OptiSystem

Optical Communication System and Amplifier Design Suite

14.0

New Features

Created to address the needs of research scientists, photonic engineers, professors and students; OptiSystem satisfies the demand of users who are searching for a powerful yet easy to use photonics system design tool.

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Key Features for OptiSystem 14

OptiSystem 14 includes several enhancements including a new C++ co-simulation component, updates to our multimode component portfolio (to better support the analysis of spatial mode multiplexed systems), the addition of star and circular QAM constellations for coherent transmission systems, and improvements to our transmitter and receiver component portfolios. Key new features include:

- The introduction of a new **Cpp** component and **Cpp CoSimulation Visualizer** to allow users to import or build their own customized C++ algorithms/components and directly co-simulate their customized models (using dynamic link libraries) with any other OptiSystem component.
- The **Universal DSP**, **Decision**, **QAM Sequence Generator** and **QAM Sequence Decoder** components have been updated to support a broader range of modulation formats, including star and circular QAM constellation formats as well as 32-QAM, 128-QAM, and 256-QAM constellations.
- Several enhancements have been made to the Multimode components library including the introduction of a new **Spatial Demultiplexer** component, improvements to the **Erbium Doped MM Fiber**, **Ytterbium Doped MM Fiber**, **Measured-Index Multimode Fiber** and **Parabolic-Index Multimode Fiber** amplifier and fiber models (for modelling spatial multiplexed systems and concatenated fibers) and the integration of LP mode generators into our Spatial Transmitter components.
- Several components within the Transmitters and Receivers libraries have been improved including the introduction of a new **Spectral Light Source** component, improvements to the noise models in the **APD** and **PIN** components, the addition of thermal noise models to our **Analog to Digital** and **Digital to Analog** components and the addition of user-defined PAM amplitude maps to our **PAM** Coder and Decoder components
- Other improvements include updates to our **Measured Filter**, **Measured Optical Filter**, **Lightwave Analyzer**, **View Signal Visualizer** and **Power Splitters**; and the introduction of a new **Diffuse Channel** component for the modeling of indoor optical wireless systems.

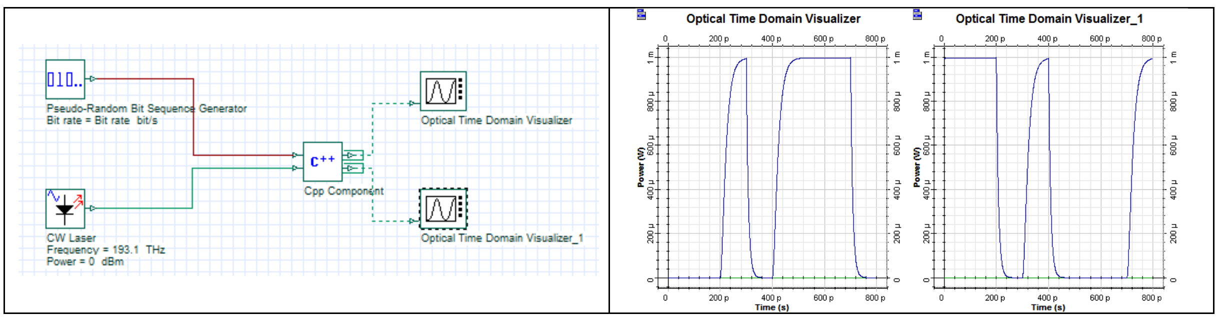
New library components and enhancements

<u>Co-simulation capabilities</u>: Cpp, Cpp CoSimulation Visualizer

We are pleased to announce the launch of our new **Cpp** component in OptiSystem 14. Designed for users who wish to import or build their own customized C++ algorithms/components, the **Cpp** component will allow for the direct co-simulation of customized models (using dynamic link libraries) with any other OptiSystem component. It includes an open signal architecture interface to allow users to input and/or output any of OptiSystem's signal types and complex waveform data arrays.

In addition to the **Cpp** component, we have launched a new Visualizer, the **Cpp CoSimulation Visualizer**. The new **Cpp CoSimulation Visualizer's** primary function is to duplicate all the signals that are designed to enter the Cpp component thus allowing for signal files to be loaded into the component design project (without OptiSystem running) when running in debug mode.

