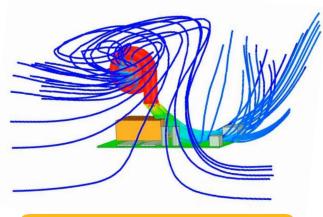


ANSYS 2022 R1 Icepak新功能介绍

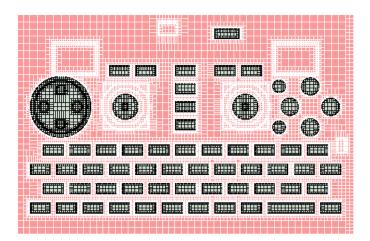
新科益系统与咨询(上海)有限公司

Icepak 2022 R1 Highlights

- Reduced Order Modeling (ROM)
 - Redhawk CTM 2-Way & New Delphi Network Creation
- Blower Modeling
- ECAD Import Wirebond & IDX
- Maxwell 2D Icepak EM Loss Coupling



Streamlines into and out of a Centrifugal CAD Blower cooling a PCB assembly

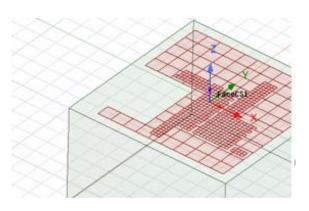


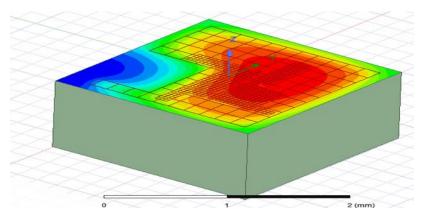
- Mesher Enhancements 2.5D Improvements
- User Experience
 - Streamlines & Validation Enhancements
 - Improved Error messaging & troubleshooting
- Migration
 - Improve speed of TZR conversion
 - Network Schematic enhancements
 - Toolkit enhancements
 - PCB, Package parameterization



RedHawk CTM Two-Way Workflow

- Chip Thermal Model (CTM) two-way co-simulation
 - Chip-aware system design (2021 R2)
 - System-aware chip design (2022 R1)
 - Auto-export temperatures to RedHawk after simulation
 - Defaults to export folder specified under Design Settings
 - Binary format
 - CTM import using a 3rd party text file
 - CTM native component created
 - No temperature data export





M Component : I	mport CTM pro	files
Name	CTM1	
CTM File	D:\ANSYSDev\	TestProjs\CTM <mark>\CTMImport.bt</mark>
Import settings:	-	
Rotation	Odeg	•
Density number	500	
Resolution	4	
	Import Data	
Radiation	Steel-cold	sed-sunhuce.
CTM profiles		CTM summary
Sources		Tem Total power (W) SH po
	CTM	limport bt 🔀
	1	#DistanceUnit: mm
	2	#TemperatureUnit: cel
	3	<pre>#Power/HeatFluxUnit: W</pre>
		#CellLocations
		0.0 0.0 1.0 1.0
	6	0.0 0.0 -1.0 -0.5
	7	0.0 1.0 1.0 1.5
	8	
	9	
	1011101	#PowerMapOfCells
	11	
	12	
	13	0.1 0.12 0.14 0.16 0.18 0.2
	14	



Blower Modeling

- Generalized Blower boundary •
 - Impellers (type 1) -
 - Centrifugal blowers (type 2) -
 - Single and dual inlets for all geometries
- Blower toolkit ٠
 - Geometry and BC for rectangular and cylindrical geometries
- Vendor Component Library
 - Adda, Jaro, Minebea, Sunon
- Blower Assignment •
 - Polygonal approximation allowed for type 1 -
 - Multiple co-planar inlet faces allowed for type 2 -
 - Ability to toggle inlet/outlet faces -
- **Blower Specifications** •
 - Blower flow curve
 - Fan blade/exit angle
 - RPM (type 1) -
 - **Blower Power**

🧑 Optime
🔁 Results
Field O
🗄 💼 Definitions

Model Thermal Blower_1 🛷 Inlet 🛷 Outlet

Analysis Optimetrics

Results Field Overlays

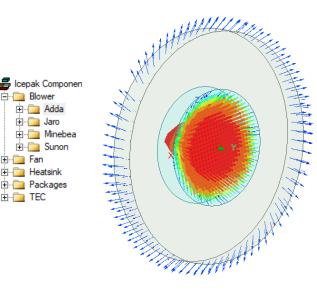
Blower Thermal Model			×
General Defaults Name: Blower_1			
Blower Type: C Type 1 (Type 2 Blower Specification Blower Flow: Flow Curve	_	Dataset ordinatesClick on hea	ader to change unit
Blower Power: 0.5	• [Pressure [in_water]
Edward Erit Analys	L	0	0.5
Exhaust Exit Angle: 17 rad	-	20	0.48
		50	0.425
		80	0.35
		90	0.25
		100	0

