

Circuit Design and Simulation: Educator and Classroom Resources









Overview

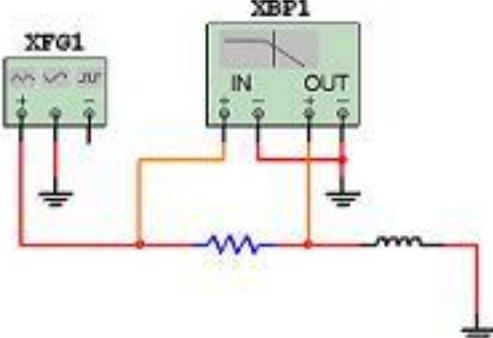
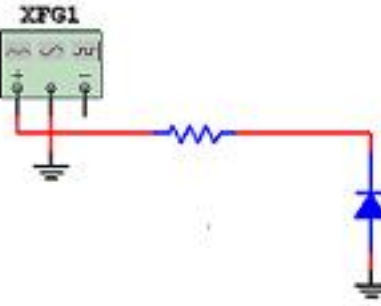
National Instruments provides educators and students with a single platform to aid in the transition of complex circuit theory to the real-world of design and test.

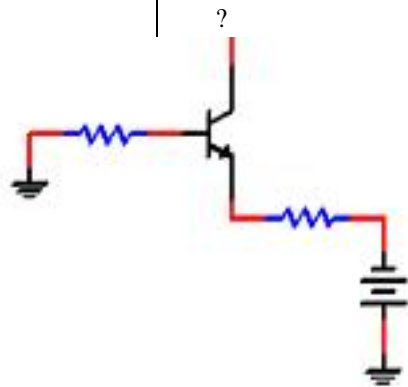
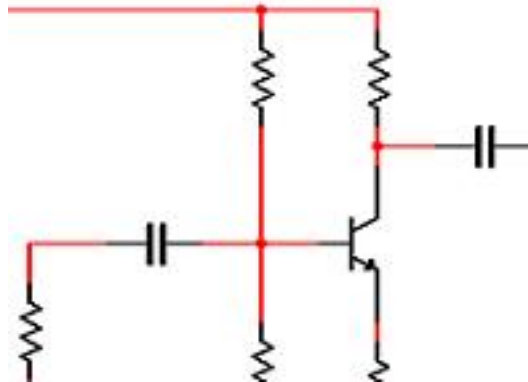
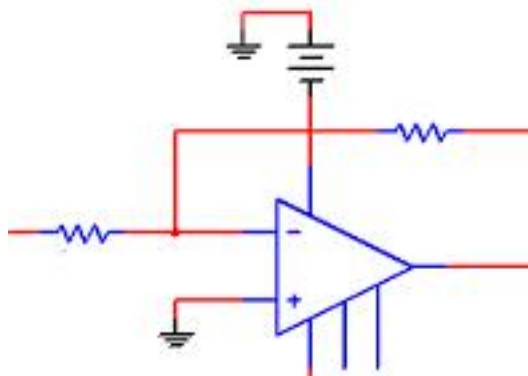
Professors and instructors can now take a graphical approach to teaching, and provide students with a seamlessly integrated design flow to reduce the learning curve in the laboratory environment.

