$p \equiv$ internal
$x \equiv$ cartesian

$$B\,\delta x = \delta q$$

$$g_x = B^T g_p$$

$$H_x = B^T H_p B + \sum_i^P g_i B^i$$ not a linear transformation when $g_i \neq 0$.

Assume 6 rotational or translational displacement coordinates, N, $\eta = 1\text{-}6$

$$\sum_X^{3N} H_{xy} N_x^\eta + \sum_X^{3N} g_x N_{xy}^\eta = 0$$ (D2) in JCP, 98 p.3013, 1993

Get H_{xy} by solving a 6X6 for each element.

Problem remains: What is 'derivative B matrix', in this case, the derivative of the external displacement coordinates, or 2nd derivative of rotation angle/COM wrt cartesian displacement.

For COM coordinates, isn't ~~H_{xy}^2~~ if $N'_{xy} = \frac{\partial^2 X_{com}}{\partial x_i \partial x_j}$, $= 0$?

Need to write down and differentiate these.

This is right way to do it. No extra displacements.