

IDA Coupling Workflow

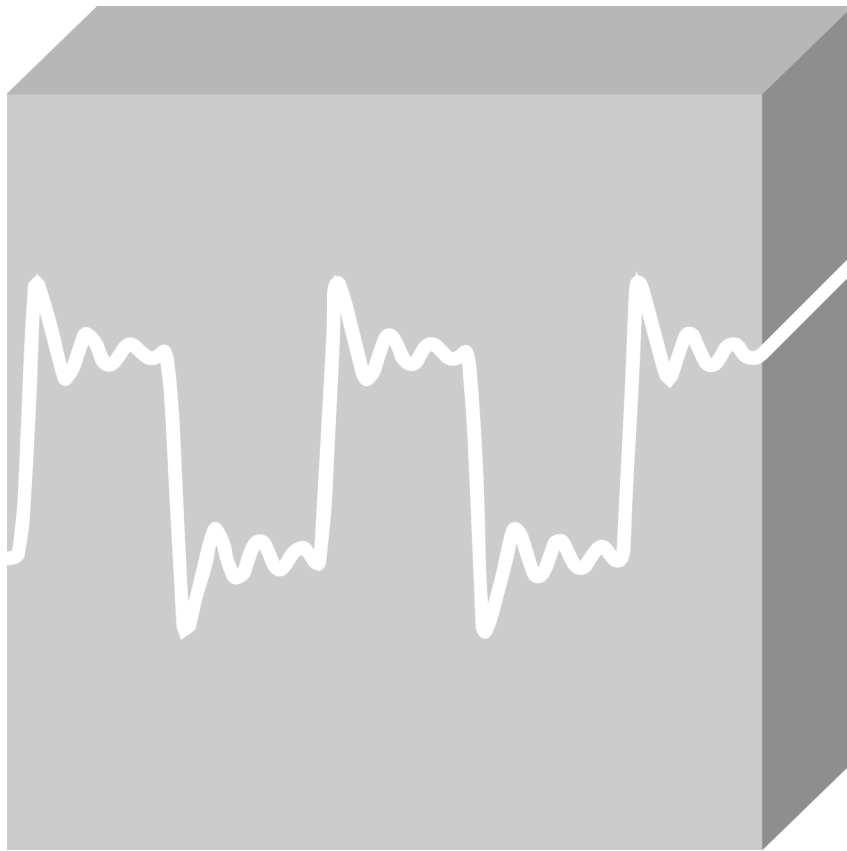


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1 Software Prerequisites

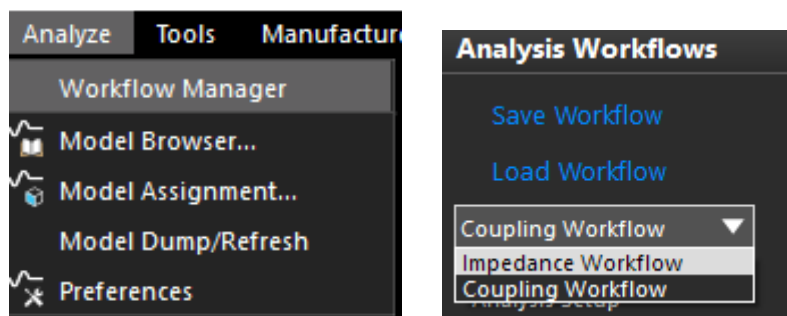
To use Sigrity Aurora, Allegro IDA, Topology Explorer, or SystemSI products from Allegro schematic or layout editors, you require both the following installations:

- Sigrity 2019 Hotfix 001 or higher
- OrCAD and Allegro Release 17.40-2019 QIR1 or higher
 - Install the latest versions of both products.

2 Starting Coupling Workflow

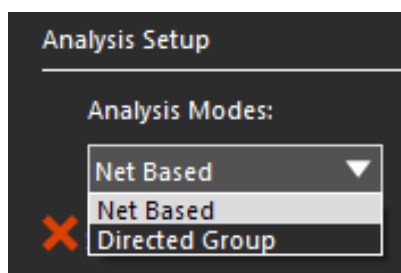
In OrCAD PCB Designer Professional, open the Workflow Manager by selecting **Analyze > Workflow Manager** from the menu. Make sure **Coupling Workflow** is selected.

The Analysis Workflow Manager will walk you through the necessary steps and settings to perform the Impedance Analysis.



