

Donald E. LaCourse

Handbook of Solid Modeling



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*President
The Solid Modeling ExChange*

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These advisory entries are offered for their potential benefits and do not indicate strengths or weaknesses of any Solid Modeling systems.

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				15.19	Feature Support	40	15.13
				15.20	Gouge-Free Toolpaths	40	15.13
				15.21	Toolpath Verification	40	15.14
				15.22	SM Integration	40	15.14
				15.23	Associable Process Plans	40	15.14
				15.24	Parametric Constraints	40	15.14
				15.25	Primitive Preference	40	15.15
				15.26	Information Availability	40	15.15
				15.27	Site Specific	40	15.15
				15.28	Determine & Identify	40	15.15
	Customizing	Customizing		16.1	Debugging Macros	41	16.8
				16.2	Small Adjustments	41	16.9
				16.3	Start-Up Files	41	16.9
				16.4	Default Models	41	16.9
				16.5	Batch Mode Processing	29	16.10
		Writing Your Own SM Program		16.6	Planning Checklist	41	16.10
				16.7	Planning Action	41	16.10
				16.8	SM Engines	41	16.10
				16.9	Graphics Libraries	41	16.10
				16.10	The Graphic User Interface (GUI)	41	16.10
				16.11	Start Small	41	16.11
				16.12	Integration	41	16.11
		Good to Know		16.13	Productivity Aids	21	16.11
				16.14	Tutorial Sources	41	16.11
				16.15	Off-the-Shelf Code	41	16.11
				16.16	Available Tool Kits	41	16.11
	Documentation	Associativity		17.1	Solid Errors and Cleanup	09	17.3
				17.2	Detailing Associativity	09	17.3
		Desktop Publishing		17.3	Graphics Conversion	09	17.5
				17.4	Screen Images to Film	09	17.11
				17.5	The HPGL Format	41	17.11
				17.6	Image Processing	41	17.11
				17.7	SM, CE, and Desktop Publishing	20	17.11
		Detail Drawings		17.8	What You Model Is What You Get	36	17.14
				17.9	Control Drawings	17	17.15
				17.10	Understanding Less Documentation	17	17.15
				17.11	SM Start to Finish for Die Castings	07	17.15
				17.12	HPGL as a Translator	09	17.15
				17.13	Cleaning Up	41	17.15
				17.14	Zero Deviations	41	17.16
				17.15	Tessellation Lines	41	17.16
				17.16	Overlapping Entities	41	17.16
				17.17	Long Plots	09	17.16
		Hardcopy		17.18	Patterns and Plots	41	17.16
				17.19	Resolution	41	17.16
				17.20	Troubleshooting Checklist	41	17.16
				18.1	Leverage Known Design Techniques	43	18.9
Interfacing	Graphic User Interfaces (GUIs)	Design Principles		18.2	Design Characteristics	43	18.10
				18.3	Design Guidelines	43	18.10