Blower

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🗄 📄 Fan

🗄 🛅 TEC

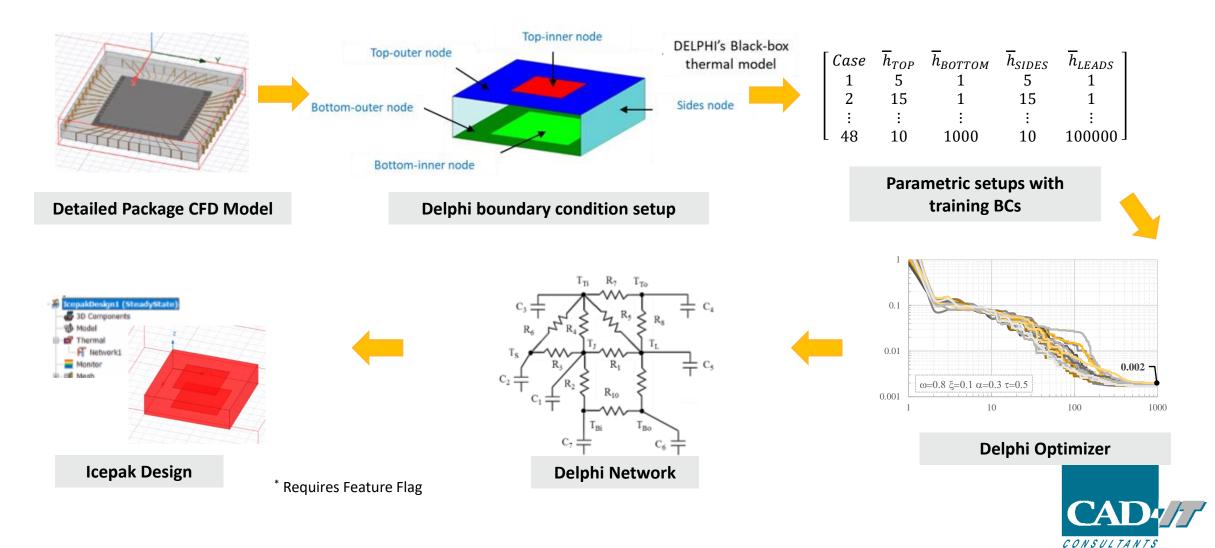




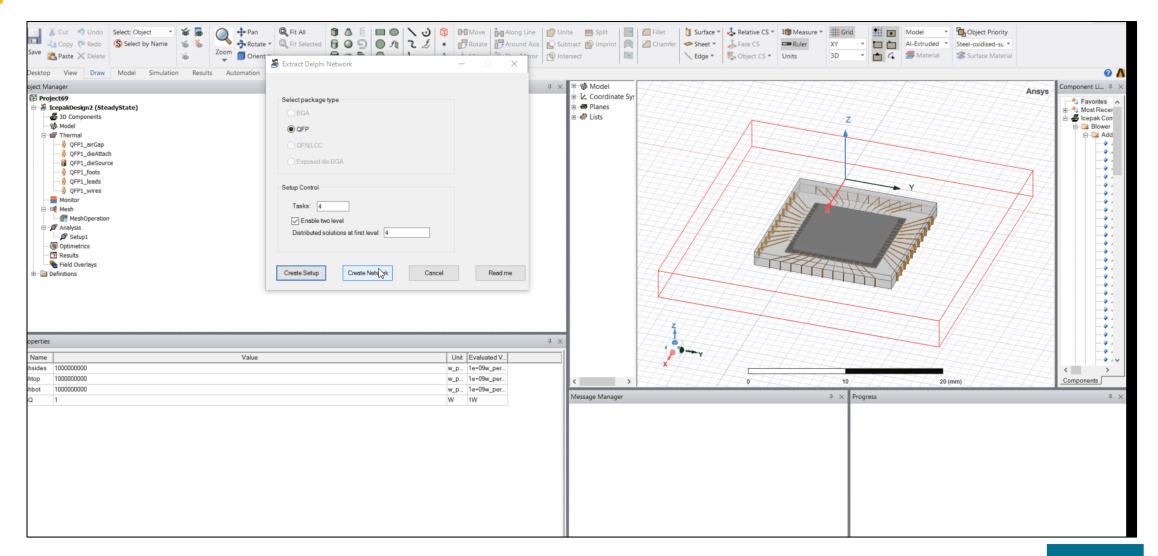


Reduced Order Modeling - Delphi Network Creation*

• Steady-state Delphi network creation for QFP packages



Automated Delphi Network Creation Workflow in AEDT



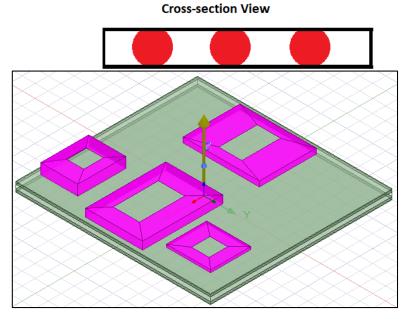


ECAD - Bondwire Import

- Bondwire Import with PCB Component
 - Bondwires attached to components with die properties
 - Material and wire diameter input options
 - Modeled as sheets with shell conduction plate BC

	Components P
Component Model ×	Regular Expr:
Component Info Part Name: BA780J Part Type: IC Ref Des: U2 No. Pins: 33 Model Interface Interface: Manual Die Properties Type: Wire bond Orientation: Dhip up Height: 0.0003 Solder Ball Properties Shape: None Diameter: 0 Mid Diameter:	Regular Expr: P ← ✓ Resistor P ← ✓ Capacitor P ← ✓ Capacitor P ← ✓ CG A780J P ← ✓ U2 (33 pins) P ← ✓ U2 (33 pins) P ← ✓ U3 (16 pins) P ← ✓ U3 (16 pins) P ← ✓ PE42693 P ← ✓ U1 (26 pins) P ← ✓ Other

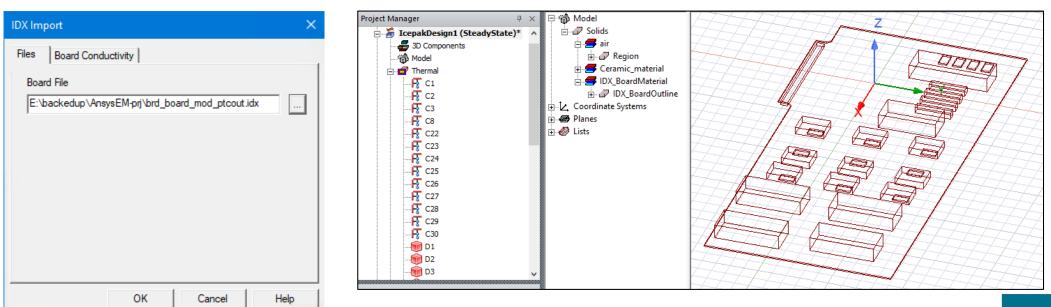
Include Parts: C None	C Device Parts	Package Parts
Above Stackup		
Model Connectors As	:	
C Solderbumps 📀 I	Bondwires	
Bondwire Material:	Au-Typical	
Wire Diameter:	0.05	mm 💌