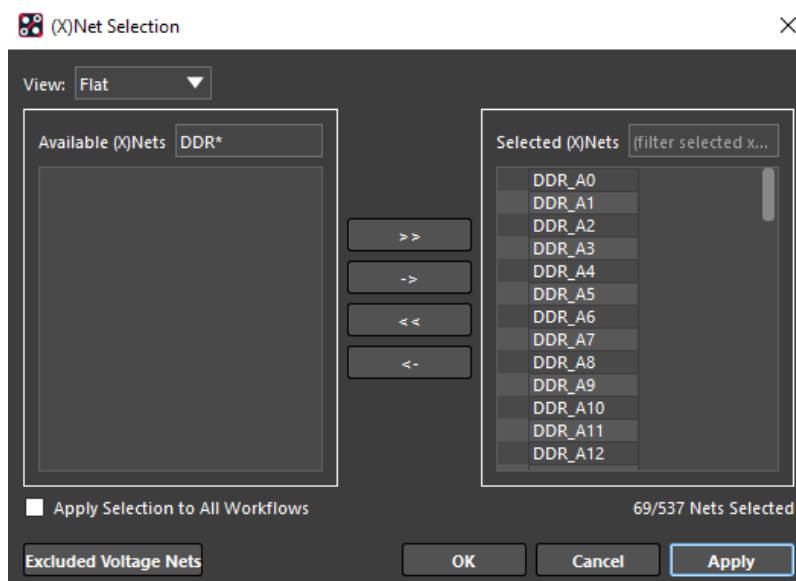
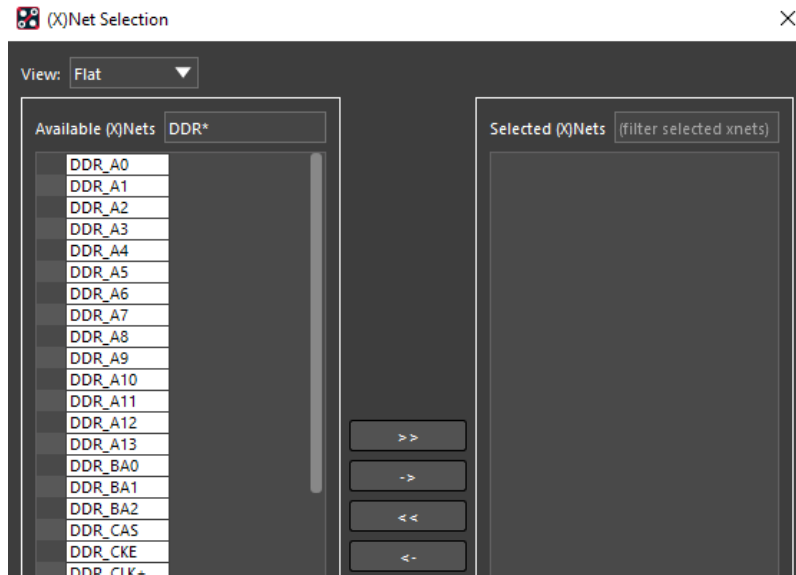
3 Performing Coupling Analysis

- Choose either Net Based or Directed Group from **Analysis Modes**. Net Based is chosen by default.

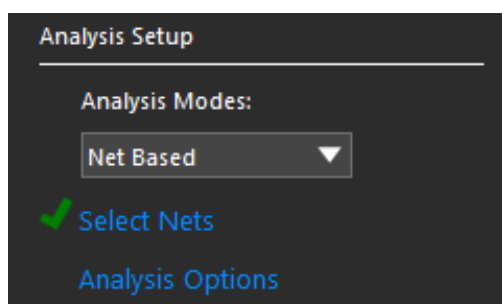


- Select the link for **Select Nets** nets or specify directed groups based on the analysis mode. In terms of setting up directed groups, you will find more information in section **Specifying Directed Groups**.
In the upper-left section of the dialog, notice the choice of **View**.
The **Flat** view lists all nets in the design in alphabetical order.
The **Hierarchical** view lists the nets under defined hierarchy objects, such as differential pairs, net groups, bus, XNets, or nets.

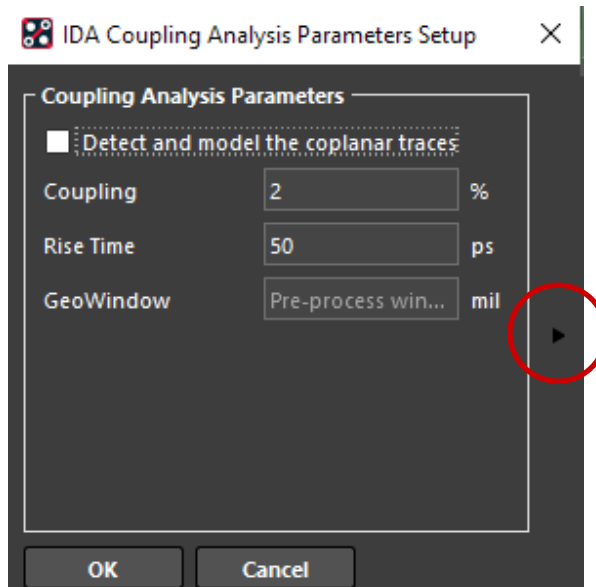
Use **Flat** when filtering by net name and use **Hierarchical** when selecting by Bus or Net Group.



Notice that there is now a green check mark next to Select Nets and that the Start Analysis link is now active.



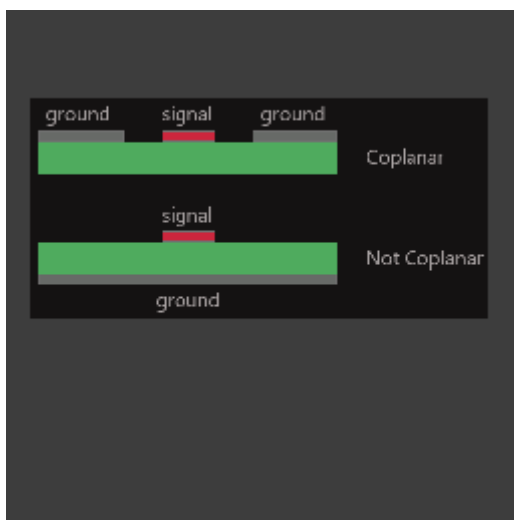
- Click **Analysis Options**. The Coupling Analysis Parameters dialog appears. Click on the small arrow to open additional information.