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Section	Topic	Group	Icon	SMA	Name	Orig	Pg
Interfacing (continued)	Graphic User Interfaces (GUIs) (continued)	Organization	✓	18.4	Order and Chaos	43	18.10
				18.5	Consistency	43	18.10
				18.6	GUI Screen Layout	43	18.11
				18.7	Relationships	43	18.11
				18.8	Navigability	43	18.11
		Economy	✓	18.9	Economic Guidelines	43	18.11
		Communication	✓	18.10	Achieve a Balance	43	18.12
				18.11	Layout	43	18.12
				18.12	Legibility	43	18.12
				18.13	Screen Backgrounds	43	18.13
				18.14	Readability	43	18.13
				18.15	Typography	43	18.13
				18.16	Symbolism	43	18.13
				18.17	Multiple Views	43	18.14
		Color and Texture	FM	18.18	What Is Color?	43	18.14
			✓	18.19	Accomplishments	43	18.14
				18.20	Similarity	43	18.14
				18.21	Consistency	43	18.15
		Color Economy	✓	18.22	Principles and Redundancy	43	18.15
				18.23	Enhancement	43	18.15
				18.24	Sequencing	43	18.15
		Color Emphasis	✓	18.25	Suggested Emphasis	43	18.15
				18.26	Hierarchy	43	18.15
				18.27	Viewer Differences	43	18.16
		Color Communication	✓	18.28	Central and Peripheral Colors	43	18.16
				18.29	Combinations	43	18.16
			FM	18.30	Area	43	18.16
			✓	18.31	High Chroma and Spectrally Extreme Colors	43	18.16
			⊗	18.32	Chroma and Value	43	18.16
				18.33	Combinations to Avoid	43	18.16
			✓	18.34	For Dark Viewing	43	18.16
				18.35	For Light Viewing	43	18.16
			FM	18.36	Interactions	43	18.17
		Color Symbolism	✓	18.37	Using Color Codes	43	18.17
			⚠	18.38	Connotations	43	18.17
		Good to Know	FM	18.39	Shortcutting the GUI	09	18.17
			+	18.40	For the Occasional User	30	18.17
Rapid Prototyping		STL Interface	FM	19.1	Surface Gaps	44	19.14
				19.2	Facet Adjustment	09	19.14
		SLA Part Modeling	⊕	19.3	Additional Modeling Effort	09	19.14
				19.4	Part Orientation	09	19.15
				19.5	Multiple Parts	09	19.15
			FM	19.6	Additional Features	09	19.15
			↖	19.7	Part Size	09	19.15
			✓	19.8	Model Closure	44	19.15
		SLA Supports	⚠	19.9	Internal Supports	09	19.15
			⊕	19.10	Self-Supporting Features	09	19.15
				19.11	Avoid Delays and Rework	09	19.16
				19.12	Review Support Structure Designs	09	19.16
				19.13	Support Generation	09	19.16
				19.14	Separate STL Files	09	19.16
			FM	19.15	Support Structure Software	44	19.16

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Section	Topic	Group	Icon	SMA	Name	Orig	Pg
Interfacing (continued)	Rapid Prototyping (continued)	SLA Production	FM	19.16	Surface Finish	44	19.16
				19.17	Layer Thickness	44	19.17
				19.18	Resin Viscosity	44	19.17
				19.19	Photo Sensitivity	44	19.17
				19.20	The SLA Unit	44	19.17
				19.21	Production Time	09	19.17
		SLA Recommendations		19.22	Unnecessary Geometric Features	09	19.17
				19.23	Look for Stress	09	19.17
				19.24	Let the Polymer Drain	09	19.17
				19.25	Polymer Materials	44	19.18
		SLS		19.26	Thermal Stress	44	19.18
		LOM		19.27	Drafts and Radii	45	19.18
		Needed Improvements		19.28	The Right Tool for the Job	44	19.18
				19.29	A Push-Button System	44	19.18
			+	19.30	Build Directly	44	19.19
				19.31	Accept Smooth Surface Data	44	19.19
				19.32	Become Fiscally Sound	44	19.19
				19.33	Improve Price/Performance Ratio	44	19.19
				19.34	Education	44	19.19
			FM	19.35	Dispel the RP myths	44	19.19
			+	19.36	Expand the Use of SM	44	19.19
	Data Exchange	Protection & Integrity		20.1	Security Plan	46	20.9
				20.2	Access Limitations	46	20.9
				20.3	Security Measures	46	20.9
				20.4	Design for Data Integrity (DFDI)	46	20.9
		Legal Issues	FM	20.5	New Questions	46	20.9
				20.6	Anxieties and Perception	46	20.9
				20.7	The Uniform Commercial Code	46	20.9
				20.8	New Agreements	46	20.10
				20.9	Record Keeping	46	20.10
				20.10	Existing Agreements	46	20.10
				20.11	Ten Commandments of Data Exchange	46	20.10
		Utilizing Existing Guidelines		20.12	Why Reinvent the Wheel?	46	20.12
			FM	20.13	AIAG Label Conventions	46	20.12
				20.14	Auto Company Guidelines	46	20.12
			FM	20.15	CALS Implementation	46	20.13
		Managing Expectations	FM	20.16	Time and Effort	46	20.13
				20.17	Strive for Value, Not Perfection	46	20.13
		Evaluating Translator Capability		20.18	Translator Flexibility	46	20.13
				20.19	Translator Accuracy or Granularity	46	20.13
				20.20	What to Look For	46	20.13
				20.21	What to Ask	46	20.13
		Delivery Mechanisms		20.22	Check Compatibility	09	20.14
				20.23	Floppy Disks	09	20.15
				20.24	Tape-Drive Densities	46	20.15
			FM	20.25	UNIX Tape Archive (TAR) Utility	46	20.15
	Data Compression	FM		20.26	ASCII IGES Format	46	20.15
				20.27	UNIX Platforms	46	20.15
				20.28	Personal Computer (PC) Platforms	46	20.15