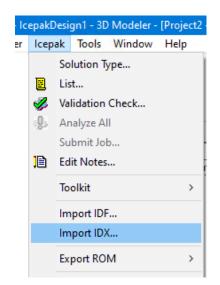


ECAD - IDX Import

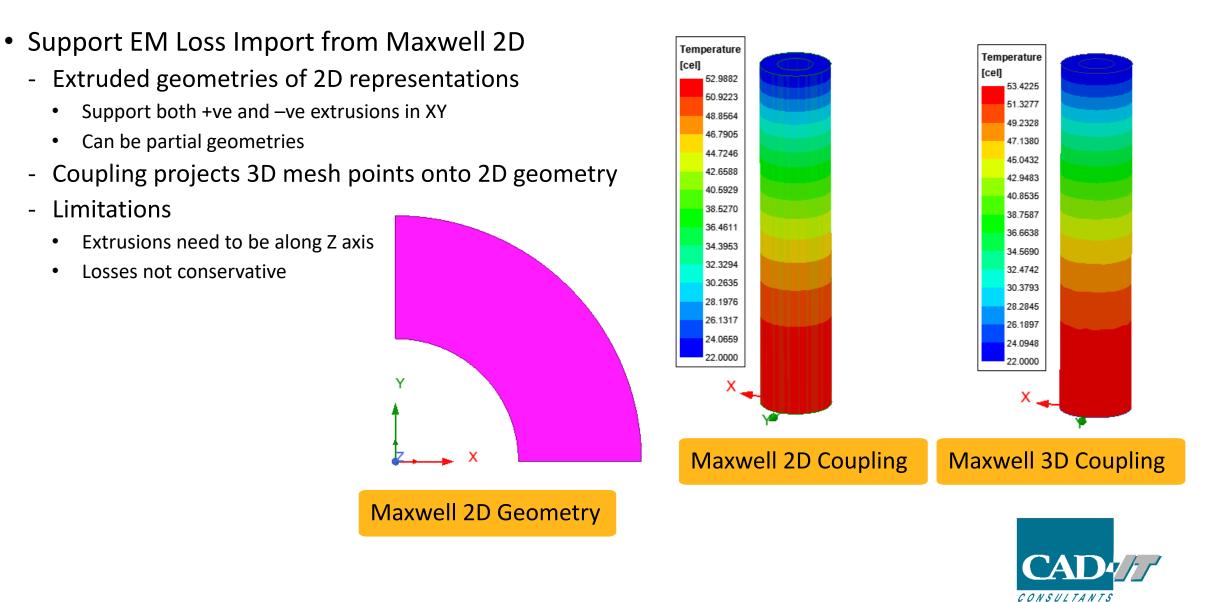
- IDX Import XML based format consisting of ECAD and MCAD data
 - Support geometry and boundary condition import (MCAD)
 - Like IDF import in Icepak AEDT
 - Limitations
 - ECAD data import not supported
 - Filters, Modeling options, Cutouts not supported







Maxwell 2D – Icepak EM Loss Coupling



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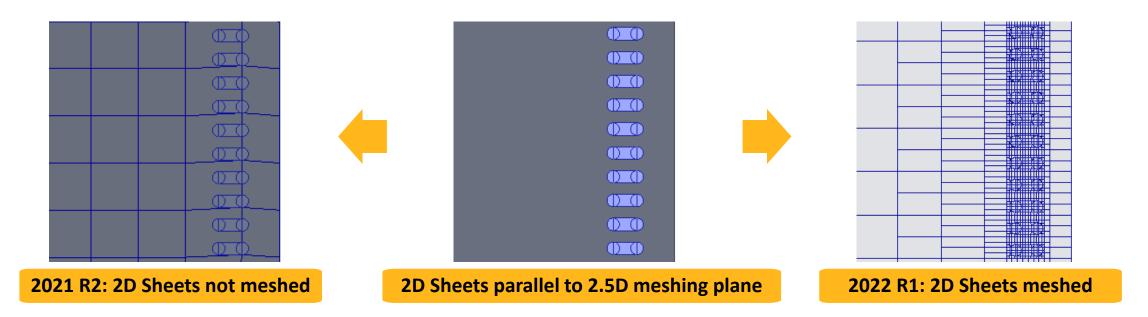
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Meshing Enhancements - 2.5D Meshing

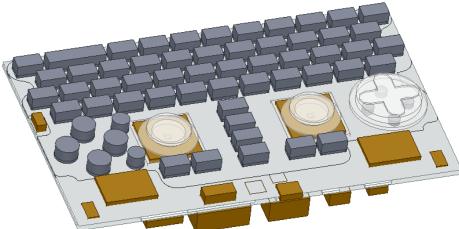
- Capturing Thin Objects in 2.5D Meshing
 - Refinement around 2D sheets parallel to the 2.5D meshing plane
 - Create additional refinement and multi-level around 2D sheets
 - Further mesh optimization using 2.5D mesh sub-blocking in following slide





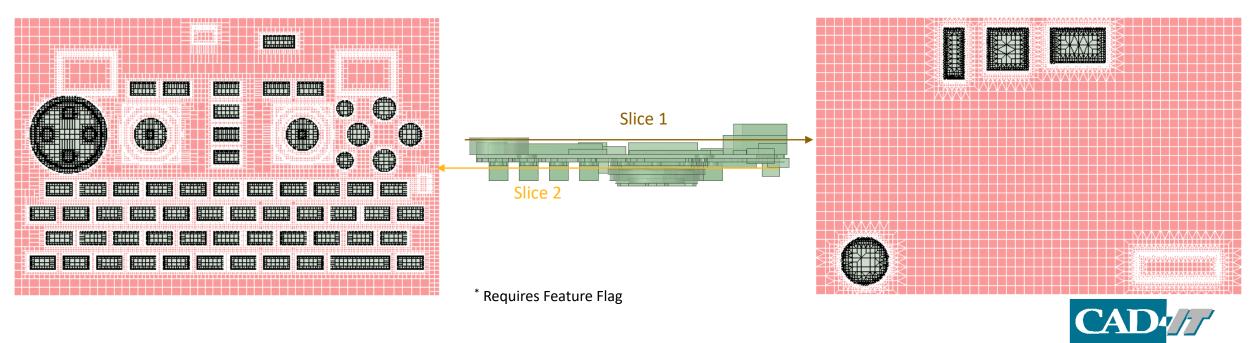
Meshing Enhancements - 2.5D Meshing*

- Domain Sub-blocking for 2.5D Meshing
 - Prevent refinement from being imprinted throughout extrusion
 - Domain split according to in-plane geometry features
 - Uses non-conformal interface to couple different meshing blocks
 - Reduced mesh counts and improved performance (~50%)