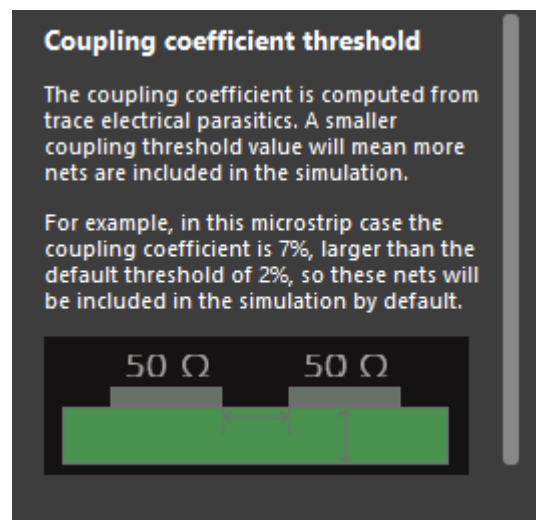
Specify the following parameters:

Coupling and **Rise Time** are essentially used to eliminate segments that are below a specific coupling coefficient. These default values produce reasonable results.

- Detect and model the coplanar traces: Choose to include **coplanar data** in the simulation results.
- **Coupling**: Specify the minimum net level coupling coefficient threshold in percentage. The default value is 2%.
- **Coupling Percent**: This is the near-end coupling coefficient threshold for a coupled line configuration. If the calculated coupling coefficient is less than the specified threshold, the lines will not be considered as coupled. This value is calculated on a per unit length based on parasitics of traces.

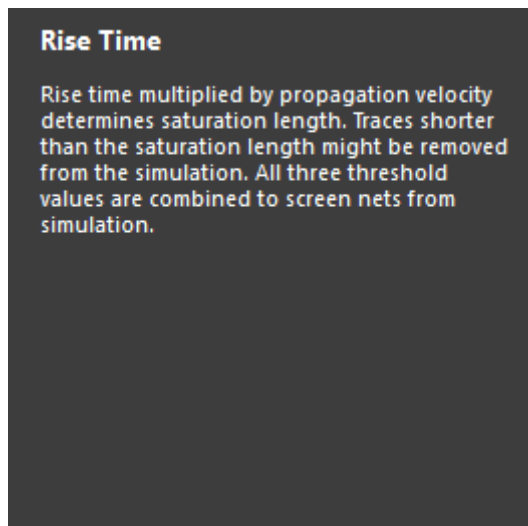


Coplanar data option

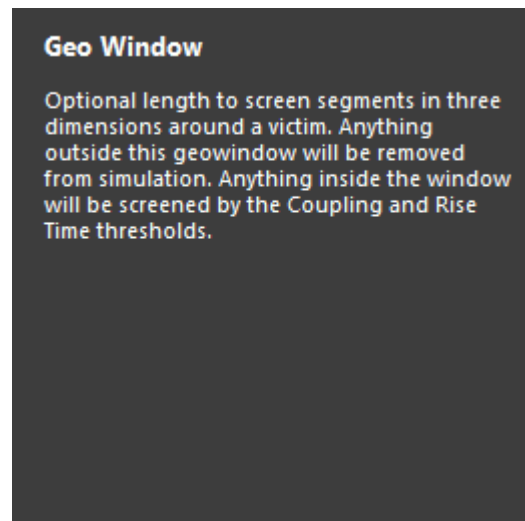


Coupling coefficient option

- **Rise Time:** Specify the rise time for minimum coupled length in ps (picoseconds). The default is 50ps. Rise Time is used to calculate a saturation length (a characteristic of near-end coupling).
- **GeoWindow:** Set a geometry window value in design units for aggressor inclusion for the selected victim nets.
The GeoWindow allows for a defined distance around each selected net (in all directions based on the cross section of the trace) in which to look for potential aggressors. These potential aggressors will be included in the analysis.
All net segments within the specified distance from the selected net across layers will be considered as aggressors.
This is optional for coupling analysis and allows for additional potential aggressors to be found based on the window.