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Interfacing (continued)	Data Exchange (continued)	Checklists	✓	20.29	Rules for Data Integrity	46	20.15
				20.30	Data Integrity Checklist	46	20.16
				20.31	Contingency Plans	46	20.16
		Good to Know	FM	20.32	2D Drawing File Sizes	36	20.16
				20.33	Organizational Preparation	46	20.17
				20.34	Macintosh Drives	46	20.17
			⊕	20.35	System ASCII Support	46	20.17
				20.36	Emerging Delivery Mechanisms	46	20.17
	IGES	Anatomy	+	21.1	Custom Start Sections	46	21.7
				21.2	If Resulting Scale Is Too Large	46	21.7
		Entity Mapping	FM	21.3	IGES Subsets	46	21.11
				21.4	Mathematical Approximations	46	21.11
			⚠	21.5	Entity Mismatch in Loop Testing	46	21.11
		Utilities	FM	21.6	What IGES Utilities Can Do	46	21.13
				21.7	Pinpointing Pre- or Postprocessor Errors	46	21.13
				21.8	IGES Viewing Utilities	46	21.14
				21.9	Product Capability	46	21.14
				21.10	Product Reliability	46	21.14
			⚠	21.11	Human Understanding	46	21.14
		IGES Testing	⊕	21.12	Vendor Verification & Conformance Tests	46	21.14
			✓	21.13	Scope the Test	46	21.16
				21.14	Compare Entity Maps	46	21.16
			FM	21.15	Visual Equivalence for Good Pictures	46	21.16
				21.16	Functional Equivalence for Good Data	46	21.16
			✓	21.17	Measuring Results	46	21.16
				21.18	Test Case Characteristics	46	21.17
				21.19	Test Case Sources	46	21.17
		Analysis and Debugging	FM	21.20	Analysis & Verification	46	21.18
			✓	21.21	Debugging Hints	46	21.18
				21.22	IGES File Verification	46	21.18
			↖	21.23	If the IGES File Will Not Load	46	21.18
			✓	21.24	Plot-to-Plot Comparisons	46	21.19
		Judging and Documenting Test Results	FM	21.25	The Final Judge	46	21.19
			⊕	21.26	Case Study Repositories	46	21.19
				21.27	Documentation	46	21.19
			✓	21.28	Record Keeping	46	21.20
		Overall Evaluation	FM	21.29	An Iterative Approach	46	21.20
			⊕	21.30	Know the Model's History	46	21.20
		Contacts	FM	21.31	CALS Test Network (CTN)	46	21.23
				21.32	The National IGES User Group and the IGES/PDES Organization (IPO)	46	21.23
				21.33	Translator and Utility Vendors	46	21.24
		Good to Know	⚠	21.34	Don't Jump to Conclusions	09	21.24
				21.35	Check Modeling Tolerances After Transfers	35	21.24
			⊕	21.36	Not Just SM Data	47	21.25
				21.37	View-Dependent IGES Transfers	08	21.25
			↖	21.38	Typical Record-Length Problem	46	21.25
			+	21.39	Limited IGES File Size Acceptance	46	21.25
			FM	21.40	Useful Facts About IGES Files	46	21.25

