



# Nucleus® Kernel Evaluation Overview

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# Chapter 1

## Introduction

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The Mentor Graphics' Nucleus Kernel Evaluation lets you explore the full capabilities of the Nucleus Kernel. In this evaluation, you will debug a demonstration of Nucleus PLUS, a Nucleus embedded kernel product.

The evaluation provides the following functionality:

- Limited version of EDGE SimTest, the Mentor Graphics Embedded Systems Division's cutting-edge simulation tool. EDGE SimTest allows native execution of the Nucleus Embedded Kernel on a Windows XP host machine. It also provides a visual interface for modeling hardware and controlling data flow. However, this limited version only provides support for executable simulations, such as the Nucleus Kernel Evaluation.
- Native host execution. Nucleus embedded software is compiled for Windows and does not require slower instruction set simulators.
- Nucleus PLUS demo project and pre-built libraries. The Nucleus PLUS demo provides you with an introduction to the Nucleus embedded kernel. The demo may be debugged and modified in Visual C++ Express. For more information on the Nucleus PLUS demo, see the [Nucleus PLUS Demonstration Overview](#) section of this document.

This document is a guide to using the Mentor Graphics' Nucleus Kernel Evaluation. It contains instructions for downloading and installing Microsoft® Visual Studio Express, opening the Nucleus PLUS demo project in Visual C++® 2008 Express Edition, and building and debugging the Nucleus PLUS demo.



# Chapter 2

## Getting Started

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In an effort to reduce the intrusiveness of an evaluation product, this installer does not provide an uninstaller. You may uninstall it by deleting the installation directory, and by removing the following environment variables from your system:

- SIMTEST\_ROOT
- CM\_COMMAND\_PORT

In addition to those environment variables, your system path is also modified to include *c:/mgc/embedded/simtest\_eval/bin*. You may remove this entry as well, but it is advised that you make a backup of the entire path's contents first.

## Using the Evaluation

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### Note



**Attention EDGE Customers:** Do not install Nucleus Kernel trial software on the same computer with any existing EDGE Developer Suite installation.

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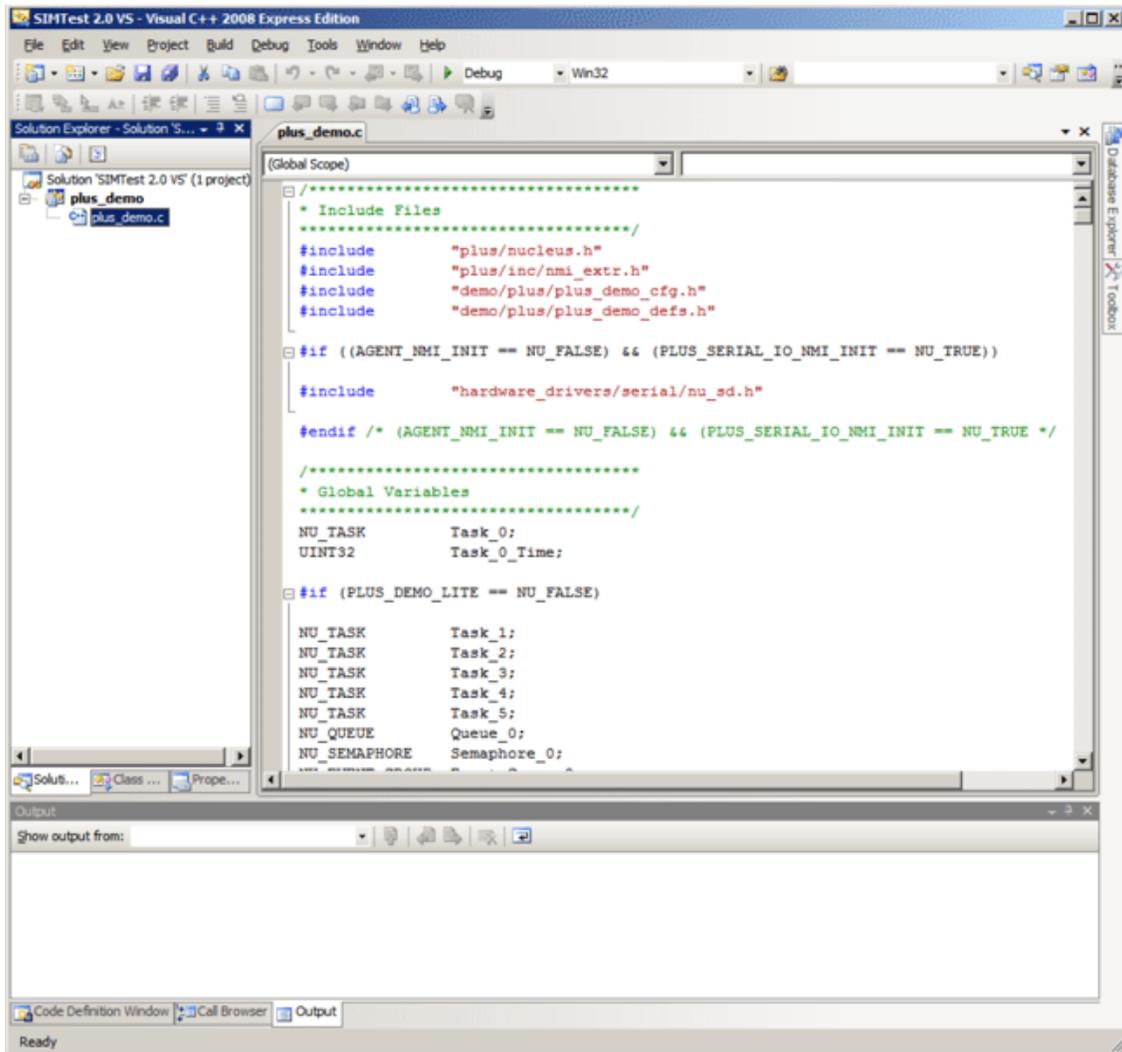
1. To begin using the evaluation, download and install Microsoft Visual C++ 2008 Express Edition from the following web site:

