Mazzoleni Notation Development Document

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1 Overview

The purpose of this document is to facilitate communication while developing a standard style and syntax for Mazzoleni notation in Latex.

2 Style Guide

The following guidelines should be followed:

- Commands should start with a lowercase letter
- Use camel case for commands
- Use snake case for labels
- Arguments should in order by precedence
  - Frame
  - Vector
  - Point

3 Frames

A frame (sometimes *reference frame*) defines a space. It may be thought of as a massless rigid body, and rigid bodies often serve as fixtures for frames. As a conceptual entity, a frame has meaning independent of basis vectors, rigid bodies, or coordinate systems, but the easiest way to define a frame is with a set of basis vectors. In the Mazzoleni notation, basis vectors are expressed with they frame that they are referring to explicitly noted, as shown in 1.

$$\vec{i}_{\bar{B}} \tag{1}$$

$$\bar{B} \tag{2}$$

We define a frame by specifying the point at which the origin is located and a basis set, as in 3.

$$\bar{A} = \{A, \vec{i}_{\bar{A}}, \vec{j}_{\bar{A}}, \vec{k}_{\bar{A}}\} \tag{3}$$

4 Position Vectors

Position vectors may be independent (i.e. have only direction and magnitude) or defined with respect to two points in space. In both cases, position vectors may be expressed in a frame (i.e. with respect to a vector basis) or independent of a basis. The independent form is given by 4.

$$\vec{r} \tag{4}$$

The default point defined form is given by 5.

$$\vec{r}_{a/b} \tag{5}$$

A vector is typically parameterized when it is expressed in a frame, although it does not need to be. Position vectors are often parameterized with x, y, and z as the scalar values when projected on the $\vec{i}$, $\vec{j}$, and $\vec{k}$ basis vectors, respectively. In that case, the position vector expressed in a frame may be written as 6.

$$\vec{r} = x\vec{e}_{1\bar{O}} + y\vec{e}_{2\bar{O}} + z\vec{e}_{3\bar{O}} \tag{6}$$

Or, using i-j-k notation, the position vector may be expressed in a frame as 7. This is the standard way to express a vector function in Mazzoleni notation.

$$\vec{r}_{a/b} = x\vec{i}_{\bar{O}} + y\vec{j}_{\bar{O}} + z\vec{k}_{\bar{O}} \tag{7}$$

5 Velocity Vectors

Position vectors are differentiated in a frame to produce a velocity vector as in 8.

$$^{\bar{A}}\vec{v} \tag{8}$$

Velocity vectors can also be defined with respect to points as in 9.

$$^{\bar{A}}\vec{v}_{a/b} \tag{9}$$

6 Angular Momentum

The definition of angular momentum is given by 10

$$^{\bar{A}}_{c}\vec{h}_{a/b} = \vec{r}_{a/b} \times m\,^{\bar{A}}\vec{v}_{a/c} \tag{10}$$

This is the form that will be used more often.

$$^{\bar{O}}\vec{h}_{a/b} = \vec{r}_{a/b} \times m\,^{\bar{A}}\vec{v}_{a/O} \tag{11}$$

Sometimes for a system of particles it is convenient to shorten the notation to a point and a frame. In that case use command that makes 12.

$$^{\bar{O}}\vec{h}_{B,sys} = \vec{r}_{a/b} \times m\,^{\bar{A}}\vec{v}_{a/O} \tag{12}$$

7 Command Tables

This section provides a table of the commands.

Table 1: Reference frame commands.

Command	Renders	Description
`\refFrame{O}`	$\bar{O}$	Reference frame
`\refFrameDefIJK{A}{A}`	$\{A, \vec{i}_{\bar{A}}, \vec{j}_{\bar{A}}, \vec{k}_{\bar{A}}\}$	Frame definition

Table 2: Generic vector commands.

Command	Renders	Description
`\gVec{q}`	$\vec{q}$	Generic vector
`\basisVec{i}{B}`	$\vec{i}_{\bar{B}}$	Basis vector
`\gVecExp{O}{x}{y}{z}`	$x\vec{e}_{1\bar{O}} + y\vec{e}_{2\bar{O}} + z\vec{e}_{3\bar{O}}$	Generic vector expressed in a frame
`\gVecExpIJK{O}{x}{y}{z}`	$x\vec{i}_{\bar{O}} + y\vec{j}_{\bar{O}} + z\vec{k}_{\bar{O}}$	Generic vector expressed in a frame

Table 3: Position vector commands.

Command	Renders	Description
`\posVec{r}`	$\vec{r}$	Basis independent position vector
`\posVecP{r}{a}{b}`	$\vec{r}_{{}^{a}/_{b}}$	Point dependent position vector

Table 4: Frame dependent vector commands.

Command	Renders	Description
`\velVec{O}{v}`	${}^{\bar{O}}\vec{v}$	Velocity vector
`\velVecP{A}{v}{a}{b}`	${}^{\bar{A}}\vec{v}_{{}^{a}/_{b}}$	Velocity vector with points noted
`\angMomFull{A}{h}{c}{a}{b}`	${}^{\bar{A}}_{c}\vec{h}_{{}^{a}/_{b}}$	Fully defined angular momentum vector
`\angMom{O}{h}{a}{b}`	${}^{\bar{O}}\vec{h}_{{}^{a}/_{b}}$	Abridged angular momentum vector
`\angMomS{O}{h}{B,sys}`	${}^{\bar{O}}\vec{h}_{B,sys}$	Further abridged angular momentum vector