For more information on this new powerful feature please visit: http:/optiwave.com/?p=28551




```
bool CDS_SystemManager::Calculate_API()
{

    ///////////////////////////////////////////////// SIGNAL LOADING///////////////////////////////////////////////////
    CDS_SignalBase* pIOSignal1 = GetSignalFromInputPort(1);
    //Load the data from the first input port. At this point we are just loading it into our parent data class : CDS_SignalBase
    //This will be the binary input

    CDS_SignalBase* pIOSignal2 = GetSignalFromInputPort(2);
    //This will be the optical input

    if (pIOSignal1 != NULL && pIOSignal2 != NULL)
    {
        if (pIOSignal1->GetSignalName() == "BinarySignal" && pIOSignal2->GetSignalName() == "OpticalSignal")
        {
            ///////////////////////////////////////////////// BINARY SIGNAL INPUT LOADING///////////////////////////////////////////////////
            LONGVECTOR* pvnData1 = ((CDS_BinarySignal*)pIOSignal1)->GetBits();
            //get the pointer to the longvector that holds the binary data's bits

            ///////////////////////////////////////////////// OPTICAL SIGNAL INPUT  LOADING///////////////////////////////////////////////////
            VECTOR_OpticalSampledSignals vectorSignal1 = GetOpticalSampledSignalsVector(pIOSignal2);
            VECTOR_OpticalSampledSignals vectorSignal2 = GetOpticalSampledSignalsVector(pIOSignal2);
            //the input is copied twice, since the model requires two optical outputs
```

__Fig 1__: __Cpp component__ – The __Cpp component__ can be used to model any type of component (optical, optoelectronic, electrical, binary, etc.). In the example above, a Cpp component has been programmed to model a binary controlled optical switch with two inputs (one for the optical signal and the other for the binary control signal) and two outputs. An example section of the C++ code contained in the application program interface (API) is also shown in the lower portion of the figure.

OptiSystem

<u>Transmitters and receiver design</u>: Universal DSP, Decision, QAM coding update, PAM coding update, ADC and DAC updates, TIA update, APD update, Spectral Light Source, LED update

The **Universal DSP** and **Decision** components have been updated to support a broader range of modulation formats, including:

- BPSK, QPSK, 8PSK, 16PSK
- 8QAM, 16QAM, 32QAM, 64QAM, 128QAM, 256QAM

In addition, for QAM modulation formats; star and circular constellation formats are now supported.

The **QAM Sequence Generator** and **QAM Sequence Decoder** components now support the definition of square, star, and circular constellation formats (with differential or gray coding).

All components which create or decode PAM sequences (**PAM Sequence Generator**, **PAM Pulse Generator**, **Electrical PAM Modulator**, **and PAM Sequence Decoder**) now include the option to import or update user-defined PAM amplitude maps (using the MxN parameters array feature).

A new **Spectral Light Source** component has been added to the Transmitters/Optical Sources library. Lorentzian, Gaussian or file-based (user-defined) spectral profiles can be created to model various ambient light sources or LEDs.

The **LED** component has been updated to include the ability to import a user-defined spectral profile (measured optical filter feature). Also the output power setting feature now includes the ability to define the slope efficiency.

The **APD** component has been updated and includes the following new features:

- The thermal noise model has been updated to include the definition of thermal noise based on temperature and load resistance.
- New results have been added for shot and thermal noise currents.
- A new parameter has been added to allow for the definition of noise bandwidth based on the Effective noise bandwidth parameter.

The **Transimpedance amplifier** component now includes the ability to import measured electrical filter data (frequency transfer function model)

A new thermal noise model has been added to the **Analog to Digital** and **Digital to Analog** components, including new calculation results for thermal noise currents and quantization noise.