<http://www.microsoft.com/express>

There are several versions of Visual Studio 2008 Express Edition available, so be sure you have chosen Visual C++.

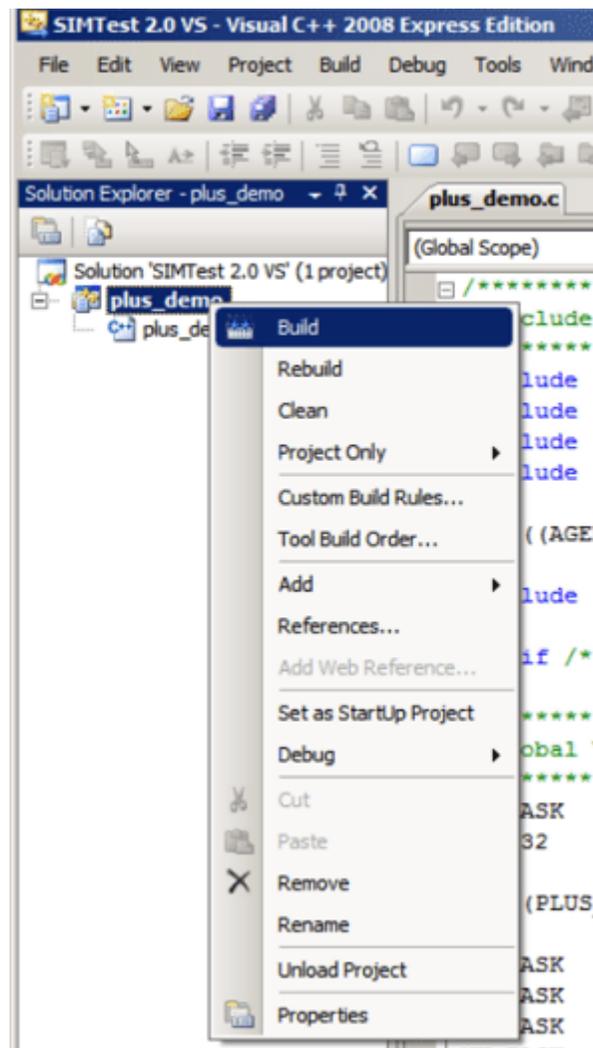
2. Download and install Java Runtime Environment (JRE) from the following web site:  
<http://java.sun.com>
3. Open your extracted downloaded evaluation zip file. Double-click *Nucleus\_kernel\_Eval\_<version>.exe* file to install the Nucleus Kernel evaluation.
4. The evaluation is installed to *c:/mgc/embedded/simtest\_eval*. Here, you can find *nucleus\_iv\SimTest 2.x VS.sln*, a Visual C++ 2008 Express Edition solution file. Double-click this file to open it in Visual C++.
5. In Visual C++, expand the **plus\_demo** project and double-click the file **plus\_demo.c**. The file opens and displays the source code of the Nucleus PLUS demo as shown in the following screenshot. For more information on the demo, see the [Nucleus PLUS Demonstration Overview](#) section of this document.

