**Bushing element implementation**

The force-displacement relationship of each bushing element is described as following:

$$\left[\begin{array}{c}F\_{x}\\F\_{y}\\F\_{z}\\T\_{x}\\T\_{y}\\T\_{z}\end{array}\right]=\left[\begin{matrix}K\_{11}&0&0&0&0&0\\&K\_{22}&0&0&0&0\\&&K\_{33}&0&0&0\\&&&K\_{44}&0&0\\&sym&&&K\_{55}&0\\&&&&&K\_{66}\end{matrix}\right]∙\left[\begin{array}{c}x\\y\\z\\α\\β\\γ\end{array}\right]+\left[\begin{matrix}C\_{11}&0&0&0&0&0\\&C\_{22}&0&0&0&0\\&&C\_{33}&0&0&0\\&&&C\_{44}&0&0\\&sym&&&C\_{55}&0\\&&&&&C\_{66}\end{matrix}\right]∙\left[\begin{array}{c}Vx\\Vy\\Vz\\Wα\\Wβ\\Wγ\end{array}\right]$$

where: *F* and *T* are the translational and torsional force components, respectively; *x, y,* and *z* are the relative translational displacements between connected bodies; *α, β* and *γ* are the relative rotational displacements between connected bodies; *K11, K22,* and *K33* are the translational stiffness coefficients; *K44, K55,* and *K66* are the rotational stiffness coefficients; *Vx, Vy,* and *Vz* are the relative translational velocities between connected bodies; *Wα, Wβ* and *Wγ* the relative rotational velocities between connected bodies; *C11, C22,* and *C33* are the translational damping coefficients; *C44, C55,* and *C66* are the rotational damping coefficients.

**Table S3. Characteristic parameters of the defined bushing elements.**

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Connected bodies | K11(N/mm) | K22 (N/mm) | K33 (N/mm) | K44 (N/°) | K55 (N/°) | K66 (N/°) | C11 (Ns/mm) | C22 (Ns/mm) | C33 (Ns/mm) | C44 (Ns/°) | C55 (Ns/°) | C66 (Ns/°) |
| Metacarpus – Radius #1 \* | 1 | 1 | 1 | 10 | 10 | 10 | 0 | 0 | 0 | 0 | 0 | 0 |
| Metacarpus – Radius #2 \* | 0 | 0 | 0 | 5 | 5 | 5 | 0 | 0 | 0 | 0 | 0 | 0 |
| Metacarpus – Radius #3 \* | 0 | 0 | 0 | 50 | 50 | 50 | 0 | 0 | 0 | 0 | 0 | 0 |
| C3 – Cu | 3000 | 1000 | 3000 | 15 | 15 | 15 | 3000 | 3000 | 500 | 15 | 15 | 15 |
| C3 – Ci | 500 | 500 | 500 | 4 | 4 | 4 | 3000 | 3000 | 500 | 15 | 15 | 15 |
| C3 – Cr | 1000 | 1000 | 500 | 5 | 5 | 5 | 3000 | 3000 | 500 | 15 | 15 | 15 |
| C3 – Metacarpus | 1500 | 1500 | 1500 | 15 | 15 | 15 | 3000 | 3000 | 3000 | 15 | 15 | 15 |
| Ci – Cu | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2000 | 0 | 0 | 0 |
| Ci – Cr | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2000 | 1 | 1 | 1 |

\* Three alternative bushing elements were used for the Metacarpus – Radius coupling. Such bushings were activated sequentially during the simulation. In detail, the bushing #1 was activated for the 0 – 26 ms time interval, the #2 for the 26 – 46 ms time interval, and the #3 for the 46 – 102 ms time interval.