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Interfacing (continued)	IGES (continued)	Good to Know (continued)	⚠	21.41	Editing & Browsing	46	21.26
			◀	21.42	Standardization	48	21.26
				21.43	The Concept of an Object	48	21.26
	PDES/STEP	Contacts	FM	22.1	PDES, Inc.	48	22.8
				22.2	NIST and NIPDE	48	22.8
				22.3	The European Community	48	22.8
				22.4	The European Commission	48	22.9
				22.5	Other Contacts	48	22.9
		Good to Know	FM	22.6	Growth Path to STEP	47	22.9
				22.7	Application Protocols	24	22.9
			⊕	22.8	Know Your Process	48	22.10
			✓	22.9	Highly Integrated STEP (HISTEP™)	49/50	22.10
			FM	22.10	Important Technology Characteristics of STEP Tools	49/50	22.10
Implementation	Strategies	Change Management	✓	23.1	Implementation and Effectiveness	51/52	23.7
			⊕	23.2	Look Inward as Well	51/52	23.7
			✓	23.3	A Case in Point	51/52	23.7
			⊕	23.4	A Cultural Mind-Set	51/52	23.7
			✓	23.5	Easy for Change	51/52	23.7
			⊕	23.6	Marketing SM Internally	29	23.8
		Planning	⊕	23.7	Needs & Productivity Analyses	51/52	23.8
				23.8	Aiding Communication	51/52	23.11
				23.9	Internal Application Support	51/52	23.13
				23.10	Configuration & Performance	51/52	23.13
				23.11	Modeling Precision	51/52	23.13
			✓	23.12	Modeling Notes Improve Communications	51/52	23.13
			FM	23.13	Methods & Performance	51/52	23.13
				23.14	Lack of Commitment	51/52	23.13
				23.15	Executive Understanding	51/52	23.13
			⊕	23.16	Proficiency Tests	51/52	23.13
				23.17	Do Not Lose Sight of Goals	51/52	23.14
			✓	23.18	Backup & Archive Procedures	51/52	23.14
			⊕	23.19	Your Hardware Budget	51/52	23.16
		Good Practices	⊕	23.20	Documenting Project Costs	29	23.18
				23.21	Sharpen the Axe	29	23.18
				23.22	Cross-Fertilization	29	23.18
				23.23	For Designers and Engineers	29	23.18
			⊖	23.24	Avoid a Poisoned Attitude	29	23.18
				23.25	Hard Disk Space	09	23.18
				23.26	Monitoring Productivity	51/52	23.19
				23.27	Supported Functions	51/52	23.19
				23.28	Implementation Investments	51/52	23.19
			✓	23.29	Implementation Guidelines	36	23.19
			FM	23.30	A Never-Ending Story	29	23.19
			✓	23.31	Software Considerations	51/52	23.19
				23.32	Order of Accuracy	51/52	23.20
			⚠	23.33	Cost Per SM Workstation	51/52	23.20
				23.34	Benchmarking	51/52	23.20
			◀	23.35	The Right Tool for the Right Job	53	23.20
			✓	23.36	Factors to Consider	54	23.20

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Section	Topic	Group	Icon	SMA	Name	Orig	Pg
Implementation (continued)	Manufacturing	Design	⊕	25.1	Principal Axes	40	25.5
		Features	⊕	25.2	Knowledge Utilization	40	25.8
		Process Planning	⊕	25.3	Exception Handling	40	25.11
			⚠	25.4	Operational Sequence	40	25.11
		Manufacturing	⊕	25.5	Standard Parts	40	25.13
			✓	25.6	Lowering NC Costs	40	25.13
			FM	25.7	Work in Progress	40	25.13
			⊕	25.8	Billet & Stock Management	40	25.13
		Robotics	FM	25.9	Part Handling	40	25.14
		Inspection	FM	25.10	Rigid Is Not Reality	40	25.15
		Patterns	FM	25.11	Casting Patterns	40	25.17
		Good Practices	✓	25.12	The Overall Design Process	40	25.19
				25.13	Modeling Advice	40	25.19
	Volumetrics	Display	FM	26.1	Display Interactivity	13	26.7
		Data Processing	⊕	26.2	Critical Trade-Offs	13	26.7
				26.3	Acquisition Parameters	13	26.8
				26.4	Segmentation Procedures	13	26.8
				26.5	Database Access	13	26.8
				26.6	Disadvantages of Volumetric Clouds	13	26.9
		Data Representation	+	26.7	An Octree Disadvantage	13	26.9
				26.8	Choosing a Representation Method	13	26.10
	Concurrent Engineering	Customer Focus	⊕	27.1	A Shared Vision	55	27.10
				27.2	Customer Contact	55	27.10
		People and Teamwork	⊕	27.3	Cross-Functional Teams	55	27.10
				27.4	A Supportive Culture	55	27.10
				27.5	Multiple Cycles	55	27.10
			FM	27.6	Take Ownership	20	27.10
				27.7	Optimize the Design Process	20	27.10
			✓	27.8	Organizational Barriers	20	27.11
		Systems	⊕	27.9	A Voice in the Process	55	27.11
				27.10	Handbook of Solid Modeling	55	27.11
				27.11	Support Human Communication	55	27.11
				27.12	Get Physical Fast	55	27.11
				27.13	Synchronization	55	27.11
				27.14	Product Data Management (PDM)	55	27.11
		Processes	⊕	27.15	All Things Considered	55	27.11
				27.16	A Value Chain	55	27.11
				27.17	Look Ahead & Behind	55	27.11
				27.18	Support Best Practices	55	27.12
				27.19	Capture Process Knowledge	55	27.12
				27.20	Seek & Use Appropriate Metrics	55	27.12
		Resources & Responsibilities	⊕	27.21	Administrative Functions	55	27.12
				27.22	The Total Product Life Cycle	55	27.12
		Manufacturing Infrastructure	⊕	27.23	External Resources	55	27.12
				27.24	Computer-Based Tools	55	27.12
				27.25	Integrate with Customers	55	27.12
				27.26	Invest in Special Relationships	55	27.12
				27.27	Old & New	55	27.12

