Parameterized Cells (PCells) of devices are key elements used to increase flexibility and productivity during layout implementation of analog and mixed-signal designs. The development and maintenance of PCell libraries typically requires device knowledge and programming expertise.

Provided as a Virtual Integrated Computer-Aided Design (VCAD) productivity package, PCell Designer combines the ease of use of a graphical user interface (GUI) with a powerful object-oriented architecture for creation of reusable PCell classes and libraries, reducing PCell development from multiple weeks to several days.

**PCell Development Challenges**

Development and maintenance of PCell libraries requires dedicated resources with specific skill profiles. There are multiple requirements in terms of complexity, technology rule agnostics, performance and maintainability. Additional challenges arise for small nodes with special DRC rules, e.g. 20 nanometers and below.

These requirements are typically addressed by programming PCells in SKILL or other languages. Managing of code databases, maintenance, reuse and applicability across technology nodes needs to be mastered.

PCell Designer is the next-generation object-oriented graphical PCell development environment addressing all of these challenges.

**PCell Designer Overview**

PCell Designer targets PCell developers and layout engineers who understand their device requirements. It provides an intuitive GUI within the Cadence® Virtuoso® Layout Suite to develop and debug PCells. Programming skills are not required. However programmers can interact on a SKILL/SKILL++ level if desired.

The result of the designed PCell is shown in a PCell rendering window in real time. There is no need to compile the PCell or to restart Virtuoso in order to see the results. Powerful debugging mechanisms allow stepwise execution and visualization of the PCell. Compared to code-based debuggers the higher level of abstraction gives superior debugging capabilities while maintaining full control over how the PCell is built. All PCell building commands are managed from the main GUI.

**Develop your PCell(s)**

**Draw Shapes**

Define shapes that belong to a device in your Virtuoso Layout Editor. Alternatively you may use any OpenAccess (OA) layout view, an existing SKILL PCell or a GDS imported layout database as a starting point.

**Build your PCell**

Import the shapes into the PCell Designer main GUI and then apply commands. These commands control the shape modifications, dependencies between shapes and layers, stretching, repeats, pitches, contact creation and connectivity.

**Figure 1: PCell Development Flow in Virtuoso**
Shapes and dimensions can be identified using a powerful geometric query mechanism.

You can use rulers instead of typing in values and use them with the building commands. CDF parameters, as well as any number of additional parameters, can be used to control the commands.

**Validate PCell variants**

Check the results in the PCell Rendering Window. A stepwise debugger allows you to view each command and its effect on the PCell. Instantiate as many PCell variants as needed to check the results visually and perform DRC checks, e.g. using iPVS within Virtuoso.

**Deploy PCell Library**

The final PCell library is a standalone library ready for use. It does not require a PCell Designer license for the end user.

**Benefits**

- Significant reduction of PCell development time
- Real time PCell rendering window
- Easy to learn workflow
- Leverages object-oriented capabilities with a couple of mouse clicks
- No specific programming knowledge required
- Built-in debugger for faster verification
- Powerful command library, clear structure and sequence, easy to maintain and hand over
- PCell maintenance becomes a lower-effort task and can be shared across team members
- Re-use of class libraries for device families and across technology nodes
- Generated PCell libraries are self sufficient and do not require an extra license to be used within Virtuoso

**Features**

- Full support of SKILL and SKILL++ including object-oriented programming styles
- No setup required. Technology rules are taken directly from the technology library. Additional rules or overrides can be specified
- Comprehensive set of commands for shape manipulation, contact/via generation, connectivity, intra device level routing functionality, etc.
- Ability to define device classes and to be used in an object-oriented hierarchical manner
- Possibility to combine individual commands into new methods to create your own generic commands for re-use
- Switch display between the command sequence or the generated SKILL code in the main GUI
- Cross reference and highlight between selected shapes in layout window, PCell rendering window and commands
- Supports hierarchical PCell instantiation
- Export complete PCell library, ready to use

**Supported PCell Features**

- Basic shape commands, including stretch, repeat, copy
- Advanced editing commands, including follow shape, follow path, modify corners, geometry queries
- Virtuoso XL Connectivity, Auto-Abutment
- Hierarchical PCells (modules)
- Derive PCells from templates
- Base PCells on existing CDF; or create CDF
Object-Oriented Features

PCells are objects
  • Define templates (classes)
  • Define variants by deriving from templates (subclasses)

Create complex devices by placing several PCells
  • Place several sub-instances
  • Configure instances based on parent parameters
  • Create extra geometry (e.g. routing)

Define behavior by writing commands (methods)
  • Re-use behavior by putting commands in mixins
  • Add/remove geometry (e.g. add a guardring)

Supported Design Environment
  • Fully integrated within the Virtuoso platform
  • Tool versions: IC 6.1.5, IC6.1.6, ICADV12.1

Example of PCell Classes

VCAD Productivity Packages

VCAD Productivity Packages are a set of pre-packaged generic core solutions that increase design system productivity. Productivity Packages are available within services contracts, which include the package integration and maintenance of the customized solution. Cadence VCAD services targets the development, implementation, and ongoing improvement and maintenance of productive design systems to ensure short time to market and silicon success.

PCell Designer is available through Cadence VCAD Services. For more information, please contact:

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