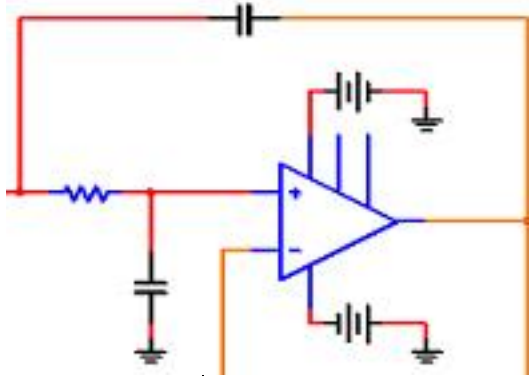
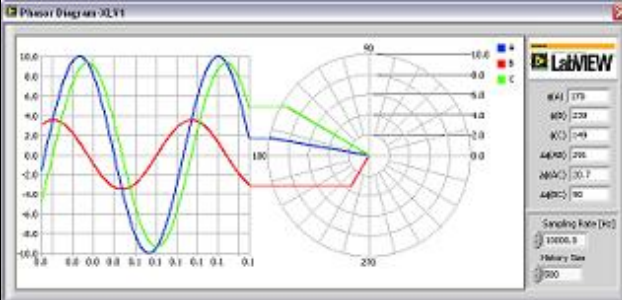
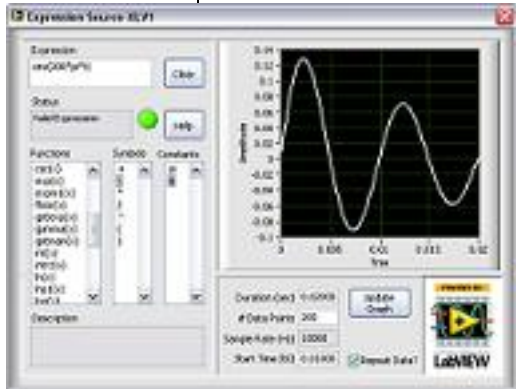
The Electronics Education Platform is made up of **NI Multisim** SPICE simulation, **NI LabVIEW** virtual instrumentation and the **NI ELVIS** breadboard prototyping station, and is complemented by academic resources created specifically to emphasize the fundamentals of electronics design.


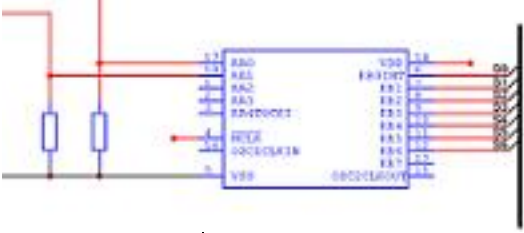

Testimonial	
<p>?</p> <p>"At UC Berkeley, EE100 is the introduction to electrical engineering class for non-EE majors. The goal of this course is to serve as a hands-on electronics class... We use Multisim in the EE100 course because it is easy-to-use and abstracts the messy details of SPICE. Multisim also provides very useful features like the breadboard tool and instruments like the multimeter (we can show students how to wire an ammeter without blowing fuses). Multisim also integrates with LabVIEW and this helps our students compare simulation data to experimental data."</p> <p>Bharathwaj Muthuswamy, Visiting Lecturer, Summer 2006, University of</p>	