Figure 2-1. plus\_demo Project in Visual C++



6. Right-click the **plus\_demo** project, and click **Build** as shown here.

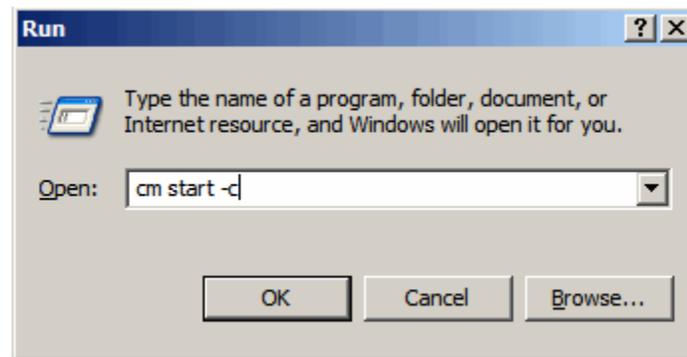
Figure 2-2. Building in Visual C++



7. You may notice several warnings in the output window (see the following example). You can ignore these warnings.  

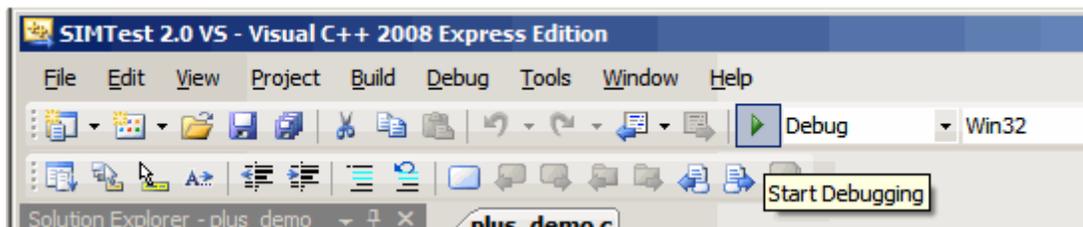
```
I 1>.\plus_demo.c(317) : warning C4127: conditional expression is constant
```
8. Before running or debugging the demo, you must first run the SimTest Communication Manager. Open the Windows® Start menu, click **Run**, and enter **cm start -c** as shown in [Figure 2-3](#).

Figure 2-3. Run Dialog Box



9. Click **OK**. A DOS console appears with several lines of information:
  - Always be sure to run the Communication Manager before launching an application that uses SimTest.
  - You can terminate the Communication Manager at any time by opening the DOS console and entering Ctrl+C. This also terminates all running applications that use SimTest.
10. You are now ready to debug the demo. Click the green arrow in the Visual C++ toolbar to start a debugging session.

Figure 2-4. Visual C++ Toolbar



You are now debugging the Nucleus PLUS demo for EDGE SimTest. You should now be able to explore the capabilities of the Nucleus Kernel Evaluation. There is no time limit on this evaluation edition, so feel free to take your time and experiment with it.

```
*****
                          Nucleus PLUS 2.1 Demonstration
                          Build Timestamp - 2009
                          Serial IO: PLUS_SERIAL   Version: 2.1
*****
Task 0 Time:                24
Timer Interrupts:          2454

Task 1 Messages Sent:      1124049

Task 2 Messages Received:  1124019
Task 2 Invalid Messages:   0
```

Task 3/4 Resource Owner: Task 4  
Task 5 Event Detections: 23  
RX Buffer:

## Using the Visual C++ 2008 Express Help System

This section explains how to access the Visual C++ 2008 Express Help System.

