

**Proofs of SIMPAT\_422 corrections**

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**Equation (3), line 207:  $\partial q$  under the fraction in the second term of the second member**

$$A_q = \frac{d\partial T}{dt\partial\dot{q}} - \frac{\partial T}{\partial q} \quad \text{with } q \text{ a generalized coordinate}$$

**Equations (4), line 210: vector  $\vec{z}_0$  instead of  $\vec{y}_0$**

$$\begin{aligned} A_x &= m_i \ddot{x}_{G_i} \\ A_y &= m_i \ddot{y}_{G_i} \quad \text{with } I_i \text{ the body moment of inertia around } (G_i, \vec{z}_0) \\ A_\theta &= I_i \ddot{\theta}_i \end{aligned}$$

**Equation (8), line 235: arrow over the whole vector  $\overrightarrow{G_i M}$  and missing right-bracket (first line), no variable  $\dot{q}$  and dot over variable  $\dot{x}_{G_i}^*$  (second line)**

$$\begin{aligned} P^* &= \vec{F} \cdot \vec{V}^{0*}(G_i) + \vec{F} \cdot \left( \vec{\Omega}_i^{0*} \times \overrightarrow{G_i M} \right) + \vec{M}(M) \cdot \vec{\Omega}_i^{0*} \\ &= \vec{F} \cdot (\dot{x}_{G_i}^* \vec{x}_0 + \dot{y}_{G_i}^* \vec{y}_0) + \left( \vec{M}(M) + \overrightarrow{G_i M} \times \vec{F} \right) \cdot \dot{\theta}_i^* \vec{z}_0 \end{aligned}$$

**Line 242: arrow over the whole vector  $\overrightarrow{G_i M}$**

Since  $\overrightarrow{G_i M}$  is a characteristic vector of the body, the variables  $F_x$ ,  $F_y$ , and  $C_z$ , char-

**Equation (14), line 302, 2<sup>nd</sup> line of the equation: size of point N letter in the vector  $\overrightarrow{G_j N}$**

$$\dots + \vec{f}_{k, \overrightarrow{ON}} \cdot (\dot{x}_{G_j} \vec{x}_0 + \dot{y}_{G_j} \vec{y}_0) + \left( \overrightarrow{G_j N} \times \vec{f}_{k, \overrightarrow{ON}} - \vec{f}_{k, \vec{x}_{jl}} \times \vec{x}_{jl} - \vec{f}_{k, \vec{y}_{jl}} \times \vec{y}_{jl} \right) \cdot \dot{\theta}_j \vec{z}_0 = 0$$

**Equations (21), line 354, 2<sup>nd</sup> equation: arrow over the whole vector  $\overrightarrow{ON}$  and index j in the last vector  $\vec{y}_{jl}$**

$$\dots f_2 \left( \overrightarrow{OM}, \overrightarrow{ON}, \vec{y}_{jl} \right) = \overrightarrow{MN} \cdot \vec{y}_{jl} = \overrightarrow{ON} \cdot \vec{y}_{jl} - \overrightarrow{OM} \cdot \vec{y}_{jl} = 0$$

**Equation (26), line 418, 1<sup>st</sup> and 2<sup>nd</sup> lines of the equation: size of vectors  $\overrightarrow{ON}$  and  $\overrightarrow{OM}$  in index**

$$\begin{aligned} &\vec{f}_{k, \overrightarrow{OM}} \cdot (\dot{x}_M^0 \vec{x}_0 + \dot{y}_M^0 \vec{y}_0) + \vec{f}_{k, \overrightarrow{ON}} \cdot (\dot{x}_N^0 \vec{x}_0 + \dot{y}_N^0 \vec{y}_0) + f_{k, \overrightarrow{OM}^2} \left( \dot{x}_M^0{}^2 + \dot{y}_M^0{}^2 \right) \\ &+ f_{k, \overrightarrow{ON}^2} \left( \dot{x}_N^0{}^2 + \dot{y}_N^0{}^2 \right) + 2f_{k, \overrightarrow{OM}, \overrightarrow{ON}} \left( \dot{x}_M^0 \dot{x}_N^0 + \dot{y}_M^0 \dot{y}_N^0 \right) + \ddot{\theta}_i \left( \vec{f}_{k, \vec{x}_{il}} \cdot \vec{y}_{il} - \vec{f}_{k, \vec{y}_{il}} \cdot \vec{x}_{il} \right) \\ &\dots \end{aligned}$$

**Equation (30), line 442, 2<sup>nd</sup> left-bracket equations: missing +2**

$$\Leftrightarrow \begin{cases} -(\ddot{x}_N^0 - \ddot{x}_M^0) \sin \theta_M^0 + (\ddot{y}_N^0 - \ddot{y}_M^0) \cos \theta_M^0 - \ddot{\theta}_i [(x_N^0 - x_M^0) \cos \theta_M^0 \\ + (y_N^0 - y_M^0) \sin \theta_M^0] + 2\dot{\theta}_i [-(\dot{x}_N^0 - \dot{x}_M^0) \cos \theta_M^0 - (\dot{y}_N^0 - \dot{y}_M^0) \sin \theta_M^0] = 0 \\ -(\ddot{x}_N^0 - \ddot{x}_M^0) \sin \theta_N^0 + (\ddot{y}_N^0 - \ddot{y}_M^0) \cos \theta_N^0 - \ddot{\theta}_j [(x_N^0 - x_M^0) \cos \theta_N^0 \\ + (y_N^0 - y_M^0) \sin \theta_N^0] + 2\dot{\theta}_j [-(\dot{x}_N^0 - \dot{x}_M^0) \cos \theta_N^0 - (\dot{y}_N^0 - \dot{y}_M^0) \sin \theta_N^0] = 0 \end{cases}$$