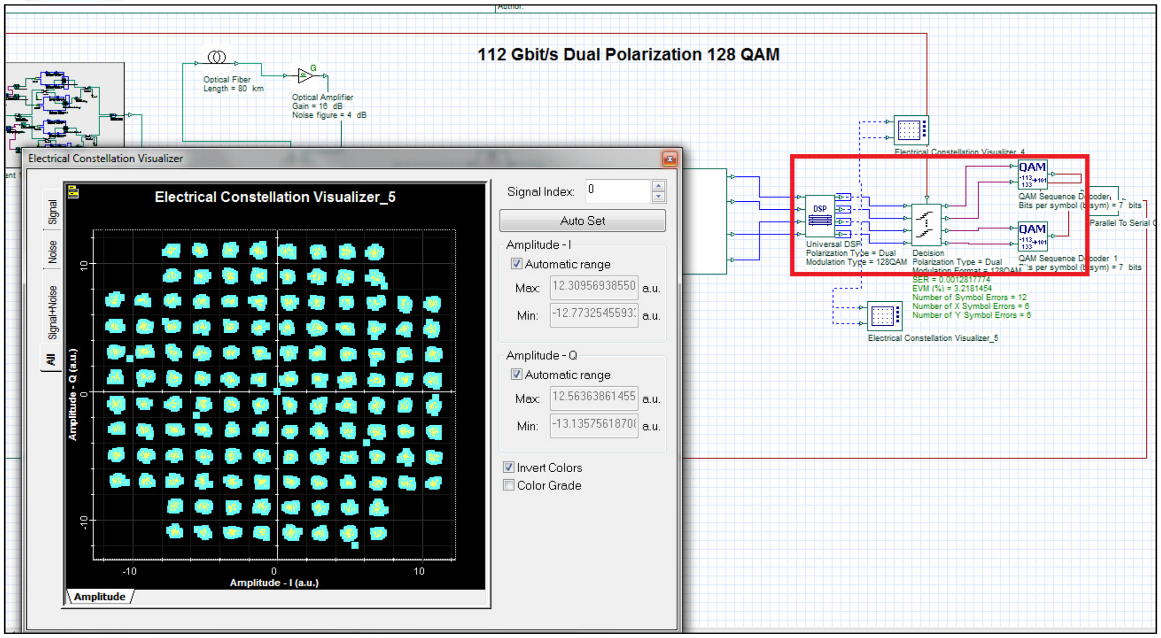


Fig 2: ***112 Gbit/s 128 QAM*** – *Example of a 112 Gbit/s, 128 QAM, dual polarization coherent transmission system using our updated Universal DSP, Decision and QAM Coder/Decoder components.*

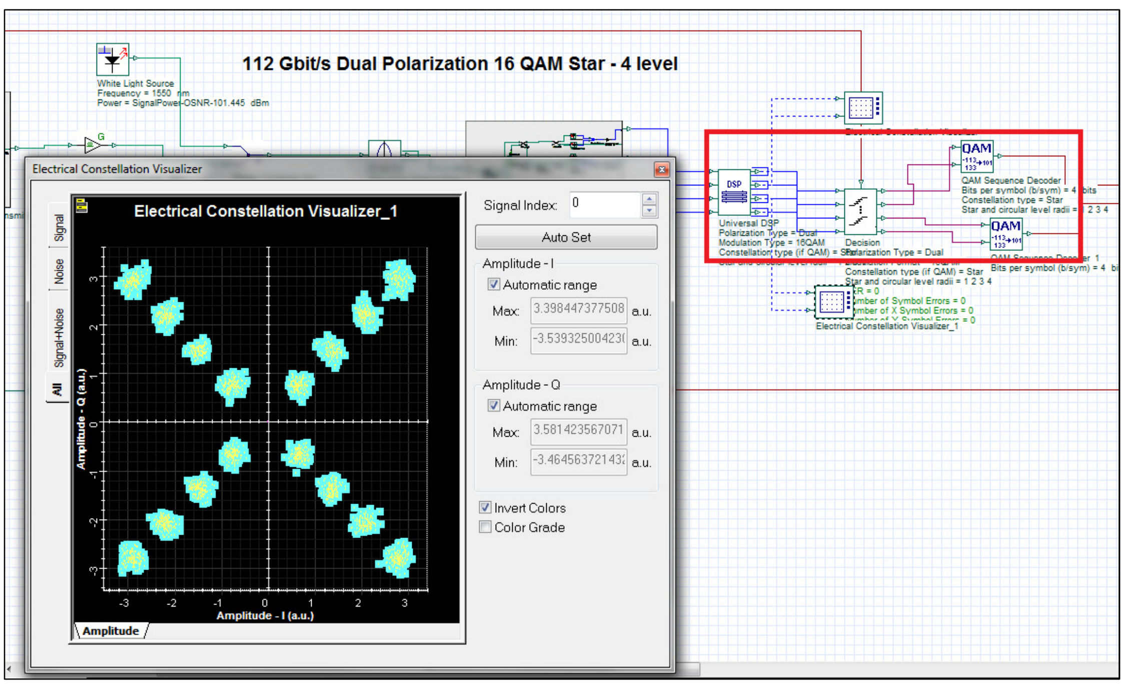


Fig 3: 112 Gbit/s DP 16 QAM Star – *Example of a 112 Gbit/s, 16 QAM Star, dual polarization coherent transmission system using our updated Universal DSP, Decision and QAM Coder/Decoder components .*

