What’s New in PSpice 17.2
What’s New in PSpice Summary

• New Website www.PSpice.com

• TI Workbench based on PSpice

• Performance and capacity upgrades for switching circuits including 64-bit support

• Device Modeling Interface - Support for C/C++, SystemC and compact models with VerilogA-ADMS

• Reports enable simulation-driven extraction of layout constraint values for optimizing analog designs with increased reliability
New Website www.PSpice.com

PSpice community
• PSpice models
• Tutorial videos
• User forum
• Applications
• Events

• Central point for all PSpice user
TI Workbench based on PSpice

Open Design

- Circuit
- Models
17.2 Release with focus on IoT

- Internet of Things devices
IoT is “A Smart Sensor”

69,- €

Sensors

Communication

Computation

### Sensor Types and Description

<table>
<thead>
<tr>
<th>Sensor Types</th>
<th>Sensor Description</th>
<th>Examples</th>
</tr>
</thead>
<tbody>
<tr>
<td>Position</td>
<td>A position sensor measures the position of an object; the position measurement can be either in absolute terms (absolute position sensor) or in relative terms (displacement sensor). Position sensors can be linear, angular, or multi-axis.</td>
<td>Potentiometer, inclinometer, proximity sensor</td>
</tr>
<tr>
<td>Occupancy and motion</td>
<td>Occupancy sensors detect the presence of people and animals in a surveillance area, while motion sensors detect movement of people and objects. The difference between the two is that occupancy sensors will generate a signal even when a person is stationary, while a motion sensor will not.</td>
<td>Electric eye, RADAR</td>
</tr>
<tr>
<td>Velocity and acceleration</td>
<td>Velocity (speed of motion) sensors may be linear or angular, indicating how fast an object moves along a straight line or how fast it rotates. Acceleration sensors measure changes in velocity.</td>
<td>Accelerometer, gyroscope</td>
</tr>
<tr>
<td>Force</td>
<td>Force sensors detect whether a physical force is applied and whether the magnitude of force is beyond a threshold.</td>
<td>Force gauge, viscometer, tactile sensor (touch sensor)</td>
</tr>
<tr>
<td>Pressure</td>
<td>Pressure sensors are related to force sensors and measure the force applied by liquids or gases. Pressure is measured in terms of force per unit area.</td>
<td>Barometer, bourdon gauge, piezometer</td>
</tr>
<tr>
<td>Flow</td>
<td>Flow sensors detect the rate of fluid flow. They measure the volume (mass flow) or rate (flow velocity) of fluid that has passed through a system in a given period of time.</td>
<td>Anemometer, mass flow sensor, water meter</td>
</tr>
<tr>
<td>Acoustic</td>
<td>Acoustic sensors measure sound levels and convert that information into digital or analog data signals.</td>
<td>Microphone, geophone, hydrophone</td>
</tr>
<tr>
<td>Humidity</td>
<td>Humidity sensors detect humidity (amount of water vapor) in the air or as a mass. Humidity levels can be measured in various ways: absolute humidity, relative humidity, mass ratio, and so on.</td>
<td>Hygrometer, hygrometer, soil moisture sensor</td>
</tr>
<tr>
<td>Light</td>
<td>Light sensors detect the presence of light (visible orinvisible).</td>
<td>Infrared sensor, photoelectric, flame detector</td>
</tr>
<tr>
<td>Radiation</td>
<td>Radiation sensors detect radiation in the environment. Radiation can be sensed by delivering ionization or detection.</td>
<td>Gauging detector, scintillation, neutron detector</td>
</tr>
<tr>
<td>Temperature</td>
<td>Temperature sensors measure the amount of heat or cold that is present in a system. They can be broadly of two types: contact and non-contact. Contact temperature sensors need to be in physical contact with the object being sensed. Non-contact sensors do not need physical contact, as they measure temperature through convection and radiation.</td>
<td>Thermometer, calorimeter, temperature gauge</td>
</tr>
<tr>
<td>Chemical</td>
<td>Chemical sensors measure the concentration of chemicals in a system. When subjected to a mix of chemicals, chemical sensors are typically selective for a target type of chemical (for example, a CO2 sensor senses only carbon dioxide).</td>
<td>Breathalyzer, pH meter, smoke detector</td>
</tr>
<tr>
<td>Biosensors</td>
<td>Biosensors detect various biological elements such as organisms, tissues, cells, enzymes, antibodies, and nucleic acids.</td>
<td>Blood glucose biosensor, pulse oximeter, electrocardiograph</td>
</tr>
</tbody>
</table>


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IoT Devices with PSpice

- Stand-alone GPS navigation devices
- Light responsive sensors
- Simple thermostats
- Motion sensors
IoT Simulation SystemC / ARM Fast Model

- Significant effort in building processor model
- Suitable only for multi-year projects
- PSpice would be required on Linux to allow use of Cadence VSP
IoT Simulation C-Algorithm

- Simple and largely independent of processor used
- Example demo in S/W controlled power supply design

SystemC Testbench to Represent IoT Environment

PSpice Mixed Signal

Controller Virtual Platform

Software Algorithm

C/C++ Algorithm
IoT Simulation C-Algorithm

PARAMETERS:
PER = 10
D = 0.2

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IoT Simulation C-Algrorithm
IoT Device Modeling Interface

- Placed in Model Editor – Model – DMI Template Code Generator
- Think only about the code description of your component

