Function Means Tree

**Tool Scope:**
Function means trees are used in conceptual design to generate solutions to functions in a hierarchic manner. Where morphological charts create a combinatorial problem for exploring the design space, function means trees support a branch-and-bound search strategy.

**Tool Description:**
This tool is a simple tree representation of the solution space. Two types of nodes are used: functions (what needs to be done) and means (how these can be done). For each mean, there may be multiple functions required to support it. Thus, this approach is a hierarchical representation of the possible solutions. Typically, the solution paths (starting at the root node and moving down to leaf nodes) are pruned continually based upon designer evaluation with respect to constraints and criteria.

**Example: People Mover**

This function means tree includes only two levels of solutions. The solid boxes indicate the functions (move people, generate power, etc.). The dashed boxes indicate the means (glide, shaft, geartrain, etc.). In pruning this tree, at the top level of means (glide, slide, roll), the designer may realize that these would not work well in a terrestrial transportation device. Thus, support functions for glide and slide are not detailed. When a path becomes too “costly” (not as promising as other paths), the designer shifts to an alternate route. This is known as “branch-and-bound” in computer science.