IRONCAD – DUAL GEOMETRIC MODELLING KERNELS

A geometric modelling kernel is the core software component (that includes an Application Programming Interface and a Set of Libraries containing complex mathematical equations) that provides the 3D modelling (B-Rep and Facet) capabilities within CAD software.

B-Rep Models: Accurate models using mathematically defined faces, edges and vertices.
Facet Models: Approximate models using a triangular surface mesh.

The selection of geometric modelling kernel is one of the first decisions that CAD developers must make, as each kernel has its own strengths, weaknesses and peculiarities (which change with each release). The most widely used commercial kernels within CAD software are:

ACIS: Developed and licensed by SPATIAL CORP (of DASSAULT SYSTEMES)
PARASOLID: Developed and licensed by SIEMENS DIGITAL INDUSTRIES SOFTWARE

Different geometric modelling kernels process information differently (including different assumptions and tolerances within their mathematical equations). The end result can be that whereas one kernel might fail to generate the desired shape, another kernel might succeed. Alternatively, one kernel might generate the desired shape more quickly than another.

Different geometric modelling kernels also use different kernel file formats; for supporting translation-free interoperability between software using that kernel. The preference should always be to collaborate using the native file format of the kernel, rather than translating to and from CAD neutral file formats such as STEP (which introduces the chance for error).

Software using ACIS	Software using PARASOLID
ALIBRE DESIGN	IRONCAD
ARES COMMANDER	MICROSTATION
BRICSCAD	SIEMENS NX
IRONCAD	SOLID EDGE
KEYCREATOR	SOLIDWORKS
SPACECLAIM	VECTORWORKS
....	....

SHAPEMANAGER

AUTODESK products AUTOCAD and INVENTOR and FUSION360.

This was forked from ACIS 7.0 in 2001. As a result, when exchanging models with AUTODESK software ACIS 7.0 (*.sat) is typically used.

Unlike other CAD software, IRONCAD is unique in that it uses both ACIS and PARASOLID geometric modelling kernels working in collaboration. The obvious benefits include:

1. Versatility in software collaboration.
2. Versatility in shape geometry and topology.
3. Future development isn't reliant upon (or limited by) either kernel.

In its practical application, having dual kernels allows users to select their preferred default kernel for generating both "Shape Features" (defined by sketches) and "Modifying Features".

If a "Shape Feature" (Extrude, Loft, Spin, Sweep, Thicken) fails using the current part kernel, then the user can manually switch the kernel of that part, and attempt the feature again.

If a "Modifying Feature" (Blend, Boolean, Chamfer, Draft, Shell, Trim) fails using the current part kernel, IRONCAD will automatically attempt the feature again using the other kernel (without changing the part kernel). This is called Kernel Collaboration.

IRONCAD – KERNEL COLLABORATION

By way of illustration, consider an intelligent All Wheel Drive (AWD) vehicle, where the front wheels can be driven when needed by their own motor (ACIS) and the rear wheels can also be driven when needed by their own motor (PARASOLID). The driver of the vehicle can choose whether the vehicle is driven by the front wheels (ACIS) by default, or by the rear wheels (PARASOLID) by default, depending on conditions or their personal preferences.

In normal operation the motor vehicle behaves like a regular front or rear wheel drive vehicle. However, in the event that the default driving wheels lose traction (for whatever reason) the vehicle automatically engages the non-driving wheels as well until traction is restored.

IRONCAD's Kernel Collaboration operates in a similar way to that of an intelligent All Wheel Drive (AWD) vehicle, in that during normal operation it uses the default kernel selected. But when problems arise it automatically engages the other kernel to try and solve the problem.

The strength of IRONCAD and All Wheel Drive (AWD) vehicles is their versatility.

EXAMPLES OF MANUALLY SWITCHING KERNELS

The following are examples of where switching the part or scene kernel solved a modelling problem at the time. However, keep in mind that ACIS and PARASOLID kernels continue to be developed. What was the case in the past might not necessarily be the case in the future.

Bevel within Intellishape (ACIS)

The "Bevel" within a shelled Intellishape failed to bevel the blended corners when the kernel of the part was set to PARASOLID, yet worked after changing the part kernel to ACIS.

Chamfer (ACIS)

The "Chamfers" failed on a shelled part (with blended corners) when the kernel of the part was set to PARASOLID, yet worked after changing the part kernel to ACIS.

Converting Faceted Models (ACIS)

After importing faceted file types (like STL, SKP, faceted DXFs, etc…), my experience has been that when using the "Convert to Solid" tool to convert these faceted models to editable solids (or surfaces), it is better to first set the kernel of the scene to ACIS.

Converting Faceted Sphere – Fit Curved Surface (PARASOLID)

After importing a Polyface Mesh 3D DXF of a sphere, the "Convert to Solid" tool was used with the "Fit Curved Surface" option selected. This option failed (instead fitting planar planes). However, when the kernel was set to PARASOLID then the option worked.

Converting Faceted Model (SKP) then Real Projection in CAXA (ACIS and PARASOLID)

After importing a Faceted Model from a SKETCHUP file, when converting the various Faceted Parts to Solid, some Parts failed when the ACIS kernel was used and some failed when the PARASOLID kernel was used. So both kernels needed to be used for converting.

Then (after converting) the Parts that had been converted using PARASOLID kernel didn't project correctly within CAXA DRAFT, so it was necessary to then change the kernel of those converted Parts to the ACIS kernel (after which they then projected correctly).

Importing from STEP (ACIS)

When importing some STEP models, the PARASOLID kernel creates more surface parts. ACIS appears to be better at stitching surfaces together during importing. Note that these surfaces (instead of solids) may relate to the CAD software that created the STEP file.

Loft (ACIS)

A "Loft" failed within a part when the kernel of the part was set to PARASOLID, yet worked after changing the part kernel to ACIS.

Rendering Problems (Switching Back and Forth)

Occasionally we've had sheet metal and imported parts that haven't rendered correctly. Where faces have been see through. In those instances switching kernels (from PARASOLID to ACIS then back to PARASOLID again) corrected the problem. Note that it is necessary to click in the scene for kernel changes to take effect.

Sweep (ACIS)

A "Sweep" along a 3D Curve failed within a part when the kernel of the part was set to PARASOLID, yet worked after changing the part kernel to ACIS.

Tapered Thread (PARASOLID)

Trying to create a "Tapered Thread" using the "Thread Tool", where the thread profile was "Normal to Tapered Face" was very problematic using the ACIS kernel; yet worked after changing the part kernel to PARASOLID.