EDA Support and Roadmap for 3D Printing of Electronics

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Agenda

- Zuken Corporate and Solution Overview
- CR-8000: System-level Design Platform
- Challenges and Roadmap for 3D Printing of Electronics
Zuken Corporate Overview
Zuken Technology Scope

Leading-edge EDA/CAE System integrated with Enterprise PLM

Engineering Design Automation for Electrical Design Process, CAD/CAM/CAE, Co-Design
  - System-level Electronics & Conceptual Design
  - System-level Circuit & PCB design & DFM
  - Interconnection design with Wire-Harness or Flexible PCB
  - System-in-Package & Module Design & DFM
  - SOC/PKG/PCB Collaboration Design & DFM
  - Electro-Mechanical Collaboration Design

Product Data Management, Product Lifecycle management for Electric & Electronic Products
  - Library Management & Design Data Management
  - Integration as Electric and Electronic EDM with Enterprise PLM Environment

Targets of Zuken’s Design & Manufacturing Solution

- Single Board Design
- Single Chip Multichip (Flat Layout) Package Design
- System in Package Design 3D/2.5D/TSV Chip Stack & PoP/PiP Module
- System in BOX Multi-Boards with Wire-Harness/Flexible-PCB
- System of Systems with Units & Wire-harness/Network
Zuken Product Portfolio
A Reliable Partner for Electrical and Electronic Design

Product-centric design

CR-8000
PCB and IC Package
Harness, Cable, and Control Systems
Library and Design Data Management

Intelligent electrical design

Engineering data management
CR-8000: System-level Design Platform

- System Planner
- Design Gateway
- Design Force
- DFM Elements
- DFM Center
CR-8000: System-level Design Platform

System Plannner
- Block Diagram Design
- Function/Board Partitioning
- Multi-board Floor Planning
- Space & Connection Planning

Design Gateway
- System Circuit Diagram
- Hierarchy Design
- Modular Design
- Rich DRC & Design Review

Design Force
- Single & Multi Board with 3D
- Constraints Driven Design
- Intelligent Routing
- SI/PI Engine Embedded

DFM Center
- Paneling & Manufacturing
- Multi CAM Format support
- Artwork & Paneling
- MRC and CAM Generation

Area& Space Feasibility Check and Optimization
Conceptual Level SI/PI/Thermal Analysis
SPICE/Saber/Simplorer
Verilog/Verilog-AMS VHDL/VHDL-AMS
Circuit Rule Check for System-level
Embedded SI/PI/EMI Sim. for System-level
Intelligent Router DRAGON Router EX
3rd Vendor SI/PI/EMC/RF/Thermal Analysis
DRC & EMC Adviser EX for System-level
Manufacturing Rule Check

System-level Conceptual Design
Module/Function Block Reuse Design
Wire Harness Co-Design
FPGA Co-Design
Multi-Board Concurrent Team Design
Multi-Area Concurrent Team Design
SOC/PKG/PCB Co-Design
Mechanical 3D Co-Design (Detail)
JTAG System Co-Design
Test Process Co-Design

Data/Variant/Version Management linked with Design Structure
Library Management for Components Symbol/Footprint/3D Model/Module
System-level High-Speed Constraints & SI/PI/EMI Analysis
Function/Block/Module Hierarchy
Physical Constraints & Manufacturing Rules
Board/Panel Hierarchy

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Key Focus Areas for CR-8000

Technology
- Latest Technologies
  - SW/HW/App

Collaboration
- Boundary-free Design Process
  - Co-Design

Globalization
- Global Partners for Global Competition
  - Flexible Process
Supporting the Latest Technologies with CR-8000

World’s highest performance with large Scale Design Data

High-Performance Verification

A
B
DF

High-Performance Design

Ultra-Large Scale Design

Nonstressful editing with over 100 layer board

Intuitive User Interface, Unified Interactive & Automatic Design

Intuitive Auto-Routing

AutoA
AutoB

Supporting New PCB/SIP/3D-IC Technologies with Native 3D Graphics

Embedded Components

PoP/PiP/3D-IC/TSV

Dynamic Technology Editing
Supporting the Latest Technologies with CR-8000
Supporting the Latest Technologies with CR-8000
Supporting the Latest Technologies with CR-8000
Enabling Collaboration with CR-8000

Design & Review with System-level Design (PCBs & Interconnections)
- System-level DRC & Verification
- System-level SI/PI Analysis
- CR-8000 Technology Partners

Collaboration with Other Design Process
- SoC/PKG/PCB Co-Design
- FPGA Co-Design
- Electro-Mechanical Co-Design

Concurrent Parallel Design & Team Design from Different Locations
- Multi-Area Concurrent Design
- Multi-Board Concurrent Design
- Multi-Object Concurrent Design