**Appendix A. Nomenclature, wrench notation: the letter W font should be the same as in the equation (6)**

**Equation (31): arrow over the whole vector  $\overrightarrow{OM}$  and the whole vector  $\overrightarrow{ON}$  (second line) and size of vectors  $\overrightarrow{ON}$  and  $\overrightarrow{OM}$  in index (fourth line)**

$$\begin{aligned} & \dots \\ & \Leftrightarrow \frac{\partial f_k}{\partial \overrightarrow{OM}} \cdot \frac{d\overrightarrow{OM}}{dt} + \frac{\partial f_k}{\partial \overrightarrow{ON}} \cdot \frac{d\overrightarrow{ON}}{dt} + \frac{\partial f_k}{\partial \vec{x}_{il}} \cdot \frac{d\vec{x}_{il}}{dt} + \frac{\partial f_k}{\partial \vec{y}_{il}} \cdot \frac{d\vec{y}_{il}}{dt} + \frac{\partial f_k}{\partial \vec{x}_{jl}} \cdot \frac{d\vec{x}_{jl}}{dt} \\ & \dots \\ & \Leftrightarrow \vec{f}_{k,\overrightarrow{OM}} \cdot \vec{V}^0(M) + \vec{f}_{k,\overrightarrow{ON}} \cdot \vec{V}^0(N) + \vec{f}_{k,\vec{x}_{il}} \cdot (\vec{\Omega}_i^0 \times \vec{x}_{il}) + \vec{f}_{k,\vec{y}_{il}} \cdot (\vec{\Omega}_i^0 \times \vec{y}_{il}) \\ & \dots \end{aligned}$$

**Equation of line 610: arrow over the whole vector  $\overrightarrow{G_iM}$  and the whole vector  $\overrightarrow{G_iN}$  (first and last lines)**

$$\begin{aligned} & \vec{f}_{k,\overrightarrow{OM}} \cdot (\vec{V}^0(G_i) + \vec{\Omega}_i^0 \times \overrightarrow{G_iM}) + \vec{f}_{k,\overrightarrow{ON}} \cdot (\vec{V}^0(G_j) + \vec{\Omega}_j^0 \times \overrightarrow{G_jN}) + \vec{f}_{k,\vec{x}_{il}} \\ & \dots \\ & \dots \\ & \dots \\ & \dots \\ & + (\overrightarrow{G_jN} \times \vec{f}_{k,\overrightarrow{ON}} - \vec{f}_{k,\vec{x}_{jl}} \times \vec{x}_{jl} - \vec{f}_{k,\vec{y}_{jl}} \times \vec{y}_{jl}) \cdot \vec{\Omega}_j^0 = 0 \quad \text{for } k=1 \text{ to } m \end{aligned}$$

**Equation of line 615: arrow over the whole vector  $\overrightarrow{OM}$  and size of the vectors  $\overrightarrow{OM}$  and  $\overrightarrow{ON}$  in index (first line)**

$$\begin{aligned} & \vec{f}_{k,\overrightarrow{OM}} \cdot \vec{J}^0(M) + \vec{f}_{k,\overrightarrow{ON}} \cdot \vec{J}^0(N) + \frac{\partial \vec{f}_{k,\overrightarrow{OM}}}{\partial \overrightarrow{OM}} \frac{d\overrightarrow{OM}}{dt} \cdot \vec{V}^0(M) + \frac{\partial \vec{f}_{k,\overrightarrow{ON}}}{\partial \overrightarrow{ON}} \frac{d\overrightarrow{ON}}{dt} \cdot \vec{V}^0(N) \\ & \dots \end{aligned}$$

**Equation of line 625: arrow over the whole vector  $\overrightarrow{OM}$  in index (second line)**

$$\begin{aligned} & \dots \\ & + 2f_{k,\overrightarrow{OM},\overrightarrow{ON}} \vec{V}^0(M) \cdot \vec{V}^0(N) + 2 \left[ f_{k,\overrightarrow{OM},\vec{x}_{il}} (\vec{\Omega}_i^0 \times \vec{x}_{il}) \right. \\ & \dots \end{aligned}$$

**References [5] and [9]: accents**

[5] P. Bérest, Calcul des variations, Application à la mécanique et à la physique, Ellipses, 1997.

[9] J. García de Jalón, E. Bayo, Kinematic and Dynamic Simulation of Multibody Systems. The Real Time Challenge, Springer-Verlag, New York, 1994.

**Reference [10], [20] and [22]: series title**

... in: Real-time Integration Methods for Mechanical System Simulation, Computer and Systems Sciences ...

**Reference [11]: book title**

[11] H. Goldstein, Classical Mechanics, Addison-Wesley, Reading, 1980.

**References [15] and [17]: superfluous caps in the titles**

[15] L. Lur'é, Mécanique Analytique: Tomes I et II, Masson, Paris, 1968.

[17] J.-J. Moreau, Mécanique Classique: Tomes I et II, Masson, Paris, 1971.