1 Nomenclature

2 Equations of Motion for A GEBF Element

The equations of motion for a GEBF element are

$$\dot{\boldsymbol{h}} = \boldsymbol{N}^{'} + \boldsymbol{f} \tag{1}$$

and

$$\dot{\boldsymbol{g}} = -\tilde{\dot{\boldsymbol{u}}}\boldsymbol{h} + \left(\tilde{\boldsymbol{x}_{\mathbf{o}}^{'}} + \tilde{\boldsymbol{u}^{'}}\right)\boldsymbol{N} + \boldsymbol{M}^{'} + \boldsymbol{\tau}, \tag{2}$$

as given by Bauchau [1].

3 Formulation of the "Two-Handle Equations" of Motion

Equations (1 & 2) can be expressed in matrix form as

$$\begin{Bmatrix} \dot{\boldsymbol{h}} \\ \dot{\boldsymbol{g}} \end{Bmatrix} = \begin{bmatrix} \mathbf{0} & \mathbf{0} \\ -\tilde{\dot{\boldsymbol{u}}} & \mathbf{0} \end{bmatrix} \begin{Bmatrix} \boldsymbol{h} \\ \boldsymbol{g} \end{Bmatrix} + \begin{bmatrix} \mathbf{0} & \mathbf{0} \\ \tilde{\boldsymbol{x}_{\mathbf{o}}^{'}} + \tilde{\boldsymbol{u}^{'}} & \mathbf{0} \end{bmatrix} \begin{Bmatrix} \boldsymbol{N} \\ \boldsymbol{M} \end{Bmatrix} + \begin{Bmatrix} \boldsymbol{N}^{'} \\ \boldsymbol{M}^{'} \end{Bmatrix} + \begin{Bmatrix} \boldsymbol{f} \\ \boldsymbol{\tau} \end{Bmatrix} , \tag{3}$$

where the $\tilde{(\ )}$ is the skew symetric matrix of the vector quantity ( ) and $(\ )^{'}$ is the derivative with respect to the coordinate along the beam axis of ( ).

4 References

References

[1] Olivier A. Bauchau. *Flexible Multibody Dynamics*. Solid Mechanics and Its Applications. Springer, 2010.