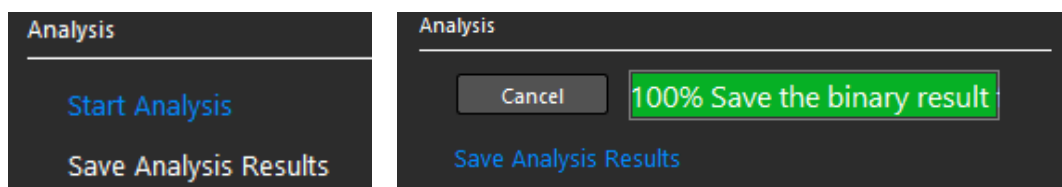


Rise time option



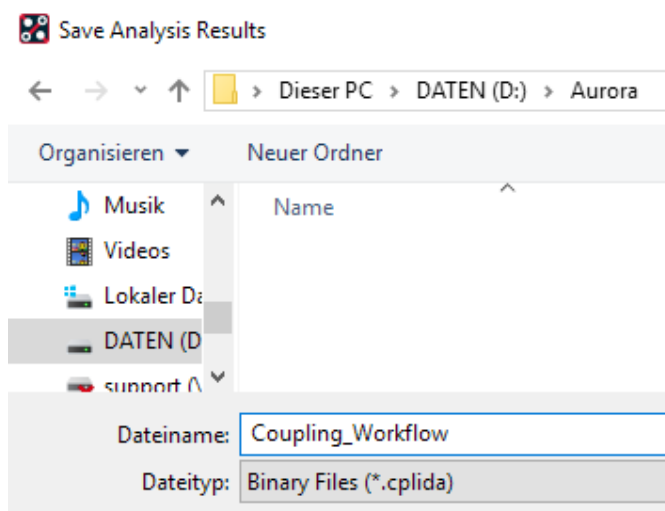
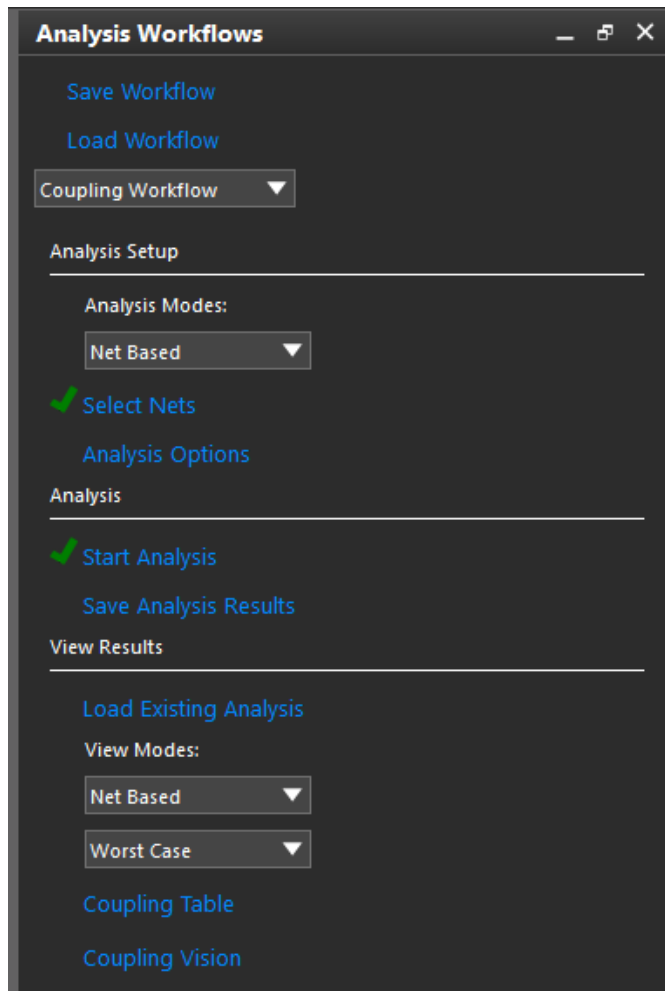
GeoWindow option

- Click **Start Analysis**. A progress meter will appear.



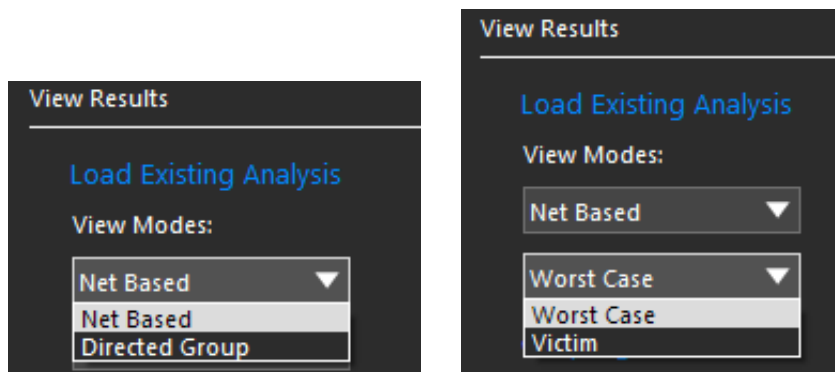
- When analysis is complete, a green check will appear for the Start Analysis task. If a previous analysis is stored, a prompt appears for overwriting the old analysis.
- The Save Analysis Results link also becomes active now.

- Click **Save Analysis Results** to save the results. Specify a name and location for the results file. The extension for the result file is .cplida for coupling analysis.



Make sure the pulldowns in the **View Results** section of the workflow are set to **Net Based** and **Single Ended**, and select the Impedance Vision link.

- Specify **View Modes**. Choose:
 - Net Based** to view results for all segments of selected nets. Available for all analysis results.
 - Directed Group** to view results for segments defined in selected directed groups. Available only if analysis results contain directed group data.
 - Worst case** to view the maximum coupling coefficient for all segments of selected nets.
 - Victim** to view aggressor segments for a selected victim net.



- Coupling Table
 - Coupling Table**, **Worst Case** and **Victim modes** differ in the way aggressors are color coded in the table.
- Summary Table** lists summary coupling results for each net selected for analysis. Detailed Table lists the coupling results for each segment on the net selected in Summary Table.
- Detailed Table** provides a hierarchical view where each victim segment and all related aggressors are listed in one block of information as contiguous rows. Within the victim segment block, the aggressors are listed in the order of the highest coupling coefficient. If coupling coefficients are same, length is considered for ordering.
 - The first row in each block is the victim summary line and displays the total aggressor count for the block in the first column. If the block hierarchy is contracted, the aggressor with the highest coupling coefficient and longest length is displayed.

- In **Worst Case** mode, the coupling coefficient (Coupling Coef) column is color coded on the victim summary line and the maximum aggressor within the block. The coupling coefficient column for non-maximum aggressors is colored gray.

Simulation Table

Worst Case Mode

Summary Table

Net Name	Aggressor Net Name	Max Coupling Coef(%)	Length(%)	% Length with Coupling Coef > 5%	2%~5%	Total Coupling Index (mils-%)
DDR_A0	DDR_CS	10.30	1.68	19.37	34.87	6004.74
DDR_A1	DDR_A4	5.20	0.74	3.05	74.87	9283.96
DDR_A2	DDR_A3	5.80	0.59	0.59	62.12	7434.36
DDR_A3	DDR_A2	5.80	0.56	7.16	65.49	8215.06
DDR_A4	DDR_A1	5.20	0.70	2.88	77.29	9062.20
DDR_A5	DDR_A2	3.40	5.57	0.00	26.20	3114.36
DDR_A6	DDR_BA1	6.10	0.46	4.85	48.63	5616.28
DDR_A7	DDR_A13	6.50	0.30	2.69	57.30	6879.17
DDR_A8	DDR_A6	5.90	4.67	5.83	72.97	9813.60
DDR_A9	DDR_A7	5.40	2.50	2.50	40.35	5350.59
DDR_A10	DDR_A8	5.50	0.55	9.06	53.77	7073.82
DDR_A11	DDR_A6	4.40	1.65	0.00	77.12	8240.05