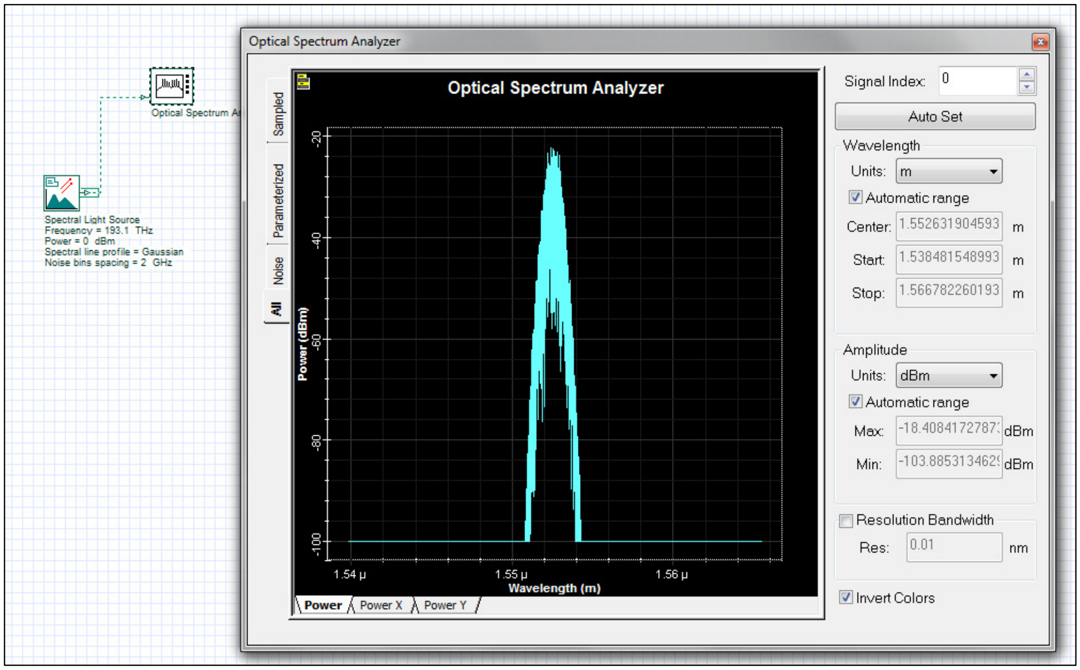


***Fig 4: Spectral Light Source** – Example view of our new Spectral Light Source (Gaussian profile).*

<u>Multimode system design</u>: Spatial Demultiplexer, Erbium Doped MM Fiber, Ytterbium Doped MM Fiber, Measured-Index Multimode Fiber, Parabolic-Index Multimode Fiber, Spatial Transmitters

A new **Spatial Demultiplexer** component has been added to the Multimode Library. In addition to separating WDM channels, the **Spatial Demultiplexer** allows for the separation of spatial modes contained within each WDM channel (each with an independent output port).

The **Erbium Doped MM Fiber** and **Ytterbium Doped MM Fiber** amplifier models have been improved to allow for the more realistic and efficient modeling of space division multiplexing systems. Updates include:

- The specification of the refractive index profile based on parabolic index, alpha, step index or file-based specification.
- Parameters associated with cladding pumping have been removed. Instead the input signal to the fiber can be coupled to a cladding pump by using the Donut Transverse Mode Generator component.
- The numerical algorithm (overlap integrals) has been improved and now applies a mode dependent gain. Please note that the computation time may take longer compared to the previous version of these components.
- Parameters associated with spatial properties of the pumps have been removed. Instead the pumps can now be set up with spatial mode properties.

The **Measured-Index Multimode Fiber** and **Parabolic-Index Multimode Fiber** models have been improved to support the modeling of spatial multiplexing systems and concatenated fibers. Updates include:

- A new method for incorporating optical phase changes due to mode-dependent path length differences.
- Improved management of multiple input spatial modes.
- Improved tracking and preservation of phase data between concatenated fibers.
- An improved Fibers report feature including customized ordering of spatial mode results based on power, group index or LP index.