Keyboard model mesh count: 2021 R2: **2.35M** 2022 R1: **1.38M**

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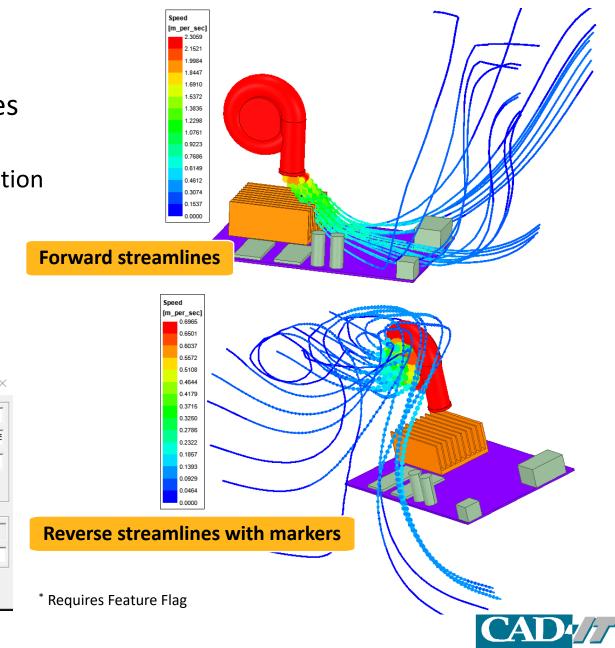


Fluid Flow Streamlines*

- Steady-state and transient particle traces
 - Forward and reverse direction
 - Uniform and mesh node seeding with skip option
 - Color by variable
 - Standard AEDT line and marker options
 - Animations are not supported yet

Specify Name Speed2	Fields Calculate	or Surface Smoothing
Specify Folder Speed	Category: Standard	d 💌
Design: IcepakDesign3	Quantity	In Volume
Context Solution: Setup1 : SteadyState	Pressure SurfPressure Temperature	Region SERIAL_PORT MEMORY1
Field Type: Fields	SurfTemperature Velocity Vectors Ux	MEMORY1_1 CAPACITOR CAPACITOR_1
Intrinsic Variables	Uy Uz	KB HEAT_SINK
	SurfVelocity Vectors	s CPU
	SurfUy	ALPHA_MAIN_PCB Component2
	SurfUz	AllObjects Box1
	Speed ViscocityRatio	Box2
	WallYPlus TKE	
	Epsilon	Plot on surface only
Save As Default	Kx	
	Kγ	🛛 🗹 Streamline 🛛 Edit
Done	Cancel	1

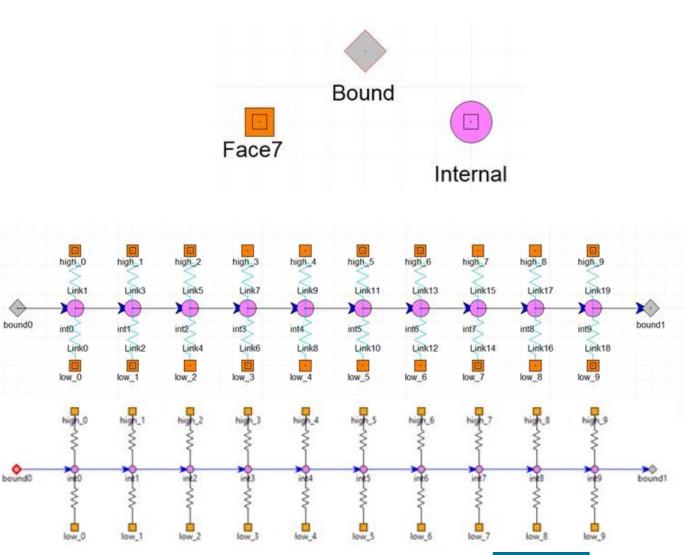
Particle Trace Definition $\qquad imes$
Trace options
Start time(s): 0
End time(s): 1752.93328985
Max steps: 1000
Reverse direction
Seeds options
C Uniform Count: 6
Nodes Skip: 5
OK Cancel



CONSULTANTS

Network Schematic Enhancements

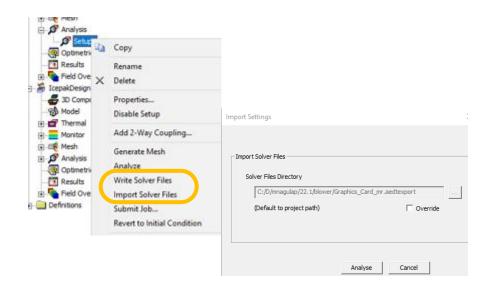
- Network circuit schematic enhancements
 - Simplified node representations
 - Similar 'look-and-feel' to Icepak Classic
 - Symbols
 - Color scheme
 - Links connect to nodes directly at centers
 - Icepak Classic network import
 - Networks with non-angled links imported
 - Angled links still imported using page ports

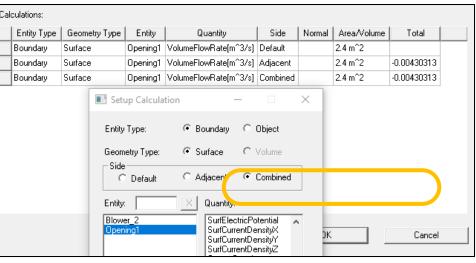




Miscellaneous Enhancements

- Solver File Export / Import
 - Write Solver Files option
 - Import Solver Files option*
- Fields Summary
 - Combined side option for surface quantities
 - Algebraic sum of Default and Adjacent side values
 - Single option to report:
 - Non-zero values at all 1-sided surfaces
 - Ensure heat balance at 2-sided surfaces
- TZR File Import Speed Improvement
 - Synchronization & Validation*
 - Speed-ups up to 70x observed







* Requires Feature Flag

Toolkits Development





Blower

Extract Delphi Network

Contour File Export

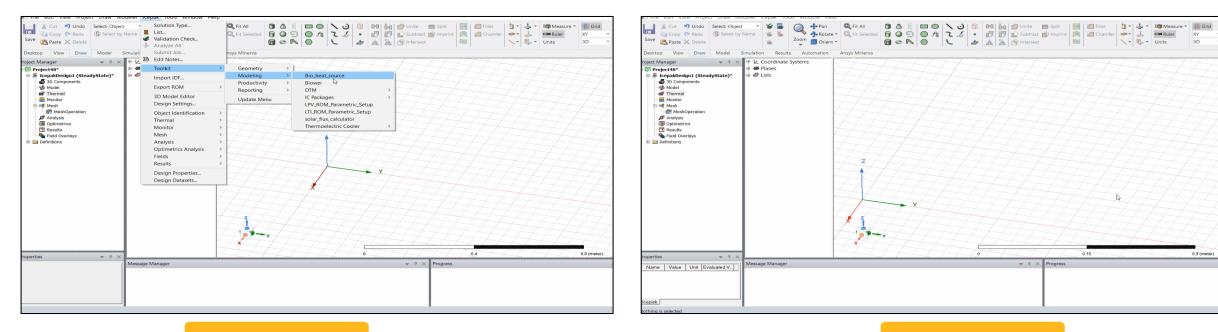
– Cut Plane

Enhancements (5)