Detailed Table

Victim Trace Ref	Aggressor Net	Aggressor Trace Ref	Coupling Coef	Length	Layer	Victim Segment	Aggressor Segment
(1) Trace2429::DDR_A0	DDR_CS	Trace938::DDR_CS	10.30	7.42	INT3	(1711.00 2229.00), (1716.2...	...
Trace2429::DDR_A0	DDR_CS	Trace938::DDR_CS	10.30	7.42	INT3	(1711.00 2229.00), (1716.2...	(1705.25 2234.75), (17...
(1) Trace2429::DDR_A0	DDR_CS	Trace753::DDR_CS	10.30	33.59	INT3	(1758.75 2276.75), (1782.5...	...
(2) Trace2429::DDR_A0	DDR_CS	Trace753::DDR_CS	9.93	7.08	INT3	(1716.25 2234.25), (1721.2...	...
(2) Trace2429::DDR_A0	DDR_CS	Trace753::DDR_CS	9.93	30.40	INT3	(1737.25 2255.25), (1758.7...	...
(2) Trace2429::DDR_A0	DDR_CS	Trace753::DDR_CS	9.93	22.63	INT3	(1721.25 2239.25), (1737.2...	...
(2) Trace2387::DDR_A0	DDR_BA0	Trace1339::DDR_BA0	6.08	20.76	INT4	(1481.24 3089.76), (1502.0...	...
(2) Trace2387::DDR_A0	DDR_BA0	Trace1339::DDR_BA0	6.08	66.96	INT4	(1533.50 3089.76), (1600.4...	...
(3) Trace2387::DDR_A0	DDR_BA0	Trace1339::DDR_BA0	6.07	31.50	INT4	(1502.00 3089.76), (1533.5...	...
(1) Trace2430::DDR_A0	DDR_CS	Trace752::DDR_CS	6.03	6.17	INT3	(1711.00 2200.33), (1711.0...	...
(2) Trace2430::DDR_A0	DDR_CS	Trace752::DDR_CS	6.03	3.45	INT3	(1711.00 2196.88), (1711.0...	...
(2) Trace2430::DDR_A0	DDR_CS	Trace752::DDR_CS	5.96	8.00	INT3	(1711.00 2206.50), (1711.0...	...
(2) Trace2430::DDR_A0	DDR_CS	Trace752::DDR_CS	5.96	14.00	INT3	(1711.00 2214.50), (1711.0...	...
(1) Trace2430::DDR_A0	DDR_CS	Trace937::DDR_CS	5.54	0.50	INT3	(1711.00 2228.50), (1711.0...	...

- In **Victim mode**, the coupling coefficient column is color coded for all aggressors but the victim summary line is gray. On the victim summary line, the victim segment column is color coded with the default color as it appears on the canvas.

Simulation Table

Victim Mode

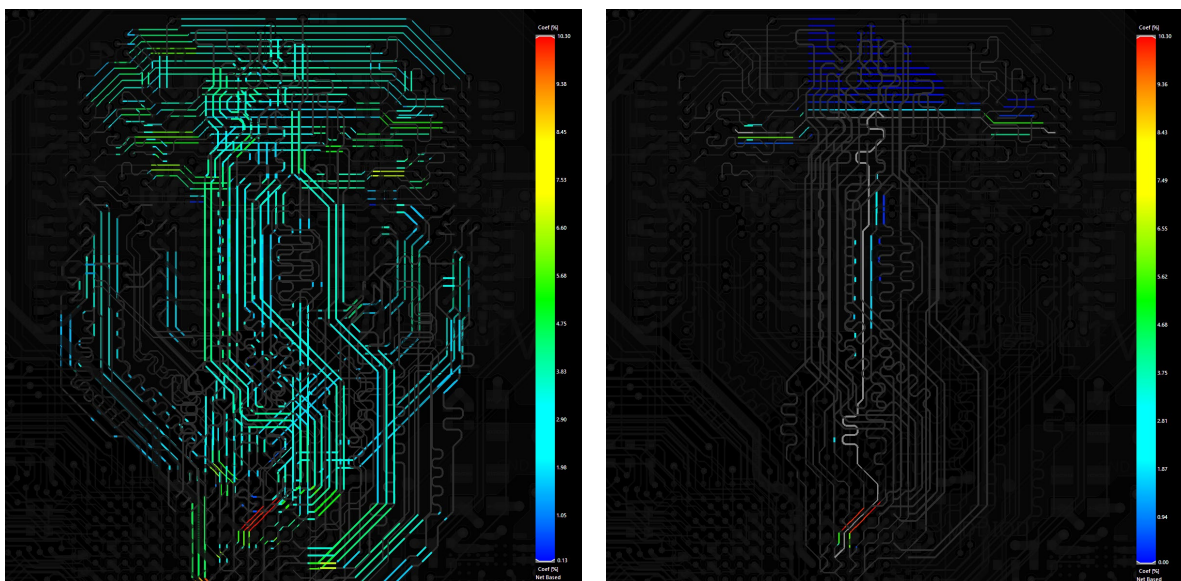
Summary Table

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DDR_A3	DDR_A2	5.80	0.56	7.16	65.49	8215.06
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DDR_A6	DDR_BA1	6.10	0.46	4.85	48.63	5616.28
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DDR_A9	DDR_A7	5.40	2.50	2.50	40.35	5350.59
DDR_A10	DDR_A8	5.50	0.55	9.06	53.77	7073.82
DDR_A11	DDR_A6	4.40	1.65	0.00	77.12	8240.05