The Spatial Transmitters components (**Spatial Optical Transmitter**, **Spatial CW Laser**, **Spatial single mode laser**, **Spatial LED**, **Spatial VCSEL**, **Spatial Optical Gaussian Pulse Generator**, **Spatial Optical Impulse Generator** and **Spatial Optical Sech Pulse Generator**), further to the generation of LG and HG modes, have been updated to include the definition and generation of fiber LP modes (for convenience and testing purposes).

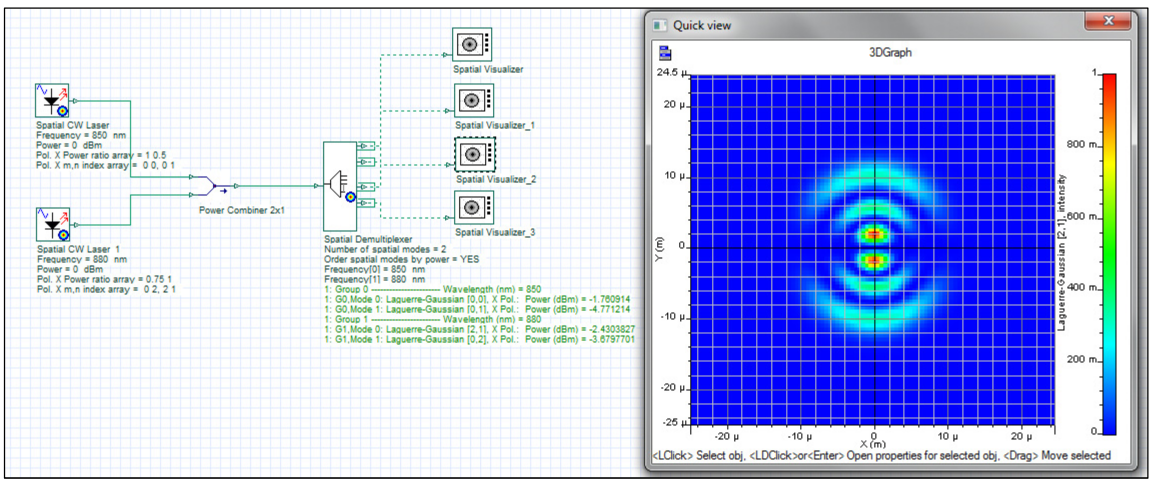


Fig 5: Spatial Demultiplexer *– Two spatial WDM signals (at 850 and 880 nm) are demultiplexed into two wavelength groups. The modes contained in each group are then automatically separated and routed to different output ports. The Spatial Visualizer is displaying the output from Group 1 - Mode 0 (LG [2, 1])*

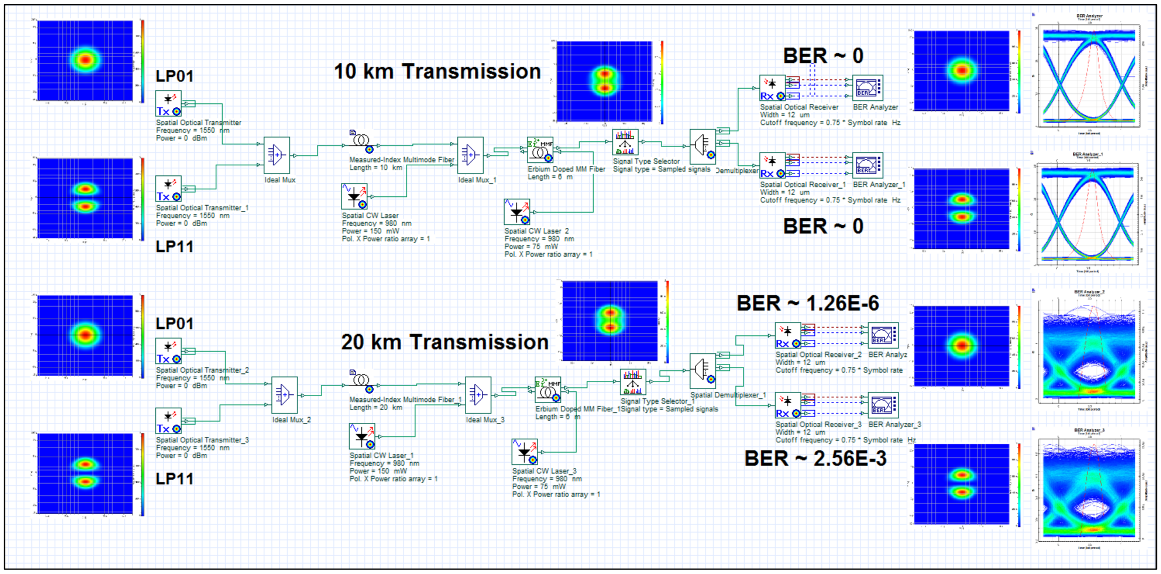


Fig 6: Spatial Mode Division Multiplexing & Amplification *– Transmission of two independent spatial modes through few mode fiber and multimode amplifier. Changing the two pump signals and their spatial mode profiles allows the user to vary the gain of the two signal modes independently.*

