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Corrigendum

Corrigendum to 'Construction of new enriched beam models accounting for cross-section deformation and pinching'☆

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The beam model introduced for thick beams undergoing large motions account for non-classical effects such as warping, out- and in-plane deformations. Although the introduction of a set of directors attached to the beam section described in equations (1) to (5) of the paper is a well-adopted notion in the literature since the early work of Antman [5], the beam kinematics has been properly formulated in an achieved form in the more recent contribution [D. Durville, Computational Mechanics, 49, Issue 6, pp 687–707, 2012], using the same notations. We acknowledge that this work is an important contribution in the field of nonlinear beam mechanics.

The expression of the Green-Lagrange strain includes few misprints and shall be corrected as follows, starting from the transformation gradient:

$$
\begin{aligned}
\mathbf{F} &= \mathbf{d}_\alpha \otimes \mathbf{e}_\alpha + \left(\xi_\alpha \mathbf{d'}_\alpha + \mathbf{r'}\right) \otimes \mathbf{e}_3 \\
\mathbf{F}^T\mathbf{F} &= \left(\mathbf{e}_\alpha \otimes \mathbf{d}_\alpha\right)\left(\mathbf{d}_\beta \otimes \mathbf{e}_\beta\right) + \left(\mathbf{e}_\alpha \otimes \mathbf{d}_\alpha\right)\left[(\xi_\beta \mathbf{d'}_\beta + \mathrm{r'}) \otimes \mathbf{e}_3\right] \\
&\quad + [\mathbf{e}_3 \otimes (\xi_\beta \mathbf{d}'_\beta + \mathbf{r'})](\mathbf{d}_\alpha \otimes \mathbf{e}_\alpha) + [\mathbf{e}_3 \otimes (\xi_\beta \mathbf{d}'_\beta + \mathbf{r'})][(\xi_\beta \mathbf{d}'_\beta + \mathbf{r'}) \otimes \mathbf{e}_3] \\
&= \left(\mathbf{d}_\alpha \cdot \mathbf{d}_\beta\right)\mathbf{e}_\alpha \otimes \mathbf{e}_\beta + \left(\xi_\beta \mathbf{d'}_\beta \cdot \mathbf{d}_\alpha + \mathbf{r'} \cdot \mathbf{d}_\alpha\right)\left(\mathbf{e}_\alpha \otimes \mathbf{e}_3 + \mathbf{e}_3 \otimes \mathbf{e}_\alpha\right) \\
&\quad + \left(\mathrm{r'} \cdot \mathrm{r'} + 2\xi_\alpha \mathbf{d'}_\alpha \cdot \mathrm{r'} + \xi_\alpha \xi_\beta \mathbf{d'}_\alpha \cdot \mathbf{d'}_\beta\right)\mathbf{e}_3 \otimes \mathbf{e}_3
\end{aligned}
$$

$$
\begin{aligned}
\mathrm{E} &= \frac{1}{2}\left(\mathbf{F}^T\mathbf{F} - \mathrm{I}\right) \\
&= \frac{1}{2}\begin{pmatrix}
\mathbf{d}_1 \cdot \mathbf{d}_1 - 1 & \mathbf{d}_1 \cdot \mathbf{d}_2 & \xi_1 \mathbf{d'}_1 \cdot \mathbf{d}_1 + \xi_2 \mathbf{d'}_2 \cdot \mathbf{d}_1 + \mathrm{r'} \cdot \mathbf{d}_1 \\
\mathbf{d}_1 \cdot \mathbf{d}_2 & \mathbf{d}_2 \cdot \mathbf{d}_2 - 1 & \xi_1 \mathbf{d'}_1 \cdot \mathbf{d}_2 + \xi_2 \mathbf{d'}_2 \cdot \mathbf{d}_2 + \mathrm{r'} \cdot \mathbf{d}_2 \\
\begin{matrix}\xi_1 \mathbf{d'}_1 \cdot \mathbf{d}_1 \\ +\xi_2 \mathbf{d'}_2 \cdot \mathbf{d}_1 + \mathrm{r'} \cdot \mathbf{d}_1\end{matrix} & \begin{matrix}\xi_1 \mathbf{d'}_1 \cdot \mathbf{d}_2 \\ +\xi_2 \mathbf{d'}_2 \cdot \mathbf{d}_2 + \mathrm{r'} \cdot \mathbf{d}_2\end{matrix} & \begin{matrix}\mathrm{r'} \cdot \mathrm{r'} + 2\xi_1 \mathbf{d'}_1 \cdot \mathrm{r'} + 2\xi_2 \mathbf{d'}_2 \cdot \mathrm{r'} \\ +\xi_1^2 \mathbf{d'}_1 \cdot \mathbf{d'}_1 + 2\xi_1\xi_2 \mathbf{d'}_1 \cdot \mathbf{d'}_2 + \xi_2^2 \mathbf{d'}_2 \cdot \mathbf{d'}_2 - 1\end{matrix}
\end{pmatrix}
\end{aligned}
$$

We would also like to underline that the strain quantities $\mathbf{d}_i.\mathbf{d'}_j$ exist for rigid sections; they describe the coupling between transverse and longitudinal deformations and they can be interpreted as representing the beam torsion. Warping involves a nonlinear kinematic model, and it is not possible for linear kinematic models since the beam sections remain planar.

The authors would like to apologise for any inconvenience caused.

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