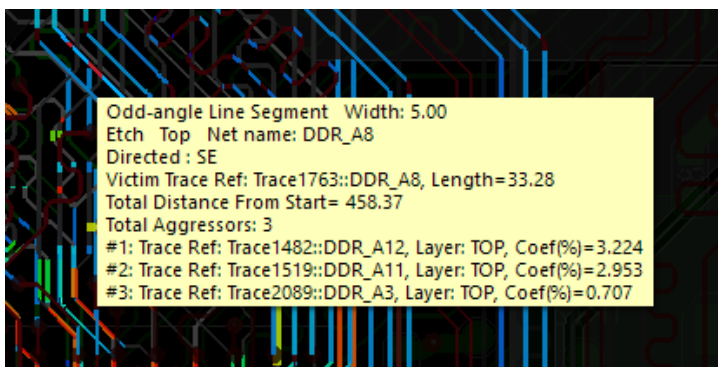
Detailed Table

Victim Trace Ref	Aggressor Net	Aggressor Trace Ref	Coupling Coef	Length	Layer	Victim Segment	Aggressor Segment
(1) Trace2429::DDR_A0	DDR_CS	Trace938::DDR_CS	10.30	7.42	INT3	(1711.00 2229.00), (1716.2...	...
Trace2429::DDR_A0	DDR_CS	Trace938::DDR_CS	10.30	7.42	INT3	(1711.00 2229.00), (1716.2...	(1705.25 2234.75), (17...
(1) Trace2429::DDR_A0	DDR_CS	Trace753::DDR_CS	10.30	33.59	INT3	(1758.75 2276.75), (1782.5...	...
Trace2429::DDR_A0	DDR_CS	Trace753::DDR_CS	10.30	33.59	INT3	(1758.75 2276.75), (1782.5...	(1764.50 2271.00), (17...
(2) Trace2429::DDR_A0	DDR_CS	Trace753::DDR_CS	9.93	7.08	INT3	(1716.25 2234.25), (1721.2...	...
(2) Trace2429::DDR_A0	DDR_CS	Trace753::DDR_CS	9.93	30.40	INT3	(1737.25 2255.25), (1758.7...	...
(2) Trace2429::DDR_A0	DDR_CS	Trace753::DDR_CS	9.93	22.63	INT3	(1721.25 2239.25), (1737.2...	...
(2) Trace2387::DDR_A0	DDR_BA0	Trace1339::DDR_BA0	6.08	20.76	INT4	(1481.24 3089.76), (1502.0...	...
(2) Trace2387::DDR_A0	DDR_BA0	Trace1339::DDR_BA0	6.08	66.96	INT4	(1533.50 3089.76), (1600.4...	...
(3) Trace2387::DDR_A0	DDR_BA0	Trace1339::DDR_BA0	6.07	31.50	INT4	(1502.00 3089.76), (1533.5...	...
Trace2387::DDR_A0	DDR_BA0	Trace1339::DDR_BA0	6.07	31.50	INT4	(1502.00 3089.76), (1533.5...	(1502.00 3078.90), (15...
Trace2387::DDR_A0	DDR_A3	Trace2026::DDR_A3	2.55	31.50	INT4	(1502.00 3089.76), (1502.0...	(1502.00 3106.00), (15...
Trace2387::DDR_A0	DDR_A10	Trace1605::DDR_A10	0.81	31.50	INT4	(1502.00 3089.76), (1502.0...	(1502.00 3067.00), (15...
(1) Trace2430::DDR_A0	DDR_CS	Trace752::DDR_CS	6.03	6.17	INT3	(1711.00 2200.33), (1711.0...	...