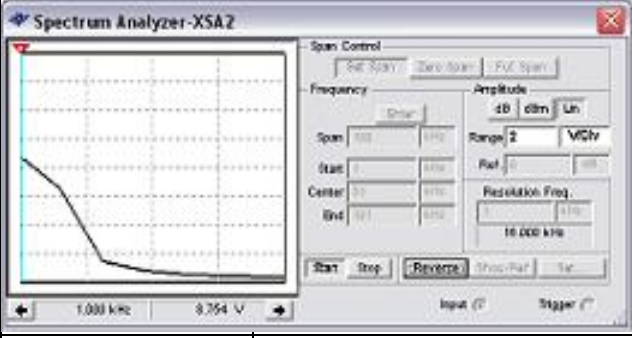


California Berkeley			
Resources			
	Classroom Resources Download sample courseware, instructor slides and links to university course websites		 Software Simulations & Examples Explore example labs, LabVIEW demos, and project ideas
	Textbooks & Applicable Courses Discover the textbooks that use LabVIEW to teach circuit design		 Hardware Labs & Exercises Perform hardware-based experiments to explore concepts
	Case Studies & Conference Papers See how other schools use LabVIEW for circuit design		 Videos & Webcasts View short video demonstrations, webcasts of concepts
	Software Licensing Options Adopt LabVIEW at your institution with these licensing options		 Recommended Lab Configurations Outfit your teaching and research labs with these setups
? Visit ni.com/academic for additional teaching and research resources ?			
?Classroom Resources			
Practical Teaching Ideas			
Practical Teaching Ideas is a collection of laboratories that implement elements of the NI Electronics Education platform. The course was originally developed by Tracy Shields, an electrical engineer and experienced instructor from Toronto, Canada.			
View the Experiment >>			
UC Berkeley Physics III Semiconductor Lab			
This Basic Semiconductor Circuits Labs developed at UC Berkeley and available on ni.com , contains an introduction to signal measurement, processing, and graphical programming in the LabVIEW environment. Throughout the labs, interactive LabVIEW applications (VIs) allow the reader to experimentally gain familiarity with key concepts.			

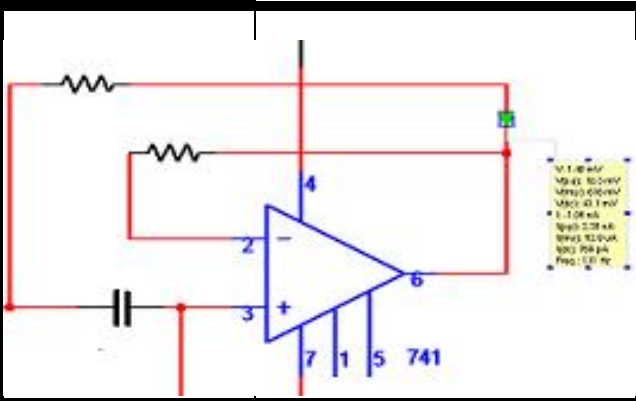
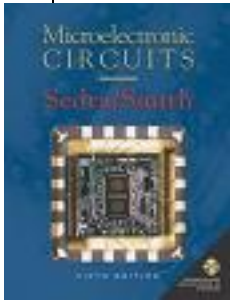
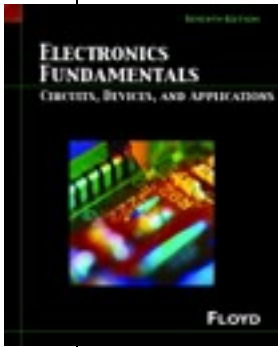
View the Experiment >>	
UC Berkeley EE145 Opamp Filters Lab	
This set of pre-lab and lab assignments utilized by lecturer Bharathwaj Muthuswamy at UC Berkeley utilizes NI Multisim and NI LabVIEW to provide students with a complete experience to understand filter behavior.	
View the EE145 Pre-Lab Assignment >>	
View the EE145 Lab Assignment >>	
Florida International University: Multisim Tutorial	
This tutorial utilized by Dr. Subbarao V. Wunnava at the Florida International University is a comprehensive tutorial on using Multisim for the classroom	
View the online tutorial >>	
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Software Simulations and Examples	
The following list of circuits and virtual instruments demonstrate complex circuit behavior in the easy-to-use environments of NI Multisim and NI LabVIEW.	
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RLC Circuits	
	<p>These example circuits created in NI Multisim 10 investigate a number of basic electronics laws and passive component designs with interactive SPICE simulation.</p> <p>Download Files</p>
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Diodes	
	<p>These example circuits created in NI Multisim 10 investigate a number of diode and Zener diode circuits. Topics covered include half and full rectifier circuits as well as voltage regulation.</p> <p>Download Files</p>