 Variable support for Packages and PCB
 PCB
 DTM Monitor Support
 Dataset support for Power Budget
 Power density support for Bio-Heat Source



Blower Modeling - Toolkits



Type 1 Blowers

Type 2 Blowers

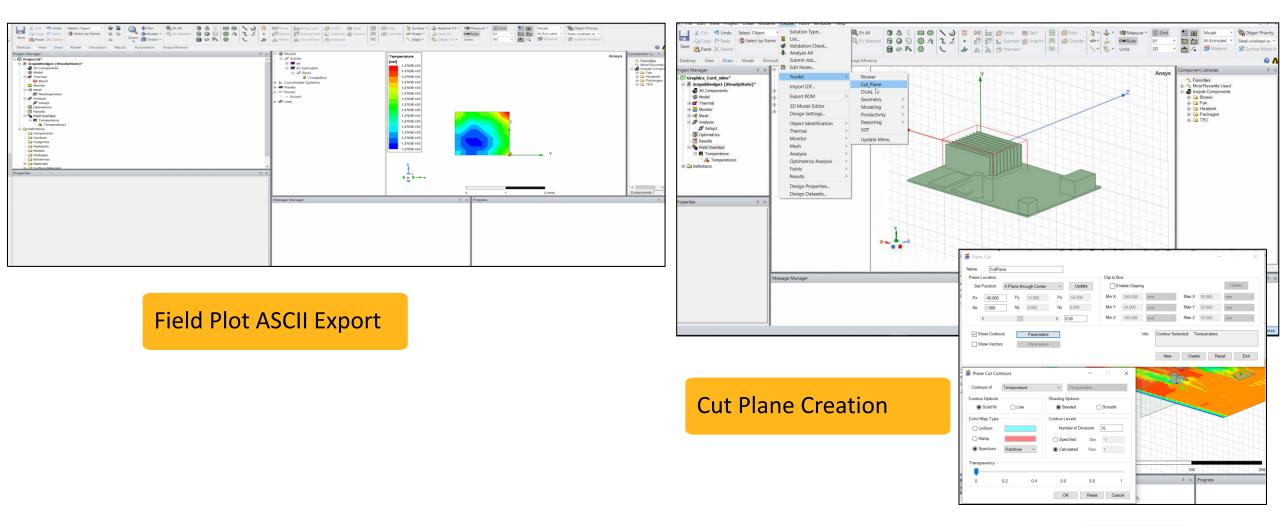


L.

0.3 (meter

0.15

Post Processing Toolkits





Other Toolkit Enhancements

cro Specification	Monitor Point:	Trigger Temperature:	Power Factor:		
	Wontor Font.	ON OF		F	
Select Object(s): source_1.source_1_ Select Object(s): source_1_1_1.source_1_		onstant 20.0 cel 29 onstant 20.0 cel 29		Edit	 New Delete
up Name: Setup1 t Name: DTM ect folder: D:/DTM/	~ Brow	50			

DTM Monitor Support

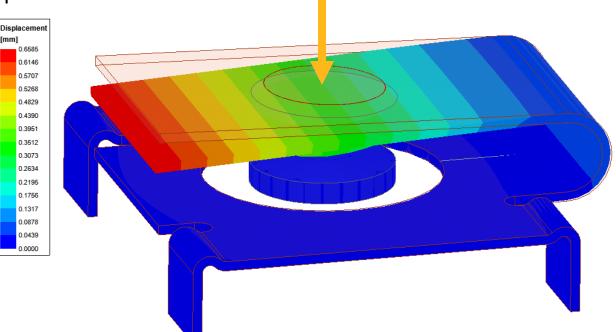
omet	try Propertie	s							
:b ty	/pe	Compact	~						
Rack	k specification								
	ber in rack	1							
Rack	k spacing	0.0	meter	~					
her	mal specificati	ion				Vias parameters			
Fotal	l power	0	W		~				
Cube	strate Thickne								
Juba	su die Thiokine	0.0016	meter		~	Configur	e Vias		
Subs	strate Materia	FR-4			\sim				
	ce layer Type e layer parame	· ·	Detailed				A 🕀 ר	dd layer	
Trac #	e layer parame Layer thickn	eters less		% coverage	Layer Material			dd layer elete layer	
Trac # 1	Layer parame	eters less mm	~	% coverage	Cu-Pure	~		-	
Trac #	Layer parame Layer thickn 0.1 0.1	eters	~ ~	% coverage 55 80	Cu-Pure Cu-Pure	~ ~ ~		-	
Trac # 1 2	Layer thickn 0.1 0.1 0.1	eters	~	% coverage 55 80 80	Cu-Pure Cu-Pure Cu-Pure	~		-	
Trac # 1 2 3	Layer parame Layer thickn 0.1 0.1	eters	~ ~	% coverage 55 80	Cu-Pure Cu-Pure	~		-	
Trac # 1 2 3	Layer thickn 0.1 0.1 0.1	eters	~ ~	% coverage 55 80 80	Cu-Pure Cu-Pure Cu-Pure	~		-	
Trac # 1 2 3	Layer thickn 0.1 0.1 0.1	eters	~ ~	% coverage 55 80 80	Cu-Pure Cu-Pure Cu-Pure	~		-	
Ггас # 1 2 3	Layer thickn 0.1 0.1 0.1	eters	~ ~	% coverage 55 80 80	Cu-Pure Cu-Pure Cu-Pure	~		-	
Frac # 1 2 3 4	E layer paramu Layer thickr 0.1 0.1 0.1 0.1	mm mm mm mm	× × ×	% coverage 55 80 80 60	Cu-Pure Cu-Pure Cu-Pure Cu-Pure	~ ~		-	
Trac # 1 2 3 4 Effe	Layer thickn 0.1 0.1 0.1 0.1 0.1 0.1 0.1 0.1	eters	× × × ×	% coverage 55 80 60 60	Cu-Pure Cu-Pure Cu-Pure Cu-Pure	~		-	
Frac # 1 2 3 4 Effe	Layer thickn 0.1 0.1 0.1 0.1 0.1 0.1 0.1 0.1	mm mm mm mm mm	× × × ×	% coverage 55 80 80 60 To All	Cu-Pure Cu-Pure Cu-Pure Cu-Pure	~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~		-	
Trac # 1 2 3 4 Effe	Layer thickn 0.1 0.1 0.1 0.1 0.1 0.1 0.1 0.1	mm mm mm mm mm	× × × ×	% coverage 55 80 80 60 To All	Cu-Pure Cu-Pure Cu-Pure Cu-Pure	~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~		-	
Trac # 1 2 3 4 Effe	Layer thickn 0.1 0.1 0.1 0.1 0.1 0.1 0.1 0.1	mm mm mm mm mm	× × × ×	% coverage 55 80 80 60 To All	Cu-Pure Cu-Pure Cu-Pure Cu-Pure	~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~		-	