### Caution

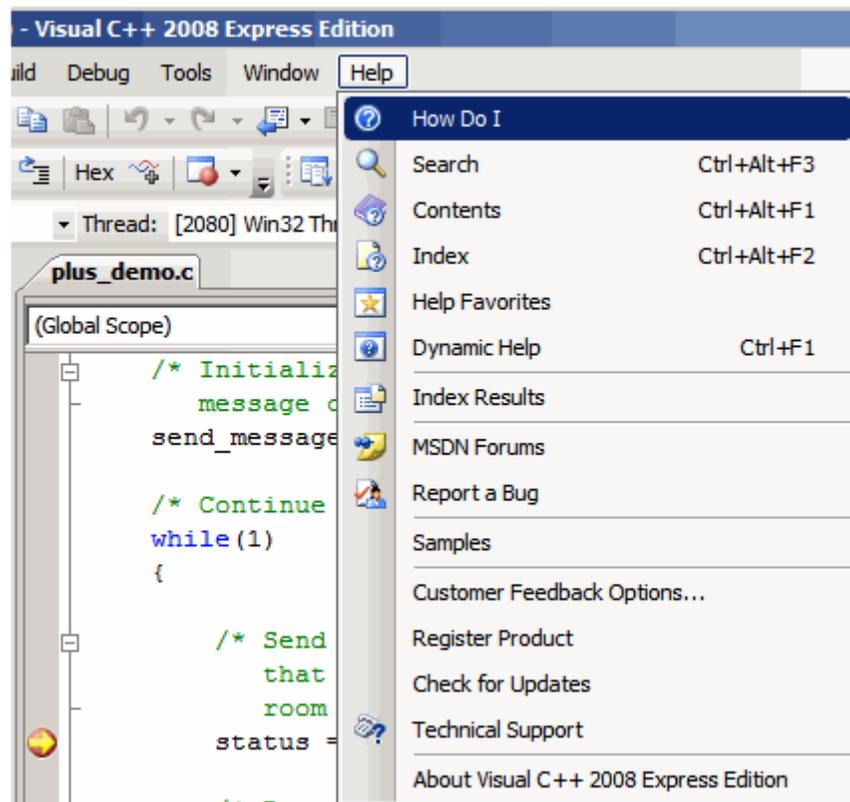


It is strongly recommended that you stop execution of the demonstration prior to accessing this help system.

- Press the **Break All** button to pause execution of the demonstration.
- Press the **Continue** button to continue executing the demonstration.
- Press the **Stop Debugging** button to stop executing the demonstration.

Visual C++ 2008 Express offers a rich and powerful set of debugging features. Consult its help system for more information on debugging tools. [Figure 2-5](#) shows you how to access the help.

**Figure 2-5. Help Menu in Visual C++**





# Chapter 3

## Nucleus PLUS Demonstration Overview

---

The Nucleus PLUS demonstration is composed of the following files:

**Table 3-1. Nucleus PLUS Demonstration Files**

<b>File Name</b>	<b>File Location</b>	<b>File Description</b>
<i>plus_demo.c</i>	<i>&lt;nucleus_installation&gt;/demo/plus</i>	This file contains the C code and data for the Nucleus PLUS demonstration.
<i>plus_demo_defs.h</i>	<i>&lt;nucleus_installation&gt;/demo/plus</i>	This file contains the Nucleus PLUS demonstration specific defines, constants, and so on.
<i>plus_demo_cfg.h</i>	<i>&lt;nucleus_installation&gt;/demo/plus</i>	This file contains the demonstration configuration settings for Nucleus PLUS.

The Nucleus PLUS demonstration is comprised of an `Application_Initialize` function and six tasks. In addition to task execution, task communication and synchronization are demonstrated in this example.

All system objects in this demonstration (tasks, queues, semaphores, and event flag groups) are created during initialization within the `Application_Initialize` function. This initialization includes the following:

- Allocating memory for each of the six demonstration tasks
- Creating each of the six demonstration tasks
- Allocating memory for the single demonstration queue
- Creating the demonstration communication queue
- Creating the demonstration semaphore
- Creating the demonstration event group

**Note**



The size of the task stacks is determined at compile-time. The demonstration defaults to allocate eight times the minimum stack size for each task in the demo. This size can be changed in the *plus\_demo\_defs.h* demonstration header file.

---

Task 0 is the first task to execute when the system starts with the default settings. This is because task 0 is the highest priority task in the system (priority 6). Task 3 (priority 10) executes after task 0 suspends, and task 4 (priority 10) executes after task 3 suspends. It is important to realize why task 3 executes before task 4 even they both have the same priority. The reason for this is that task 3 was created and started first (see the `Application_Initialize` function in `plus_demo.c`). Tasks of the same priority execute in the order they become ready for execution. After task 4 suspends, task 5 executes (priority 12).