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Transistors		
	<p>These example circuits created in NI Multisim 10? focusses?on transistor based circuit, and investigates various PNP and NPN biased transistors</p> <p>?Download Files</p>	
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Amplifiers		
????		<p>These example circuits created in NI Multisim 10?investigate?various amplifier designs with interactive SPICE simulation and analyses. The amplifier examples include both single and two stage designs.</p> <p>?Download Files</p>
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Operational Amplifiers		
?		<p>These example circuits created in NI Multisim 10?focus on operational amplifier circuits with interactive SPICE simulation. Topics include inverting and non-inverting designs, as well as peak detectors.</p> <p>?Download Files</p>
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Filters		
?		<p>These example circuits created in NI Multisim 10? focusses?on filter designs with interactive SPICE</p>



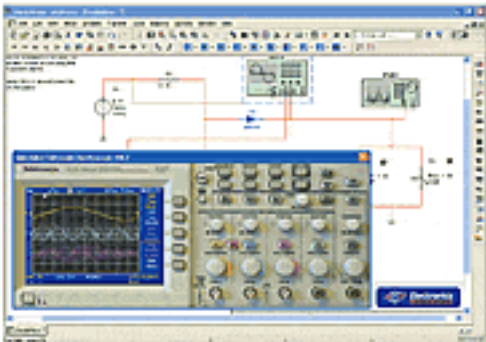
	<p>simulation and analyses. Topics include low-pass, high-pass, butterworth and notch filters.</p> <p>?Download Files</p>
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<p>Phasor Diagram - Custom Multisim Virtual Instrument</p> 	<p>This custom LabVIEW virtual instrument for NI Multisim uses a phasor diagram representation of AC voltage rather than a Bode plot. This instrument has an oscilloscope projection of the phasors, including phase measurements.</p> <p>?Download Files</p>
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<p>Expression Source - Custom Multisim Virtual Instrument</p> 	<p>This LabVIEW based expression source allows engineers to create custom signalforms based on mathematical expressions. This instrument enables students and educators to extend the source capabilities of SPICE and NI Multisim by applying more complex signals to their circuits.</p> <p>?Download Files</p>
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<p>Elevator Display - Custom Multisim Virtual Instrument</p>	<p>Visualize simulation data in applications investigating analog, digital, MCU and controls simulation with this custom LabVIEW instrument for NI Multisim.</p> <p>?Download Files</p>

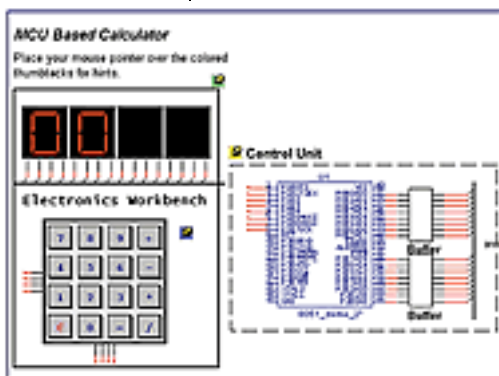
		
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PIC16F84 Microcontroller Up-Down Counter		
		<p>This NI Multisim MCU Module based example utilizes a PIC16F84 from Microchip to demonstrate a simple up and down counter.</p> <p>Download Files</p>
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<h2>Hardware Labs and Exercises</h2>		
Practical Teaching Ideas		
		<p>Practical Teaching Ideas is a collection of laboratories that implement elements of the NI Electronics Education?platform. The course was originally developed by Tracy Shields, an electrical?engineer and experienced instructor from Toronto, Canada.</p> <p>?Learn More</p>
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NI ELVIS Courseware		
		<p>This courseware contains ten separate experiments that utilize the many features of NI ELVIS. The experiments</p>

