Computational Structural Mechanics and Dynamics

Assignment 9

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1) **Describe in extension how can be applied a non-symmetric load on this formulation.**

When it comes to an axisymmetric shell under an arbitrary and a non-symmetric load, it is necessary to define the load in question using Fourier series, in a revolution case, taking a circumferential direction. This way we will have sine and cosine terms. Doing so, the load applied to the system will have both symmetric and anti-symmetric parts and it will be possible to calculate them separately and then summing them together.

2) **Using thin beams formulation, describe the shape of the B(e) matrix and comment the integration rule.**

As we have seen, Kirchhoff beam theory applied to thin shells is inaccurate because we neglect the transverse shear deformation. This is due to having the normal to the symmetry axis orthogonal during the deformation.

Taking into consideration both normal and tangential displacement, we can use C^1 continuous interpolation for the normal displacement and C^0 for the tangential one. This last displacement can be interpolated in a linear form using just 2-noded Kirchhoff elements. Then, we can assume that the B matrix is formed by two different parts: membrane and bending; B_m and B_b respectively.

We can integrate using 2 Gauss points quadrature, Lobatto integration cannot be used because it requires having the points in the revolution axis and this will cause the matrix B to go to infinity. One point reduced quadrature can be used in order to avoid the shear locking effect.