2022 R1 AEDT Mechanical Update

AEDT Mechanical 2022 R1 Highlights

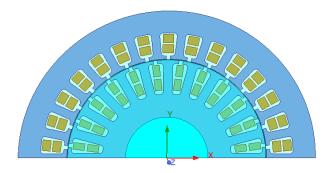
- Coupling
 - Maxwell 2D Thermal EM Loss Coupling
- Materials
 - General expression support for temperature-dependence
- Structural Beta
 - Boundaries
 - Displacement
 - Pressure/Force
 - Coupling
 - Mechanical Thermal-Structural Link
 - EM Force Structural Coupling
- Meshing Beta
 - Thermal Slider bar Meshing
- Reporting
 - Fields Summary



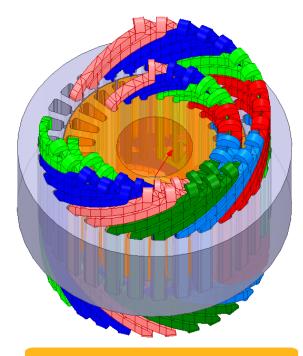


Maxwell 2D – Thermal EM Loss Coupling

- Support EM Loss Import from Maxwell 2D
 - Extruded geometries of 2D representations
 - Support both +ve and –ve extrusions in XY
 - Can be partial geometries
 - Coupling projects 3D mesh points onto 2D geometry
 - Limitations
 - Extrusions need to be along Z axis
 - Losses not conservative
 - 2-way coupling not supported



Maxwell 2D Geometry



Thermal 3D Geometry



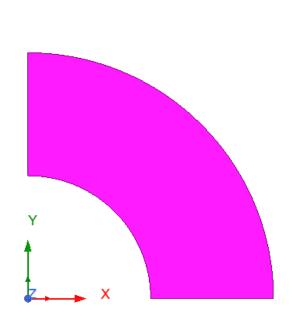
Temperature-Dependent Materials

- Temperature Dependent Material
 - General expression support
 - Quadratic expressions
 - Advanced coefficient support •
 - Converted to datasets for solver
 - Thermal & Structural

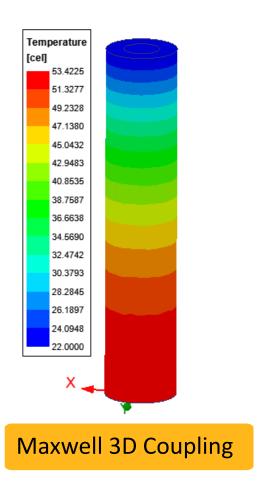
				Edit Thermal Modifier	×
	Edit Thermal Modifier		×	Expression C Quadratic	
	C Expression © Quadratic			Expression	
erials	Basic Coefficient Set Advanced Coef			Temperature-Dependent Thema P(Temp) = Pref [Modifier]	Conductivity:
	Temperature-Dependent Thema P(Temp) = Pref [1 + C1(Temp Reference Themal Conductivity Pref = 205 Parameters TempRef: 22 C1: 0.0012 C2: 2.39e-06	- TempRef) + C2(Temp - TempRef) ^ 2]		0.0012 * (Temp - (. 14.95100476, #(Temp < 0cel, 0.97475676, 1 + 22cel)) + 2.39e-06 * pow ((Temp - (22cel)) , 2))) e dependent dataset
Edit Thermal Modifier		ок	Cancel		OK Cancel
Expression Image: Quadratic Basic Coefficient Set Advanced Coefficient Set Temperature Limits TL TL and TU are the lower and up quadratic formula is valid. TL: 0 TU: 2200 Value Limits TML and TMU are the constant interval[TL, TU]. Image: Auto calculate TML, TMU TML: 0.97475676 TMU: TMU: 14.95100476			MPTEMP, 1, 0 MPTEMP, 2, 20 MPTEMP, 3, 40 MPTEMP, 4, 60 MPTEMP, 5, 80 MPTEMP, 6, 100 MPTEMP, 7, 120 MPTEMP, 9, 140 MPTEMP, 10, 180 MPTEMP, 13, 400 MPTEMP, 13, 400 MPTEMP, 14, 500 MPTEMP, 15, 600 MPTEMP, 15, 600 MPTEMP, 16, 700 MPTEMP, 16, 700 MPTEMP, 19, 900 MPTEMP, 19, 900 MPTEMP, 19, 000 MPTEMP, 19, 000 MPTEMP, 10, 199 MPDATA, KXX, 1, , 233.8134788, 244.53 MPDATA, KXX, 1, , 347.9940158, 434.53 MPDATA, KXX, 1, , 244.2173358, ! W m	00638,248.2786078,256.0991118,2 37358,510.8724558,597.0101758,6	64.3115758,311.2532958,

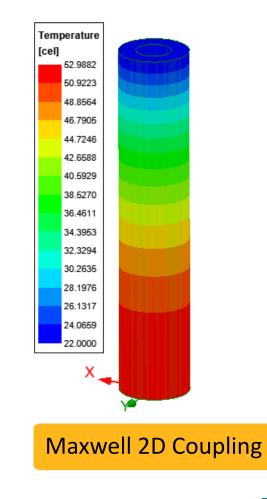


Maxwell 2D – Thermal EM Loss Coupling



Maxwell 2D Geometry



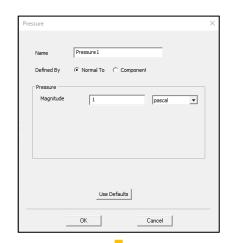




Mechanical Structural - Pressure/Force Excitations

- Force Excitation
 - Face and Object assignment
 - Uniform and Non-uniform Force options
 - Uniform (face): X, Y, Z components
 - Non-uniform via Setup Link to HFSS/Maxwell
- Pressure Excitation
 - Face assignment
 - Normal To or Component options
 - Normal To: Magnitude
 - Component: X, Y, Z components
 - Support curved faces