Definition of
- IOs
- .Lib
- .DLL
- Parameters
- VS-project
IoT DMI Steps

1. Create component using DMI
2. Describe the model behavior in Visual Studio Community (i.e. C/C++, SystemC)
3. Compile and debug generating .DLL
4. Associate PSpice model with symbol and simulate

Digital Devices
Analog Behavioral Devices
Physical Devices

PSpice Simulator
DMI
Communicating with PSpice
Model Code

C/C++, SystemC, VerilogA, MATLAB Blocks
IoT Simulation Hardware in the Loop

- Minimal modeling effort
IoT – Hardware Platforms

<table>
<thead>
<tr>
<th>Name</th>
<th>Arduino Uno</th>
<th>Raspberry Pi</th>
<th>BeagleBone</th>
</tr>
</thead>
<tbody>
<tr>
<td>Model Tested</td>
<td>R3</td>
<td>Model B</td>
<td>Rev A5</td>
</tr>
<tr>
<td>Price</td>
<td>$29.95</td>
<td>$35</td>
<td>$89</td>
</tr>
<tr>
<td>Size</td>
<td>2.95”x2.10”</td>
<td>3.37”x2.125”</td>
<td>3.4”x2.1”</td>
</tr>
<tr>
<td>Processor</td>
<td>ATMega 328</td>
<td>ARM11</td>
<td>ARM Cortex-A8</td>
</tr>
<tr>
<td>Clock Speed</td>
<td>16MHz</td>
<td>700MHz</td>
<td>700MHz</td>
</tr>
<tr>
<td>RAM</td>
<td>2KB</td>
<td>256MB</td>
<td>250MB</td>
</tr>
<tr>
<td>Flash</td>
<td>32KB (SD Card)</td>
<td>4GB (microSD)</td>
<td></td>
</tr>
<tr>
<td>EEPROM</td>
<td>1KB</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Input Voltage</td>
<td>5v</td>
<td>5v</td>
<td>5v</td>
</tr>
<tr>
<td>Min Power</td>
<td>42mA (.3W)</td>
<td>700mA (3.5W)</td>
<td>170mA (.85W)</td>
</tr>
<tr>
<td>Digital GPIO</td>
<td>14</td>
<td>8</td>
<td>66</td>
</tr>
<tr>
<td>Analog Input</td>
<td>6 10-bit</td>
<td>N/A</td>
<td>7 12-bit</td>
</tr>
<tr>
<td>PWM</td>
<td>6</td>
<td>8</td>
<td>8</td>
</tr>
<tr>
<td>TWI/I2C</td>
<td>2</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>SPI</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>UART</td>
<td>1</td>
<td>1</td>
<td>5</td>
</tr>
</tbody>
</table>

Dev IDE
- Arduino Tool: IDE, Scratch, Squeak/Linux
- IDLE, Scratch, Squeak/Linux
- Python, Scratch, Squeak, Cloud9/Linux

Ethernet
- N/A
- 10/100
- 10/100

USB Master
- N/A
- 2 USB 2.0
- 1 USB 2.0

Video Out
- N/A
- HDMI, Composite
- N/A

Audio Output
- N/A
- HDMI, Analog
- Analog

Comparing the three platforms.
IoT – Arduino UNO

Technical specs

<table>
<thead>
<tr>
<th>Specification</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Microcontroller</td>
<td>ATmega328P</td>
</tr>
<tr>
<td>Operating Voltage</td>
<td>5V</td>
</tr>
<tr>
<td>Input Voltage (recommended)</td>
<td>7-12V</td>
</tr>
<tr>
<td>Input Voltage (limit)</td>
<td>6-20V</td>
</tr>
<tr>
<td>Digital I/O Pins</td>
<td>14 (of which 6 provide PWM output)</td>
</tr>
<tr>
<td>PWM Digital I/O Pins</td>
<td>6</td>
</tr>
<tr>
<td>Analog Input Pins</td>
<td>6</td>
</tr>
<tr>
<td>DC Current per I/O Pin</td>
<td>20 mA</td>
</tr>
<tr>
<td>DC Current for 3.3V Pin</td>
<td>50 mA</td>
</tr>
<tr>
<td>Flash Memory</td>
<td>32 KB (ATmega328P)</td>
</tr>
<tr>
<td></td>
<td>of which 0.5 KB used by bootloader</td>
</tr>
<tr>
<td>SRAM</td>
<td>2 KB (ATmega328P)</td>
</tr>
<tr>
<td>EEPROM</td>
<td>1 KB (ATmega328P)</td>
</tr>
<tr>
<td>Clock Speed</td>
<td>16 MHz</td>
</tr>
<tr>
<td>Length</td>
<td>68.6 mm</td>
</tr>
<tr>
<td>Width</td>
<td>53.4 mm</td>
</tr>
<tr>
<td>Weight</td>
<td>25 g</td>
</tr>
</tbody>
</table>
Arduino with Sensor as device in PSpice

Arduino UNO
Hardware-in-loop
Arduino with Sensor as device in PSpice

1. Define Arduino Board I/O with DMI as analog part type
2. Define communication between PSpice and the board using USB serial protocol creating VS project
3. Define the code you want to evaluate in Arduino
4. Define the code you want to evaluate in PSpice and generate .dll
5. Associate macro-model to schematic on OrCAD Capture canvas
6. Run PSpice simulation and analyze results
Adding Sensors on Arduino

- USB
- LED on Photo-resistor
- Thermal Sensor
- Tilt motion Sensor
- Analog Pins
- Digital Pins
Online Videos at YouTube

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Für weitere Fragen und Informationen stehen wir gerne zur Verfügung
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