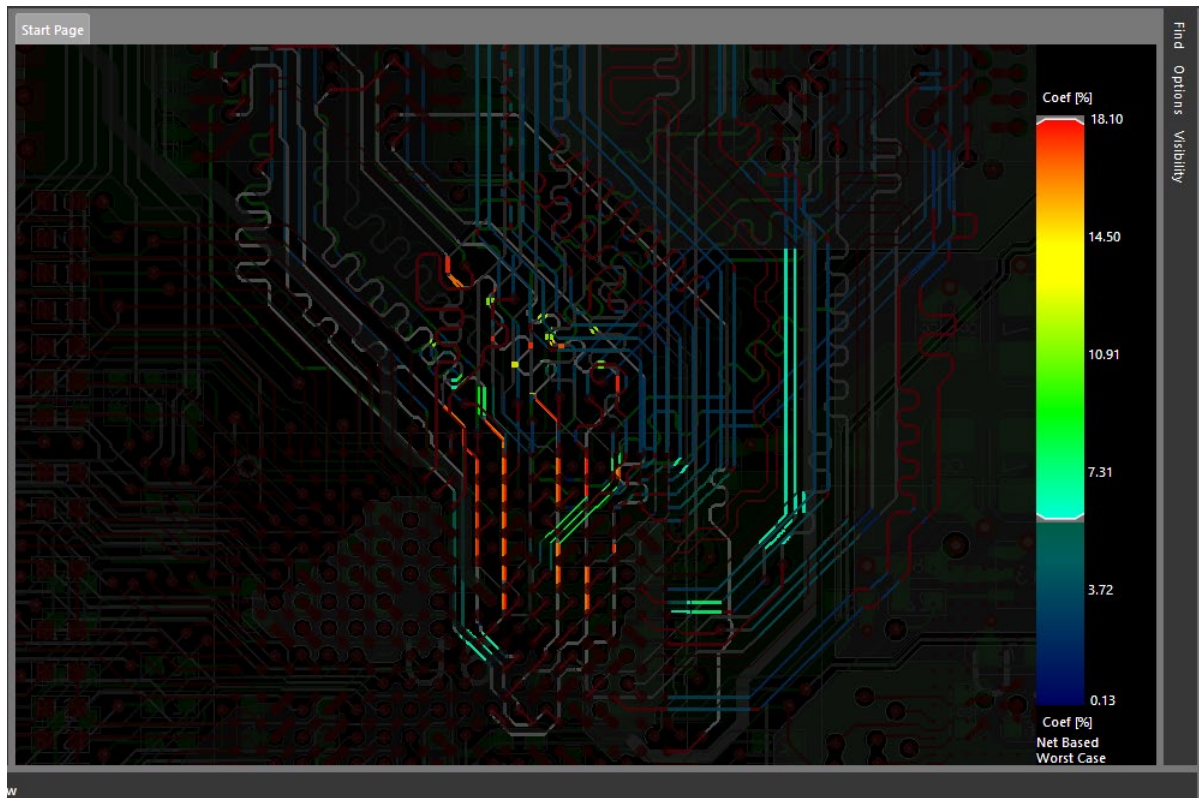
- Clicking **Coupling Vision** displays color-coded coupling segments in the canvas.
- Color coding** is based on the segment or sub-segment coupling coefficient value as mapped into the coupling color gradient, which is the continuous transition of colors from the minimum to maximum range of coupling values obtained by analysis. Nets which are not part of the analysis are dimmed in the default color. Even for a net that is part of the analysis, segments not associated with the analysis will be displayed in the default color based on layer / net color assignments.
- Worst Case** view mode setting highlights segments on victim nets. The color coding is based on the maximum coupling coefficient for any aggressor segment to that victim segment. Victim segments not having a coupling coefficient are displayed dimmed in the default color.
- Victim view** mode setting highlights aggressor segments and sets the color to active victim net/segment. The color coding is based on the coupling coefficient for each aggressor segment to the cross-probed net / segment. The victim net is displayed in the default color. Aggressor segments not having a coupling coefficient applied to the victim net / segment are displayed dimmed in the default color.



- Zoom in on a section close to the controller and use tooltips to investigate.

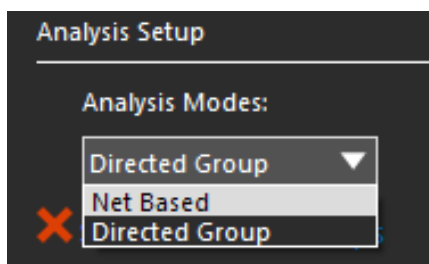


- Slider
The sliders on the color gradient allow for an easy way to filter what is seen in the vision. Also note the grey color at the top which indicates coupling coefficients with no reference found in the design.