After task 5 suspends, task 1 executes (priority 255). task 2 executes (priority 255) after task 1 suspends on a queue full condition. Execution resumes in task 0 after its timeout expires and this cycle will repeat itself indefinitely.

**Note**



The priority of each task is defined in the *plus\_demo\_defs.h* header file. Changing the priorities of each task may cause the system to operate much differently than explained in this document. These defines may be changed to evaluate system execution with different configurations.

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## Demonstration Details

The following sections describe the details of each task in the Nucleus PLUS demonstration.

### Task 0

Task 0 simulates a simple system timer task. The main purpose of this task is to increment a global timer count, output system information (if serial I/O is enabled), and set an event. Like all of the tasks in this example system, task 0 does some preliminary initialization and then starts the execution of an endless loop. Processing inside of task 0's endless loop includes calls to `NU_Sleep` and `NU_Set_Events`. task 0's loop is executed approximately once every 100 timer ticks (may be greater than 100 timer ticks due to time necessary to execute serial I/O) because of the call to `NU_Sleep`.

**Note**



Task 5 is made ready on each call to `NU_Set_Events`. Since task 5 has a lower priority than task 0, it does not execute until task 0 executes the `NU_Sleep` call again.

---

## Task 1

Task 1 continually sends a single 32-bit message to queue 0. When the capacity of the queue is reached, task 1 suspends. This suspension remains in effect until room is available in queue 0. The suspension of task 1 allows task 2 to resume execution.

The size of the queue is defined within *plus\_demo\_defs.h*. Changing the size of this queue may cause the system to execute differently than documented here. This value may be changed to evaluate different system configurations.

Task 1 is also created, in *Application\_Initialize*, with time-slicing enabled. When the default time-slice value is 5 timer ticks (defined in *plus\_demo\_defs.h*), task 1 will relinquish control to task 2 after 5 timer ticks have expired (both at same priority level). Therefore, in some systems, task 1 may relinquish control before the queue is full.

## Task 2

Task 2 continually retrieves single 32-bit messages from queue 0. When the queue becomes empty, task 2 suspends. The suspension of task 2 allows task 1 to resume execution.

Task 2 is also created within *Application\_Initialize* with time-slicing enabled. When the default time-slice value is 5 timer ticks (defined in *plus\_demo\_defs.h*), Task 2 will relinquish control to Task 1 after 5 timer ticks have expired (both at same priority level). Therefore, in some systems, Task 2 may relinquish control before the queue is empty.

## Task 3 and 4

Tasks 3 and 4 share the same instruction code. However, each task has its own unique stack. Each of these two tasks competes for a binary semaphore. Once the semaphore is obtained, the task that obtains the semaphore sleeps for 100 timer ticks before releasing the semaphore again.

This action allows the other task to execute and suspend attempting to obtain the same semaphore. When the semaphore is released, suspension is lifted on the task waiting for the semaphore.

## Task 5

This task is in an endless loop waiting for an event flag to be set. The desired event flag is set by task 0. Therefore, task 5 executes at the same frequency as task 0.



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11.4. THIS SECTION IS SUBJECT TO SECTION 8 ABOVE AND STATES THE ENTIRE LIABILITY OF MENTOR GRAPHICS AND ITS LICENSORS AND CUSTOMER'S SOLE AND EXCLUSIVE REMEDY WITH RESPECT TO ANY ALLEGED PATENT OR COPYRIGHT INFRINGEMENT OR TRADE SECRET MISAPPROPRIATION BY ANY SOFTWARE LICENSED UNDER THIS AGREEMENT.

