Chapter 10.
Model Analysis

Topic: Ignore

Model analysis determines a model object's characteristics. The model analysis capabilities of ACIS include object relationship analysis, physical properties analysis, ray testing, and cellular topology. While cellular topology may be used for analysis, it may also be used for other modeling functions, and is discussed separately in the Cellular Topology Component.

Object Relationships

Topic: *Object Relationships

ACIS provides means to analyze various object relationships. This includes both information about a single object and relationships between multiple objects.

Curve Analysis

Topic: *Object Relationships

Routines for the following types of *curve analysis* are provided in ACIS:

- Return a list of all points on an edge where the left and right derivatives of the underlying curve differ in direction or magnitude.
- Determine if a curve is self-intersecting, and if it is, return the points or intervals of self-intersection.

Wire Analysis

Topic: *Object Relationships

Routines for the following types of *wire analysis* are provided in ACIS:

- Determine if a wire is open or closed.
- Determine if a wire is self-intersecting.

Minimum Distance Calculations

Topic: *Object Relationships

ACIS provides two API functions that calculate the *minimum distances* between models. Facet data assists the minimum distance algorithms. The precise model geometry refines the results. Minimum distance functionality assists in many application areas. For example, all applications that involve motion, such as robotics, find it useful to know what the clearance is between two parts at any time. Non motion-related use includes design, where a part has to fit within existing constraints; e.g., an engine within a car body. The minimum distance APIs are api_check_face_clearance and api_check_solid_clearance.

Other Object Relationships

Topic: *Object Relationships

Other relationships that may be determined about ACIS objects include:

- Closest point
- Discontinuities
- Inside/outside edge
- Intersections

Physical Properties

Topic: *Physical Properties

ACIS provides means to analyze various physical properties of objects. These properties include area, volume, center of gravity, etc. Some of these physical properties are collectively referred to as *mass properties.*

Mass Properties

Topic: *Physical Properties

ACIS supplies routines that an application uses to find the *mass properties* attributable to a face or a body. Mass properties include:

- Volume
- Moments of inertia
- Center of gravity

A selector is set to determine which properties to calculate: all properties, volume and center of gravity, or volume only. A relative accuracy value may also be specified. Setting the accuracy to 0.01 requests an accuracy of 1 percent.

The mass property attributable to a face when it is projected on to the given projection plane may also be found. This might be used, in conjunction with the bulletin board, to compute the change in mass property of a body following some change to the body that affects just a few faces. The change in mass property for each affected face between its “before” state and “after” state is found, and the sum of the changes is used to correct the stored mass property for the body. To be meaningful, the original mass property and all incremental values for faces must be found by projecting onto the same plane.

The mass properties for cellular topology 3D cells can also be calculated.

Refer to the function reference templates for api_body_mass_pr and api_ct_cell_mass_pr for more information.

Other Properties

Topic: *Physical Properties

Other physical properties that may be determined about ACIS objects include:

- Area of a face
- Center of area of a face
- Length of a wire
- Area of a wire
- Area of a cell

Refer to reference templates for information about the specific functions that are available for this type of analysis.

Ray Testing

Topic: *Ray Testing

ACIS uses ray testing for positional analysis (as well as for picking). A ray of a specified initial position, direction, and radius can be “fired” to determine the positional relationships of objects. For example, this can be used to determine where a ray intersects a body or the position on a curve closest to a given ray.

Geometric Analysis

Topic: *Geometric Analysis

ACIS laws can be used to perform geometric analysis, which includes calculations on geometric entities such as as numerical derivatives, numerical integration, maximums, minimums, roots, etc. Refer to the chapter on laws in the *Kernel Component Manual* for more information about geometric analysis.