The following comments refer to the specification of nodal coordinates used in the mathematical model slated for analysis via APES. It is anticipated that such models have been developed using an efficient mesh generation pre-processor. However, in the instance that such a program is not available to the analyst, commands are included that allow the analyst to describe/generate all of the nodal coordinates with the APES pre-processor.

APES provides several options that facilitate the creation of valid mathematical models. In particular, node number generation and coordinate determination schemes are available for use by the analyst. These schemes must be used in accordance with the hierarchy associated with the specification of node and element information. Specifically, the locations of the nodes lying along all edges of the body must be specified. Typically this is realized using the straight line and/or circular arc generation schemes described below in conjunction with the NODES CIRCLE and NODES LINE commands. Once the edge node locations have been determined, the surface(s) bounded by these nodes must be generated; this is realized by specifying the GENERATE SURFACES command. These surfaces are collections of two-dimensional quadrilateral element “patches”. As such, the determination of the coordinates of nodes in the interior of the surface(s) is typically realized using a two-dimensional scheme [1]. If a two-dimensional analysis is being performed, then following the determination of all surface nodal coordinates, the mathematical model is complete with respect to the node and element determination. If, on the other hand, a three-dimensional analysis is being performed, then following the definition of all of the surface nodes, an extension of the two-dimensional generation scheme is used to determine the coordinates of the nodes interior to the volume enclosed by the defined surfaces. Special care must be taken to ensure that all edge nodes and all surface nodes are defined prior to the volume generation.
In a given mathematical model, the coordinates of each node point must be defined, but need not be input in any particular order. When numbering the nodes, not all numbers between 1 and the highest node number need correspond to actual nodes in the body.

If the location of a node is prescribed more than once in the input and the coordinates are not in agreement, the last description is used. If, however, in a second (or subsequent description) the node number is entered as negative, then the previous location associated with this node is assumed. The utility of this option is illustrated in conjunction with the NODES LINE command.

To assist the analyst in defining these coordinates, the APES computer program offers several data generation schemes. Using the NODES LINE command, nodal coordinates can be generated along a straight line (this is achieved using linear interpolation); this line can as well be mapped to a curve (this is achieved using quadratic interpolation). Using the NODES CIRCLE command, nodes can also be generated along a circular arc. The NODES FROM command allows a complete set of nodal coordinates to be read from an ASCII file. Finally, a general scheme is available to compute nodal coordinates within part or all of the interior of a mesh. The use of these schemes can, for example, enable one to describe the nodal coordinates of an arbitrarily large mesh with as few as five input records.
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