

## NESTING

This is a classic problem of finding the most efficient layout for cutting n parts out of a given rectangular sheet with minimum waste and/or maximum contiguous unused sheet area.

- sheets are rectangular and no larger than 6'x12'
- elements are no smaller than 1" x 1"
- the size of the cutting tool must be added to the element size plus a buffer
- element datasets will be real numbers (xxx.xxx")
- ideally, processing time will be related to efficiency (i.e. running the process for 1 hour will find a better solution than 2 minutes)
- process will run on a Pentium III class machine running at 500 Mhz or better under QNX real-time os

Elements would consist of a series of xy moves which form a non rectilinear outline (there may be additional moves which describe an element within the element such as a small circle cut out of a larger circle). These xy moves won't necessarily be continuous and may contain non-cutting "jog" moves. I would propose forming a rectilinear outline at the boundary of the elements and using this for the nesting (Boeing used this approach for their in house system).

Optionally, it would be interesting to be able to use partial sheets that are rectilinear, but not necessarily rectangular, in shape. We currently have image sensors for locating cross hairs on sheets to be cut with tangential knives. We envision using the same image sensor to "scan" a sheet which has been cut, identifying all unused areas. The sheet would be uniquely identified then stored. Our controller will maintain a database of these sheets (and their corresponding unused areas) using the information for future cutting jobs.

## TOOLPATH

This comes up constantly in all CNC table work be it laser, router, dispenser, tangential knife, etc. . Usually this is done by the CAM software which performs the translation from design to a machine toolpath. However, it is often done poorly or not at all. We would like to provide this function at our tool controller independent of the user's toolpath software. To our knowledge, no other tool manufacturer provides this.

Assumptions/Constraints:

- table size up to 6'x12'
- files will consist of a series of xyz moves from pt A to pt B
- position data will be real numbers (xxx.xxx")
- moves will not necessarily be consecutive (i.e. A to B, E to F, C to D, D to E, B to C, etc.)
- files will contain between 300 and 30,000 moves
- files will consist of moves which "cut", and jogs which reposition the tool
- for our application, the system should minimize jogs, and maximize continuous cuts
- processing time is similar to nesting (see above)
- process will run on a Pentium III class machine running at 500 Mhz or better under QNX real-time os