		<p>are designed to introduce those who are new to the NI ELVIS platform to the many features and possibilities that exist in both hardware and software.</p> <p>View Lab</p>
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Understanding RF Circuits Teaching Resource		
		<p>The Understanding RF Circuits Teaching Resource, contains radio frequency (RF) applications to be used with NI?Multisim. Twenty-one specially designed electronic communication experiments are provided for use with this computer controlled environment. These experiments are meant to supplement the theory students normally obtain in lectures.</p> <p>?Learn More</p>
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Conducting Experiments Using the NI Electronics Education Platform		
		<p>The NI Electronics Education Platform is an integrated tool-chain designed to meet the needs of students and educators. This platform consists of an ideal mix of ? hardware and software that guides students through the engineering and design process. The purpose of a laboratory experiment is to familiarize students with the engineering process, and equip them with the tools of an engineer</p> <p>?Learn More</p>
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NI Electronics Education Courseware		
		<p>This?courseware is a resource to connect professors and educators with courseware, curricula, example labs and tutorials covering the various elements of the NI Electronics Education Platform.</p> <p>?Learn More</p>
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Introduction to Multisim Schematic Capture and Simulation		
		<p>This course introduces National Instruments Multisim through instructional modules and hands-on exercises. Multisim is an interactive, graphical schematic capture tool and SPICE simulator that allows you to build circuits, simulate, and instrument them in a virtual environment.</p>

		<p>Multisim has many enhanced features that enhance the teaching of circuits and electronics concepts. ?Learn More</p>
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<p>?</p>		
<p>Textbooks and Applicable Courses</p>		
<p>Textbooks</p>		
		<p>Microelectronic Circuits, 5th Edition Adel S. Sedra and Kenneth C. Smith Oxford University Press ISBN10: 0195142519? ISBN13: 9780195142518 Download Multisim example files direct from Microelectronics Circuits</p>
		<p>Electronics Fundamentals: Circuits, Devices and Applications, 7th Edition Thomas L. Floyd Prentice Hall ISBN-10: 013219709X? ISBN-13: 9780132197090</p>
		<p>Electric Circuits, 7th Edition James W. Nilsson, Iowa State University Susan Riedel, Marquette University Prentice Hall ISBN-10: 0131329723?</p>

		ISBN-13: 9780131329720
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Applicable Course		
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<p>The following list collects the various courses in which the electronics education platform of NI Multisim, NI ELVIS and NI LabVIEW can, and have, been applied:</p> <ul style="list-style-type: none"> • Circuit Theory • Circuit Design • AC Circuits • DC Circuits • Digital Circuit Design • Analog Circuit Design • Electronics Fundamentals • Computer Aided Design of Circuits and Electronics • Electronics Laboratory • Microcontroller lab • Digital Logic Design • Mixed Signal and Circuits Labs • Digital Integrated Circuit Design 		
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Case Studies and Conference Papers		
<ul style="list-style-type: none"> • The NI Electronics Education Platform: A Case Study: This case study into a typical implementation of the electronics education platform showcases how an educator can use an integrated laboratory to enhance their electronics courses. • Integration of Virtual Instrumentation into a Compressed Electricity and Electronic Curriculum: This paper elaborates on the efforts of improving the quality of electricity and electronics education with the help of simulation, virtual instrumentation tools and the NI ELVIS (Educational Laboratory Virtual Instrumentation Suite) • Use of LabVIEW Software to Create a Virtual Electrical Power Systems Lab: This paper discusses the creation of a Virtual Electrical Power Systems Laboratory for the University of Houston Downtown in Houston, Texas. NI LabVIEW software has been used to create a cost effective user-friendly electrical power systems virtual laboratory. • Using Signal Express to Automate Analog Electronics Experiments: Many analog electronics experiments can be very time consuming. National Instruments SignalExpress is an environment dedicated to test and measurement where the individual can use high-level signal sourcing and measurement blocks to build an 		