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Implementation (continued)	Concurrent Engineering (continued)	Implementation	⊕	27.28	No Walls—One Team	25	27.12
			✓	27.29	CE Design Tips	17	27.13
			⊕	27.30	Hardware Capabilities	55	27.13
				27.31	SM Sells Ideas	55	27.13
				27.32	SM and X Terminals	55	27.13
				27.33	SM, Customers, and Suppliers	55	27.13
				27.34	Data Exchange	55	27.13
			FM	27.35	Not Just Geometry	55	27.13
		Common CE Pitfalls	⚠	27.36	Information Explosion	56	27.13
			⊖	27.37	Spurts Are Not Desirable	56	27.13
			⚠	27.38	Risk of Wasted Effort	56	27.14
				27.39	Possible Increase of Iterative Costs	56	27.14
				27.40	Errors May Build Up	56	27.14
	Data Management	Product Data Management (PDM)	⊕	28.1	PDM Is Imperative	01	28.4
			⚠	28.2	Who Will Benefit Most?	36	28.4
			⊕	28.3	A PDM Assessment	57	28.5
			FM	28.4	Nine Things PDM Can Do	17	28.5
			✓	28.5	Knowledgeable Assets	36	28.5
			⊕	28.6	Attributes	36	28.5
				28.7	If PDM Is Not Used	36	28.5
				28.8	For Multiple Users	36	28.6
		Network Considerations	✓	28.9	Network Bandwidth	01	28.6
				28.10	Networking Voice and Video	01	28.6
		Needed	+	28.11	Database Editing	08	28.6
				28.12	UNDO Applications	08	28.6
				28.13	Information Hooks	29	28.6
				28.14	Database Searches	29	28.7
		Good to Know	⊕	28.15	Smart Part Libraries	21	28.7
				28.16	SM Database Management Tips	17	28.7
				28.17	Using Alphanumeric Terminals	29	28.7
			✓	28.18	Data Access Management	29	28.7
			⊕	28.19	Data Links	09	28.8
In the Industry	At Sony Corporation	Applications	FM	29.1	Related Issues	58/59	29.11
			⊕	29.2	Where Used	58/59	29.11
		Optimum System Configuration	⊕	29.3	Exceed Minimum Requirements	58/59	29.13
			FM	29.4	Performance Resources	58/59	29.13
			⊕	29.5	RAM Disks	58/59	29.13
		File Management	⊕	29.6	File Directories	58/59	29.13
			⚠	29.7	Backup Files	58/59	29.13
		Data Management	⊕	29.8	Naming Files	58/59	29.13
				29.9	Managing Objects	58/59	29.13
		3D Orientation	FM	29.10	Local Coordinate Systems	58/59	29.13
			⊕	29.11	Orienting Objects	58/59	29.14
			FM	29.12	Wireframe Displays	58/59	29.14
		Display		29.13	Shaded Displays	58/59	29.14
			⊕	29.14	Color Management	58/59	29.14
				29.15	Display On/Off Functions	58/59	29.14
		Systems Information	FM	29.16	X-Windows System	58/59	29.14
			✓	29.17	Determining Machine Status	58/59	29.14