## 12. TERM.

- 12.1. This Agreement remains effective until expiration or termination. This Agreement will immediately terminate upon notice if you exceed the scope of license granted or otherwise fail to comply with the provisions of Sections 2, 3, or 5. For any other material breach under this Agreement, Mentor Graphics may terminate this Agreement upon 30 days written notice if you are in material breach and fail to cure such breach within the 30 day notice period. If a Software license was provided for limited term use, such license will automatically terminate at the end of the authorized term.
  - 12.2. Mentor Graphics may terminate this Agreement immediately upon notice in the event Customer is insolvent or subject to a petition for (a) the appointment of an administrator, receiver or similar appointee; or (b) winding up, dissolution or bankruptcy.
  - 12.3. Upon termination of this Agreement or any Software license under this Agreement, Customer shall ensure that all use of the affected Software ceases, and shall return it to Mentor Graphics or certify its deletion and destruction, including all copies, to Mentor Graphics' reasonable satisfaction.
  - 12.4. Termination of this Agreement or any Software license granted hereunder will not affect Customer's obligation to pay for products shipped or licenses granted prior to the termination, which amounts shall immediately be payable at the date of termination.
13. **EXPORT.** Software is subject to regulation by local laws and United States government agencies, which prohibit export or diversion of certain products, information about the products, and direct products of the products to certain countries and certain persons. Customer agrees that it will not export Software or a direct product of Software in any manner without first obtaining all necessary approval from appropriate local and United States government agencies.
  14. **U.S. GOVERNMENT LICENSE RIGHTS.** Software was developed entirely at private expense. All Software is commercial computer software within the meaning of the applicable acquisition regulations. Accordingly, pursuant to US FAR 48 CFR 12.212 and DFAR 48 CFR 227.7202, use, duplication and disclosure of the Software by or for the U.S. Government or a U.S. Government subcontractor is subject solely to the terms and conditions set forth in this Agreement, except for provisions which are contrary to applicable mandatory federal laws.
  15. **THIRD PARTY BENEFICIARY.** Mentor Graphics Corporation, Mentor Graphics (Ireland) Limited, Microsoft Corporation and other licensors may be third party beneficiaries of this Agreement with the right to enforce the obligations set forth herein.
  16. **REVIEW OF LICENSE USAGE.** Customer will monitor the access to and use of Software. With prior written notice and during Customer's normal business hours, Mentor Graphics may engage an internationally recognized accounting firm to review Customer's software monitoring system and records deemed relevant by the internationally recognized accounting firm to confirm Customer's compliance with the terms of this Agreement or U.S. or other local export laws. Such review may include FLEXIm or FLEXnet (or successor product) report log files that Customer shall capture and provide at Mentor Graphics' request. Customer shall make records available in electronic format and shall fully cooperate with data gathering to support the license review. Mentor Graphics shall bear the expense of any such review unless a material non-compliance is revealed. Mentor Graphics shall treat as confidential information all information gained as a result of any request or review and shall only use or disclose such information as required by law or to enforce its rights under this Agreement. The provisions of this section shall survive the termination of this Agreement.
  17. **CONTROLLING LAW, JURISDICTION AND DISPUTE RESOLUTION.** The owners of the Mentor Graphics intellectual property rights licensed under this Agreement are located in Ireland and the United States. To promote consistency around the world, disputes shall be resolved as follows: This Agreement shall be governed by and construed under the laws of the State of Oregon, USA, if Customer is located in North or South America, and the laws of Ireland if Customer is located outside of North or South America. All disputes arising out of or in relation to this Agreement shall be submitted to the exclusive jurisdiction of Portland, Oregon when the laws of Oregon apply, or Dublin, Ireland when the laws of Ireland apply. Notwithstanding the foregoing, all disputes in Asia (except for Japan) arising out of or in relation to this Agreement shall be resolved by arbitration in Singapore before a single arbitrator to be appointed by the Chairman of the Singapore International Arbitration Centre ("SIAC") to be conducted in the English language, in accordance with the Arbitration Rules of the SIAC in effect at the time of the dispute, which rules are deemed to be incorporated by reference in this section. This section shall not restrict Mentor Graphics' right to bring an action against Customer in the jurisdiction where Customer's place of business is located. The United Nations Convention on Contracts for the International Sale of Goods does not apply to this Agreement.
  18. **SEVERABILITY.** If any provision of this Agreement is held by a court of competent jurisdiction to be void, invalid, unenforceable or illegal, such provision shall be severed from this Agreement and the remaining provisions will remain in full force and effect.
  19. **MISCELLANEOUS.** This Agreement contains the parties' entire understanding relating to its subject matter and supersedes all prior or contemporaneous agreements, including but not limited to any purchase order terms and conditions. Some Software may contain code distributed under a third party license agreement that may provide additional rights to Customer. Please see the applicable Software documentation for details. This Agreement may only be modified in writing by authorized representatives of the parties. All notices required or authorized under this Agreement must be in writing and shall be sent to the person who signs this Agreement, at the address specified below. Waiver of terms or excuse of breach must be in writing and shall not constitute subsequent consent, waiver or excuse.