Force			\times
General Defaults			
Name Force 1			
Force			
Uniform			
Coordinate system	Global		
X Component	0	newton	•
Y component	0	newton	•
Z Component	-1	newton	•
C Non-Uniform	Setup Link		
	Use Defaults		
		ОК	Cancel



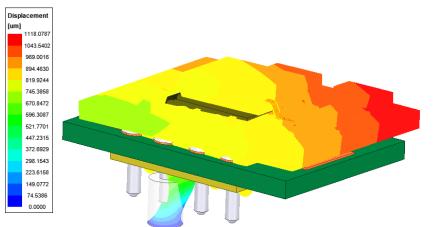
isplacem 0.6585 0.6146 0.5707 0.5268 199.5400 185.287 171 034 156.781-0.4829 142.5286 0.4390 0.3951 0.3512 0.3073 0.2634 0.2195 0.1756 0.1317 0.0878 0.0439 0.0000 128.2757 114.0229 99.7700 85.5171 71.2643 57.0114 42.7586 28.5057 14.2529 0.0000

Assembly under 1N vertical force



Structural - Displacement Excitation

- Displacement Excitation
 - Assignment: Faces and Edges
 - Normal To (faces)
 - Magnitude
 - Components (faces and edges)
 - X, Y, Z components
 - Each component can be fixed magnitude or free



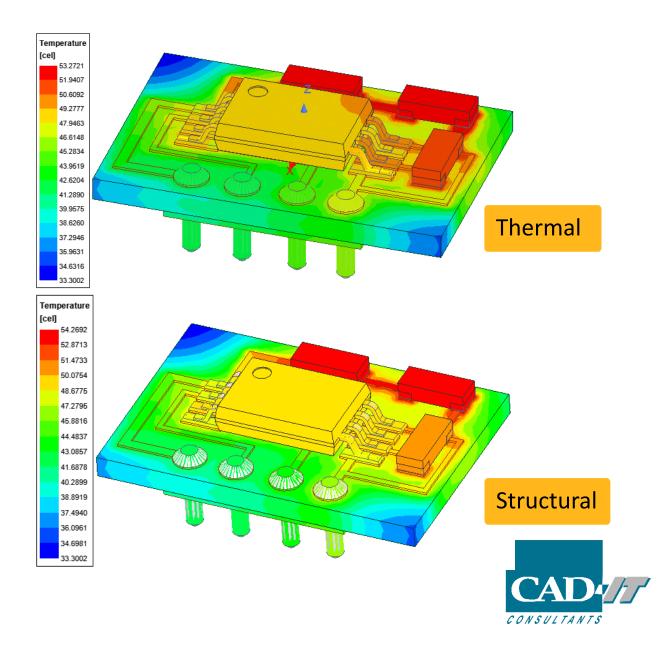
PCB Assembly with Y, Z displacements along edge

Displacement	Displacement	\times
Name Displacement2 Defined By	Name Displacement 1	
C Components Displacement Magnitude 0.5 mm	Displacement Coordinate system Global X Component Free Y component Free Z Component Free Imm Imm	
Use Defaults OK Cancel	Use Defaults OK Cancel	



Thermal Stress Analysis - Link to Mechanical Thermal

- Coupled Thermal Stress Analysis
 - Linked to Thermal design
 - Thermal condition excitation
 - Temperatures imported for objects
 - System Coupling mapper
 - Temperature field plots

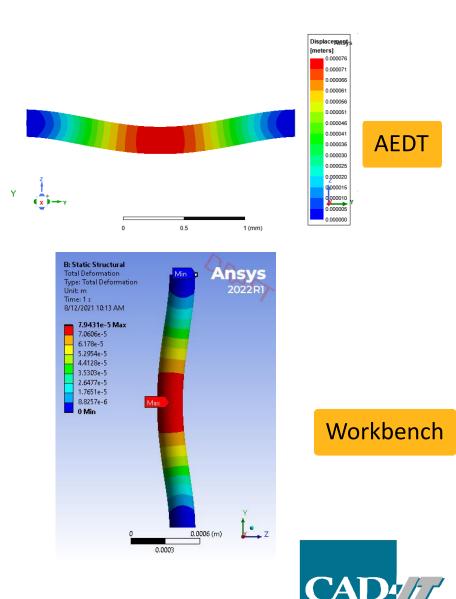


EM Force – Structural Coupling

- Coupled EM Force Structural Analysis
 - Linked to Maxwell 3D
 - Surface and Volume assignment
 - Linked to HFSS
 - Surface assignment
 - Assignment: Faces and Objects
 - 1-way coupling support

Setup Link				>
General Variable	Mapping			
Product:	ElectronicsDesktop 💌			
Source Project:	✓ Use This Project			
	Save source path relative to:			
	C The project directory of selected product			
	This project			
	This Project* - busbars2			
Source Design:	Maxwell3DDesign1		•	
Source Solution:	Setup1 : LastAdaptive		-	
Preserve sou	ce design as needed ree design solution ctor mode, source project will be saved upon exit.			
	ОК	1	Ca	ncel

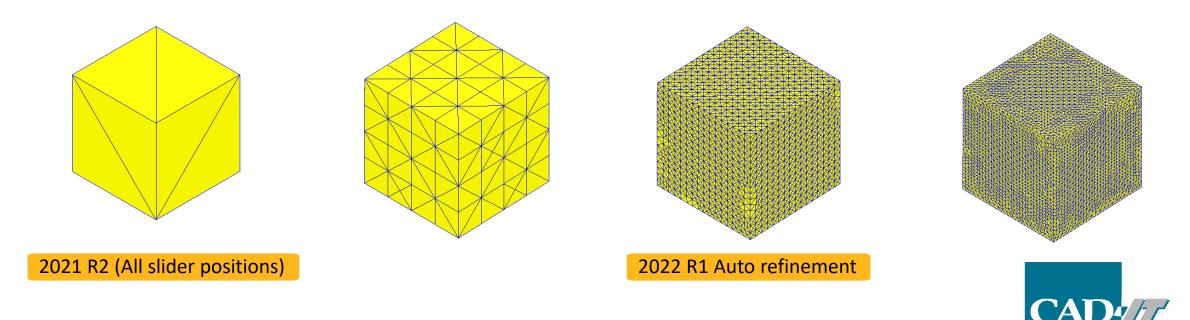
Force		×
Force		^
Name Force:	1	
Force		
C Uniform		
Coordinate system	Global	1
X Component	1	newton 💌
Y component	1	newton 💌
Z Component	1	newton 💌
Non-Uniform	Setup Link	
	Use Defaults	
OK		Cancel



