{v} = R_A^T\, m\; (\mathbf{v}_B - \mathbf{v}_A) \qquad \iff \qquad \begin{cases} \mathbf{v}_A = (-1+\mu) R_A \mathbf{v} \\ \mathbf{v}_B = \mu R_A \mathbf{v} \end{cases} \tag{2}$$

$$R = R_A^T\, R_B \tag{3}$$

$$\boldsymbol{\Gamma}_A = \mathbb{I}_A\, \boldsymbol{\omega}_A \tag{4}$$

$$\boldsymbol{\Gamma}_B = R\, \mathbb{I}_B\, \boldsymbol{\omega}_B \tag{5}$$

where $\mathbb{I}_A$, $\mathbb{I}_B$ are the standard inertia dyads for primary and secondary, respectively, given inside of the file "systemdata_standard_MKS_units" along with m, m_A, m_B, etc.