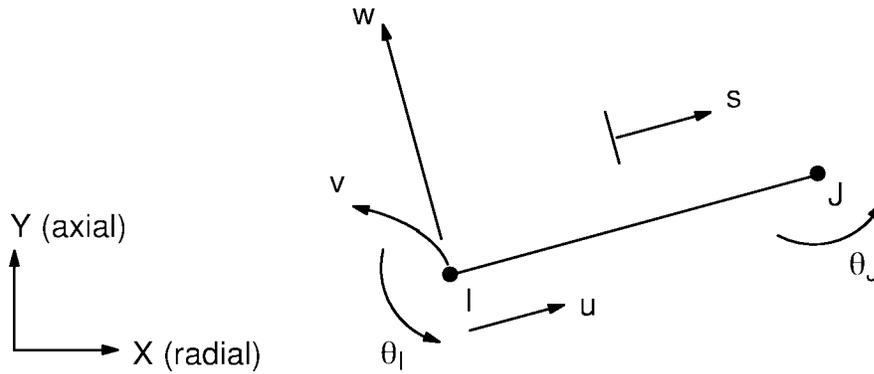


14.51 SHELL51 — Axisymmetric Structural Shell



Matrix or Vector	Shape Functions	Integration Points
Stiffness Matrix	Equations (12.3.2-1), (12.3.2-2), and (12.3.2-3). If extra shape functions are not included (KEYOPT(3) = 1): equations (12.3.1-1), (12.3.1-2), and (12.3.1-3).	3 along length
Mass Matrix	Same as stiffness matrix without extra shapes. Equations (12.3.1-1), (12.3.1-2), and (12.3.1-3).	Same as stiffness matrix
Stress Stiffness Matrix	Equations (12.3.1-1), (12.3.1-2), and (12.3.1-3).	Same as stiffness matrix
Thermal and Pressure Load Vector	Same as stiffness matrix	Same as stiffness matrix
Newton-Raphson Load Vector	Same as stiffness matrix	3 along length, 9 thru thickness

Load Type	Distribution
Element Temperature	Linear thru thickness and along length, constant around circumference

Load Type	Distribution
Nodal Temperature	Constant thru thickness, linear along length, constant around circumference
Pressure	Linear along length, constant around circumference

14.51.1 Other Applicable Sections

Chapter 2 describes the derivation of structural element matrices and load vectors as well as stress evaluations. Section 13.1 describes integration point locations. Section 14.61 contains information also applicable to SHELL51.

14.51.2 Integration Point Locations for Nonlinear Material Effects

The locations and weighting factors for the nine point integration rule through the element thickness for the nonlinear material effects is given in Table 13.1–5. Nonlinear material values are only computed at the midpoint between the nodes. When these values are needed for other integration points along the length, they are simply transferred from the midpoint. This is to avoid “sawtooth effects”.

14.51.3 Large Deflections

Unlike other line elements, SHELL51 uses the rotational strain approach (Kohnke(20)).