CONSULTANTS

Automated Slider-bar Meshing – Mechanical Thermal [Beta]

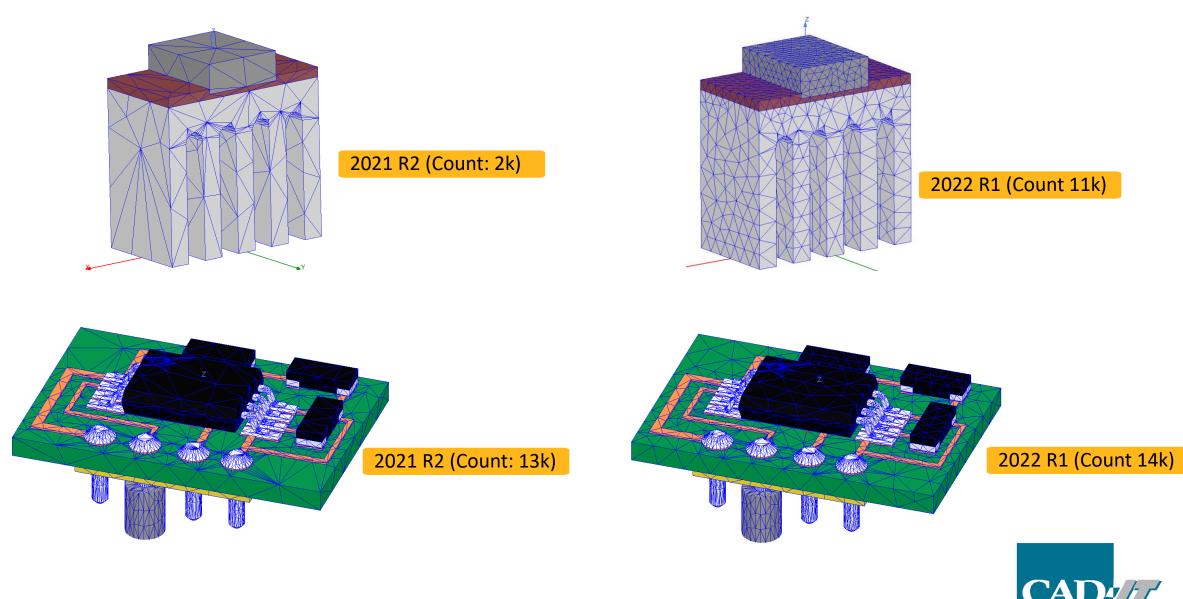
- Automated refinement based on slider position
 - Length-based refinement inside and on surfaces of all objects
 - Refinement tailored to curvilinear and rectilinear geometries
- Restrict the need for user-defined mesh operations
- Improved solution accuracy



CONSULTANTS

28

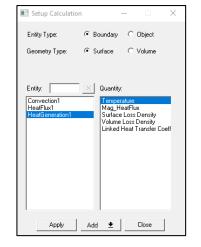
Automated Slider-bar Meshing – Mechanical Thermal [Beta]



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Fields Summary

- User-friendly report calculation capability
 - Supports all Fields Calculator variables
 - Boundary and Object selection
 - Surface and Volume calculations
 - Min, Max, Mean, Standard Deviation, Total**
 - Multi-select and multiple calculations
 - Export to CSV format



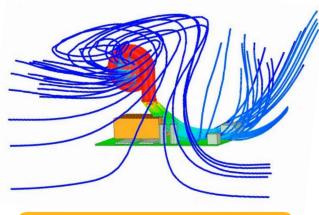
Solution:	Setup1 : Solu	Setup1 : Solution							•		
Design Variatio	on: Nominal								-		
alculations:											
Entity Type	Geometry Type	Entity	Quantity	Side	Normal	Min	Max	Mean	Stdev	Area	Setup
Boundary	Surface	Convection1	Temperature[C]	Default		87.2397	91.2407	88.6246	0.974567	0.0117:	
Object	Surface	Box1	Temperature[C]	Default		87.2397	91.2664	88.8164	1.12229	0.0128!	Delete
Object	Volume	Box1,Box2,Box3	Temperature[C]	Default		87.2397	92.0858	89.4631	1.38128	3.4966	Clear All
Object	Surface	Box1	Mag_HeatFlux[W/m^2]	Default		2065.29	48196	18972	9898.65	0.0128!	
_										>	

** Total and Heat Flow Rate available for Objects, but not boundaries

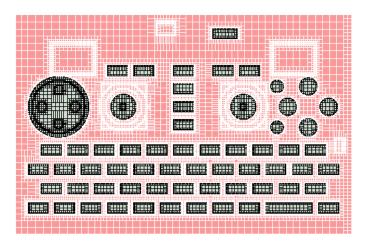


/ Icepak 2022 R1 Highlights

- Reduced Order Modeling (ROM)
 - Redhawk CTM 2-Way & New Delphi Network Creation
- Blower Modeling
- ECAD Import Wirebond & IDX
- Maxwell 2D Icepak EM Loss Coupling



Streamlines into and out of a Centrifugal CAD Blower cooling a PCB assembly

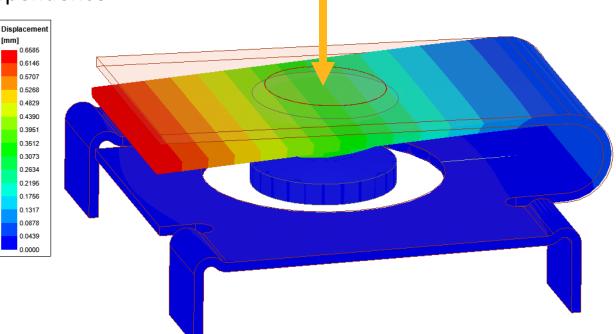


- Mesher Enhancements 2.5D Improvements
- User Experience
 - Streamlines & Validation Enhancements
 - Improved Error messaging & troubleshooting
- Migration
 - Improve speed of TZR conversion
 - Network Schematic enhancements
 - Toolkit enhancements
 - PCB, Package parameterization



Mechanical 2022 R1 Highlights

- Coupling
 - Maxwell 2D Thermal EM Loss Coupling
- Materials
 - General expression support for temperature-dependence
- Structural Beta
 - Boundaries
 - Displacement
 - Pressure/Force
 - Coupling
 - Mechanical Thermal-Structural Link
 - EM Force Structural Coupling
- Meshing Beta
 - Thermal Slider bar Meshing
- Reporting
 - Fields Summary







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