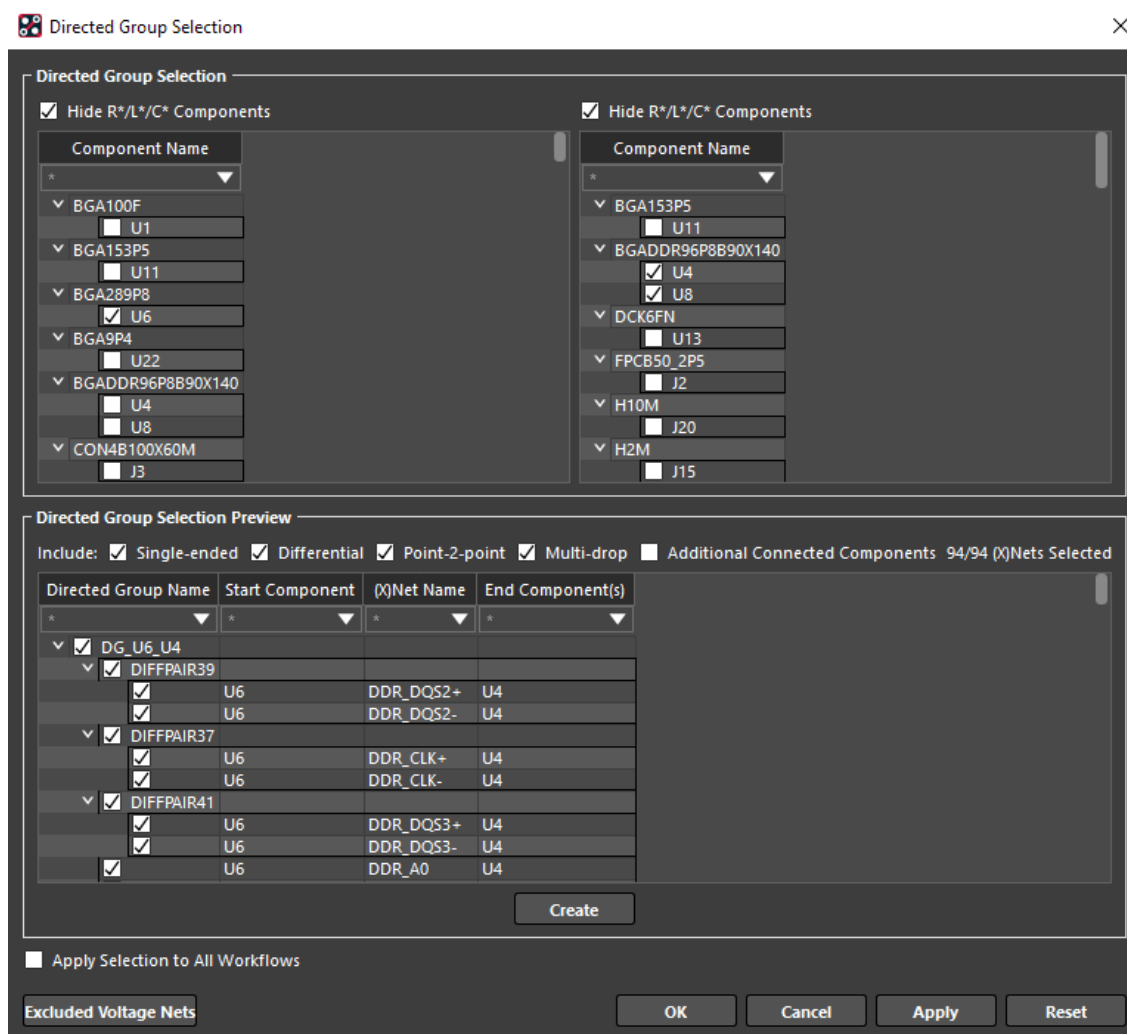


4 Specifying Directed Groups

- In directed groups or component-based net selection, you can select an entire interface based on component connectivity rather than each net name.
- Directed groups help prioritize issues; for example, issues found near the start point as compared to issues found near the end point.
- In addition, directed groups let you associate specific analysis results for a collection of nets as encountered along the same time-line as progressing from the start to the end point.
- If analysis mode is set to Directed Group, the Select Directed Group flow step is presented and marked with a cross to indicate that the step must be completed.



- To select, create, or modify directed groups or modify a selection; click **Select Directed Group**. This opens the Directed Group Selection dialog box. You can select the directed groups from the canvas or using the dialog box.
A directed group is the portion of a net between a starting component and one or more ending components.
- The **Directed Group Selection Preview** of the dialog will show the directed groups selected from the canvas. The top section, Directed Group Selection Results, lists the selected directed groups. A directed group is the portion of a net between a starting component and one or more ending components.
- Use the expandable Create Directed Groups section to create directed groups.

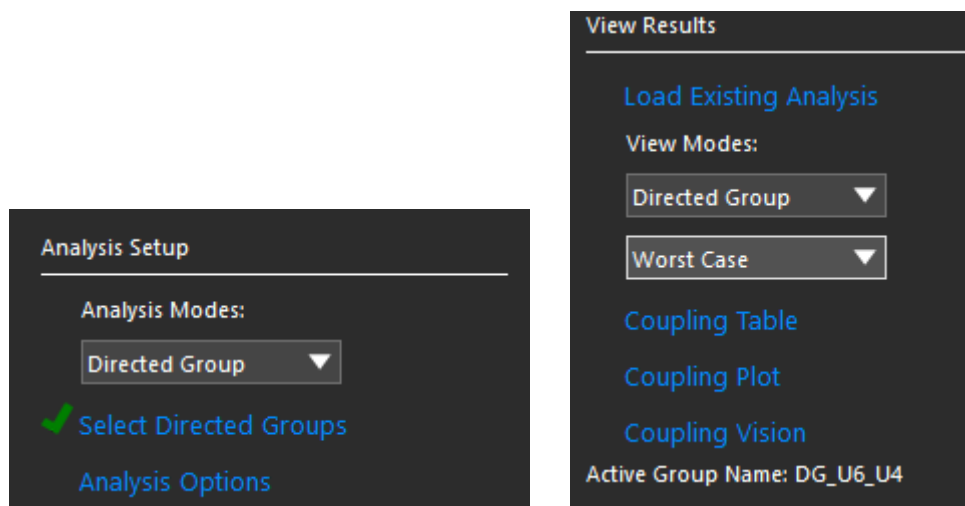


- To create a directed group, do the following steps:
 - Select a start component either on the canvas or from the list of components in the Start Component box or on the canvas. When you click a start component, all possible end components are visible while the other components are dimmed on canvas. The valid end components are listed under End Component.

- Select one or more end components. A preview of the directed group is shown in the bottom section. All nets are selected by default. You can filter the list to display selected nets.
- If needed, right-click in the preview area and choose any one of the options to select nets based on any filters.
- The nets that are displayed based on the filter settings are the visible nets. In the example image, the filter is set to * to select all nets.
- Click **Create** to create the directed group. The group is created and selected by default.
- To select available directed groups or modify a section, do the following steps:
 - Select listed directed groups from the Directed Group Selection Results section. The selected groups are marked by a tick in the box on the left.
 - Click **Apply** to update the design or click **OK** to update the design and close the dialog box. **Select Apply Selection to All Workflows** to apply the directed groups selection to all the analysis flows that require or can use directed groups. The Select Directed Groups step has a green check and you can proceed with the rest of the impedance and coupling workflow steps.

5 Coupling Plots

Coupling Plot is available only for directed groups and shows results as bar (expanded) and scatter (collapsed) plots using the distance from start component on the x-axis as determined in the Directed Groups definition.



- Clicking **Coupling Plot** opens the dockable Simulation Plot pane, which has two tabs, Bar / Expanded and Scatter / Collapsed.
- The Bar / Expanded tab can be filtered using the options on the right while the Scatter / Collapsed tab offers a global view and can be used to quickly identify outliers.

- Both tabs support data tips.
- A net selection panel on the left lists all the nets in the active directed groups. All nets are selected by default. You can choose to select only specific nets.



6 References

- Cadence Allegro User Guide: Routing the Design, Product Version 17.4-2019, October 2019, Last Updated: June 2020
- Cadence Impedance and Coupling Analysis, Rapid Adoption Kit (RAK), Product Version SPB 17.4-2019 February, 2020
- Cadence Analysis Workflows: Coupling Simulation, Rapid Adoption Kit (RAK), Product Allegro Sigrity SI 17.2 or Allegro PCB Designer 17.2, August, 2018