<p>automated measurement system that will collect and present data in a graphical form. SignalExpress has a very short learning curve so students can rapidly program their own tests.</p> <p>?</p> <p>Back to top >></p> <p>?</p>	
<h2>Videos and Webcasts</h2> <ul style="list-style-type: none"> Webcast: National Instruments Electronics Education Platform Webcast: What's New in NI Multisim 10? (Educational) Webcast: Introduction to the NI Multisim MCU Module <p>?</p> <p>Back to top >></p> <p>?</p>	
<h2>Software Licensing Options</h2>	
	<p>NI Academic Site License</p> <ul style="list-style-type: none"> Unlimited seats of NI software for your department, college or campus Comprehensive suite of LabVIEW and other circuit software Automatic bi-annual updates with new and upgraded software
	<p>Student Install Option</p> <ul style="list-style-type: none"> Allow your students to install software on their personal laptops and PCs Affordable price for your entire student body Access to all software available in the Academic Site License
<p>?</p> <p>Back to top >></p> <p>?</p>	
<h2>Recommended Lab Configurations</h2>	
	<p>NI Multisim Education</p> <ul style="list-style-type: none"> Students can create "what if" scenarios with intuitive schematic capture and interactive simulation Advanced SPICE analyses such as Monte Carlo and worst case help students develop their intuition A database with thousands of models ensures that most laboratory circuits can be realized virtually Teach instrumentation fundamentals with virtual instruments such as oscilloscopes and current probes



NI Multisim MCU Module

- Support for Intel/Atmel 8051/8052 and Microchip PIC16F84a
- Simulation with external RAM/ROM, LCDs, keypads, and so on
- Project possibilities include C, assembly, or hex code
- Full integration with the NI Multisim educational platform



NI ELVIS ?

- Tight integration with NI Multisim
- Design and prototyping platform for engineering education
- Plug-and-play USB interface for easy setup
- Virtual instrumentation suite with 12 integrated instruments



Circuit Design Bundle

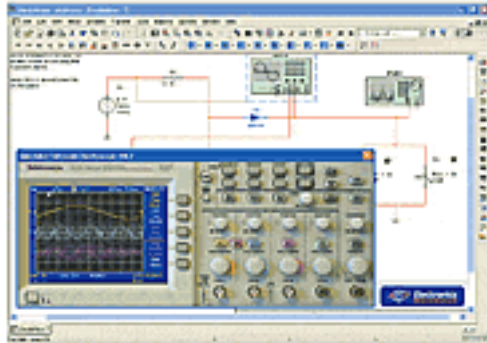
- Capture and simulate circuits in NI Multisim with advanced features like the 3D view of the NI ELVIS
- Access to integrated suite of instruments and prototyping station in NI ELVIS
- Express VIs for point-and-click configuration in National Instruments LabVIEW software
- Single platform to design, simulate, test, and prototype circuits



NI LabVIEW

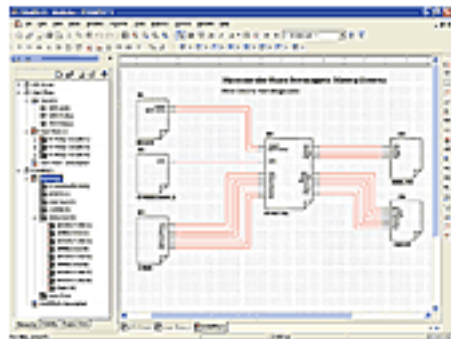
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- Tight integration with hardware (data acquisition, instrument control, motion control)
- Automatic code generation using DAQ Assistant and Instrument I/O Assistant
- Highly productive graphical programming
- Measurement analysis and digital signal processing



NI Circuit Design Suite for Education ?

- Easily capture schematics and interactively simulate designs with NI Multisim
- Co-simulate C-code or assembly-based microcontroller designs with the NI Multisim MCU Module
- Transfer designs with the click of a button to NI Ultiboard for PCB layout and routing
- Includes software made with education in mind - Multisim, Multisim MCU Module, and Ultiboard



NI Circuit Design Suite for Students ?

- Capture, simulate, and analyze circuits for homework and prelab assignments
- Breadboard in 3D at home before going to lab sessions
- Includes NI Multisim, the NI Multisim MCU Module and NI Ultiboard
- Up to 50 components in designs with nearly 4000 components to choose from

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