Other product enhancements

Measured filters

The **Measured Filter** and **Measured Optical Filter** components have been updated with additional graphs to display amplitude/power and phase. Also a new feature has been added to allow for the automatic reloading of the transfer function data file every time a simulation is initiated (such as simulations that require multiple iterations).

Visualizers and Test Sets

The **Lightwave Analyzer** has been updated to include graphs for Slope Responsivity and Responsivity (DC).

The **View Signal Visualizer** now includes the ability to view complex data in either Real-Imag or Mag-Phase formats

Optical Wireless

The new **Diffuse Channel** component allows for the modeling of indoor optical wireless systems (Lambertian source model).

Passives

A new power ratio array feature has been added to the unidirectional optical power splitter components (to allow for the definition of customized splitting ratios for all output ports). Components include: **Power Splitter 1x2**, **Power Splitter 1x4**, **Power Splitter 1x8** and **Power Splitter 1xN**

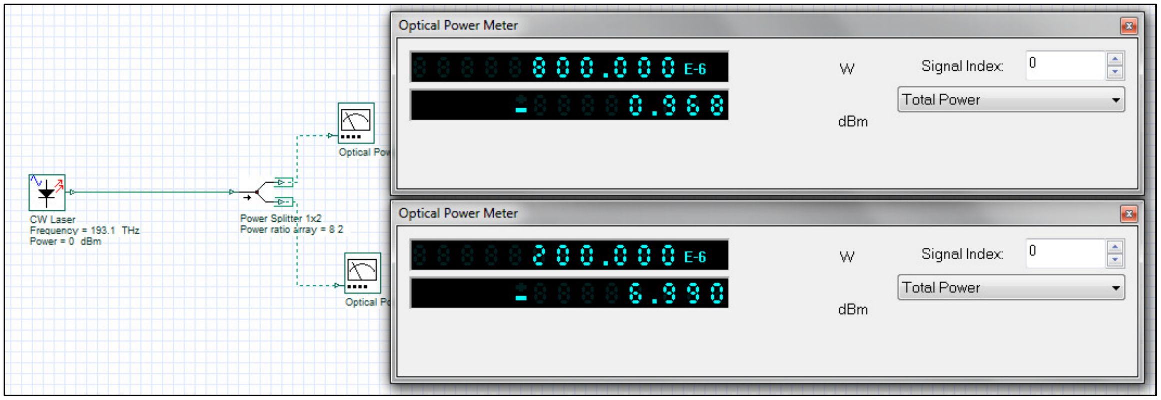


Fig 7: Power Splitters *– Example view of the updated* ***Power Splitter 1x2*** *component. The power ratio has been set to [0.8 0.2] to model an 80/20 optical power splitter.*

Documentation and help feature updates

A new *Global Parameters Reference Guide* has been included with OptiSystem 14. This new guide provides information on the global parameters features including tips on how to best set up your simulation for optimum results. To access this guide select the "Help" button within the Layout Parameters dialog box.

A new link is now available for users to access the Component Help section directly from a Component's or Visualizer's Context Menu.

New URL links have been added to the Help Menu (to provide rapid access to the OptiSystem Home Page and OptiSystem Forums).

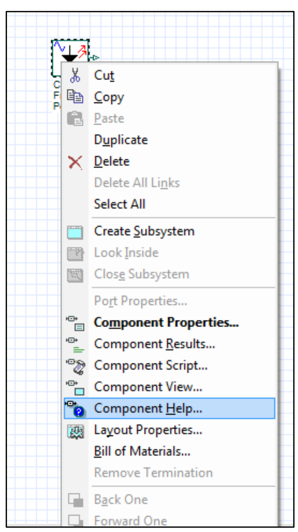


Fig 8: *New* ***Component Help*** *access is now available from a Component's or Visualizer's Context Menu*

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