Boundary-free Design Process

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Enabling Collaboration with CR-8000

3.4.3 ANSYS Multi-domain Simulation Environment

- Design Force
  - Multi-Board and Interconnections

- Mechanical CAD
  - Structure/Objects

- Multi Physics Analysis
  - SI/PI
  - EMC(SD)
  - EMC(LD)
  - Thermal Flow
  - Other Physical Analysis

- 3D Data with Electrical Information
  - Including both electrical & mechanical
  - Parametric information for E&M
  - Components & Materials

CR-8000 Technology Partners
- Keysight Technologies
- National Instruments
- Synopsys
- CST
- Ansys

Electro-Mechanical Co-Design
GPM

Multi-Object Concurrent Design
Multi-Level Design (PCBs & Interconnections)

Collaboration from Different Locations

SoC/PKG/PCB Co-Design
Electro-Mechanical Co-Design
System-level DRC & Verification
System-level SI/PI Analysis
Technology Partners

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Enabling Collaboration with CR-8000

3.4.4 Interface and collaboration with RF design and analysis environments

**ABL (.xml)**

- Lines, Area fills, Vias, Terminals, and Components
- Specified ports
- Specified layers
- Design variations

**ABL Format**

- Specify output signal
- Clip a range with auto-offset
- Specify port to output
- Output passive component
- Delete isolation
- Slitting ground via
- Exclude line when converting to polygon

**Analysis and verification**

- Analysis and verification (C-Simulator and Momentum)
- Analysis and verification (SIPro/PIPro)
- Characteristic optimization by What-if analysis

**Design Force**
Enabling Collaboration with CR-8000

Collaboration

Boundary-free Design Process
Enabling Collaboration with CR-8000

Collaboration

Boundary-free Design Process
Enabling Collaboration with CR-8000

Collaboration

Boundary-free Design Process
Promoting Globalized Engineering of Electronics

Globalization

Global Partners for Global Competition

IP management with Design and Manufacture Data for BPO

Excluding IP from Design

Design Constraints

Automatic IP Optimization

Improved output format

Flexible Design & Manufacture Process

Vertical Design & Parallel Design

System-level Design Change

Multi Format CAM In/Out

Integration with DS-2, Open SDK for customer development

DS-2 Embedded with CR-8000

Modular Design Method

Open SDK

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Promoting Globalized Engineering of Electronics

Globalization

Global Partners for Global Competition
3.5.1 DFM for Inkjet

- Design for Manufacturing of Metal Ink Jet Printer
- Wide Application Coverage
  - FPD: Electrical paper/OLE display/Inorganic EL display
  - Solar: Organic thin film, dye-sensitized RFID: Antenna, circuit
  - OLED lighting
  - Floor/table censor network
  - Primary battery, rechargeable battery
  - Contactless charging system
  - Wire circuit, SiP etc...
- Vector/Raster Intelligent Conversion
- Optimization of dot size and dot pitch
- Optimizing number of dots/area
- Intelligent Optimization/Verification/Compensation
- Optimization for Thickness Control
Challenges and Roadmap for 3D Printing of Electronics
Challenges in 3D Printing for Electronics

- Limited options for conductive materials
  - Different behavior
  - Different design rules

- Optimizing traditional CAD data for 3D printing
  - DRCs for 3D printing
  - DFM/CAM for 3D printing

- Form factor vs board size
  - Desktop vs floor

- Assembly
  - Managing component placement

- Joint Project with Fuji Machine Mfg. Co., LTD. Features of FUJI's Functional 3D Printer
  - Supporting “Inkjet technology” for 3D build-up PCB, and component mounting (including component embedding), and flexible manufacturing process
- Joint Project Step-1 (2014 - 2015 on Conventional 2D PCB-CAD)

- CR-8000 Design Force for Fuji’s Functional 3D Printer
  - Design Force has dynamic 3D design and analysis features for system-level design
  - Support for dynamic editing of “Board Technology” with embedded component.
- Joint Project Step-2 (now in planning on CR-8000)
Roadmap for Support of 3D Printing – Nano Dimension

- Dragonfly 2020 can support output from Design Force today
- Innovation of Module/MID Prototyping
- New Manufacturing Methodology Package/PCB Technology
- Direct connection of CR-8000 to Dragonfly 2020
Summary

✓ Unique conductive materials
  ✓ Support for rules by materials
  ✓ Download design rule kits

✓ Optimizing traditional CAD data for 3D printing
  ✓ DRCs for 3D printing
  ✓ DFM/CAM for 3D printing

☐ Form factor vs board size
  ☐ Desktop vs floor

☐ Assembly
  ☐ Managing component placement