SPECIFICATION LINE QUADRATIC MECHANICAL command

Synopsis

The SPECIFICATION LINE QUADRATIC MECHANICAL command is used to describe specifications involving load (stress) distributed along a line associated with a two-dimensional mechanical, coupled flow-mechanical, or thermal-mechanical analysis.

Syntax

The following syntax is used to quadratically varying tractions applied normal and tangential to a boundary:

```plaintext
SPECification LINe QUAdratic MEChanical NODE_begin ## NODE_End ##
(1_Incr ##) (2_Incr ##)
(1_History ##) (2_History ##)
(NP_Begin ##.) (NP_End ##.)
(TP_Begin ##.) (TP_End ##.)
(X1_Middle #.#) (X2_Middle #.#) (NP_Middle #.#) TP_Middle #.#)
(THIckness #.#)
```

Explanatory Notes

The SPECIFICATION LINE QUADRATIC MECHANICAL command can be used to apply a linearly varying normal and/or tangential distribution to the following linear elements:

- Three-node line (bar) elements (L3P0).
- Six-node triangles (T6P0, T6P3c).
- Eight- and nine-node quadrilateral elements (Q8P0, Q9P0, Q8P4c, Q9P4c).

If nodal specifications are to be generated automatically, the keyword 1_INCR represents the increment between corresponding corner node numbers; the keyword 2_INCR represents the increment between a corner node number and the adjacent mid-side node number.

The “N” and “T” keyword prefixes refer to the directions normal and tangential to the surface of the body being analyzed, respectively. The values associated with the keywords NP_BEGIN and TP_BEGIN represent the values of pressure normal and tangential, respectively, to the body at the first (beginning) node in the line along which the pressure is applied.
The values associated with the keywords NP_END and TP_END represent the values of pressure normal and tangential, respectively, to the body at the last (end) node in the line along which the pressure is applied. The sign convention associated with the specification of distributed quantities is described at the beginning of this section.

The optional keywords NP_MIDDLE and TP_MIDDLE represent values of the pressure at a node located somewhere between the beginning and the end of the pressure distribution. The keywords X1.Middle and X2.Middle are used to give the location of this “middle” point.

The THICKNESS keyword is used to specify the material thickness assumed for the element. Over a given element, the thickness is assumed to be constant. The default THICKNESS value is equal to one (1.0). For AXISYMMETRIC and PLANE STRAIN idealizations (see discussion of the ANALYSIS IDEALIZATION command), the THICKNESS must be equal to 1.0. For such idealizations, specified values different from 1.0 are ignored and the proper value is used.

The default values for all specified pressures are equal to zero (0.0), with associated HISTORY function equal to -2.

To be consistent with the order of node numbering employed in defining the element topology (refer to the descriptions of the ELEMENT and GENERATE SURFACES commands), during specification of a distributed quantity along a line, the nodes must likewise be specified in a counterclockwise sequence. For example, a quantity normal to an edge is assumed to be positive if it is directed into the element. A tangential quantity is assumed to be positive if it acts in a counterclockwise direction with respect to the loaded element (Figure 1).

![Figure 1: Normal and Tangential Distributed Edge Loads Applied to a Biquadratic Lagrangian Element](image)

Such definitions are necessary in order to avoid confusion when distributed loads are specified along the interface between two elements, such as that shown in Figure 2). In this figure the line loads, if they are assumed to act on element 1, are considered to be positive; if they are taken as acting on element 2, these same loads are negative.
Figure 2: Loads Specified Along an Interface Common to Two Elements
Example of Command Usage

To describe a constant distributed quadratic normal pressure equal to 200.0, applied at nodes 21 to 25 and associated with a history equal to 0, enter the following command:

```plaintext
spec line quad mech node_b 25 node_end 21 1_incr -2 2_incr -1 &
                2_hist 0 np_begin 200.0 np_end 200.0
```
References