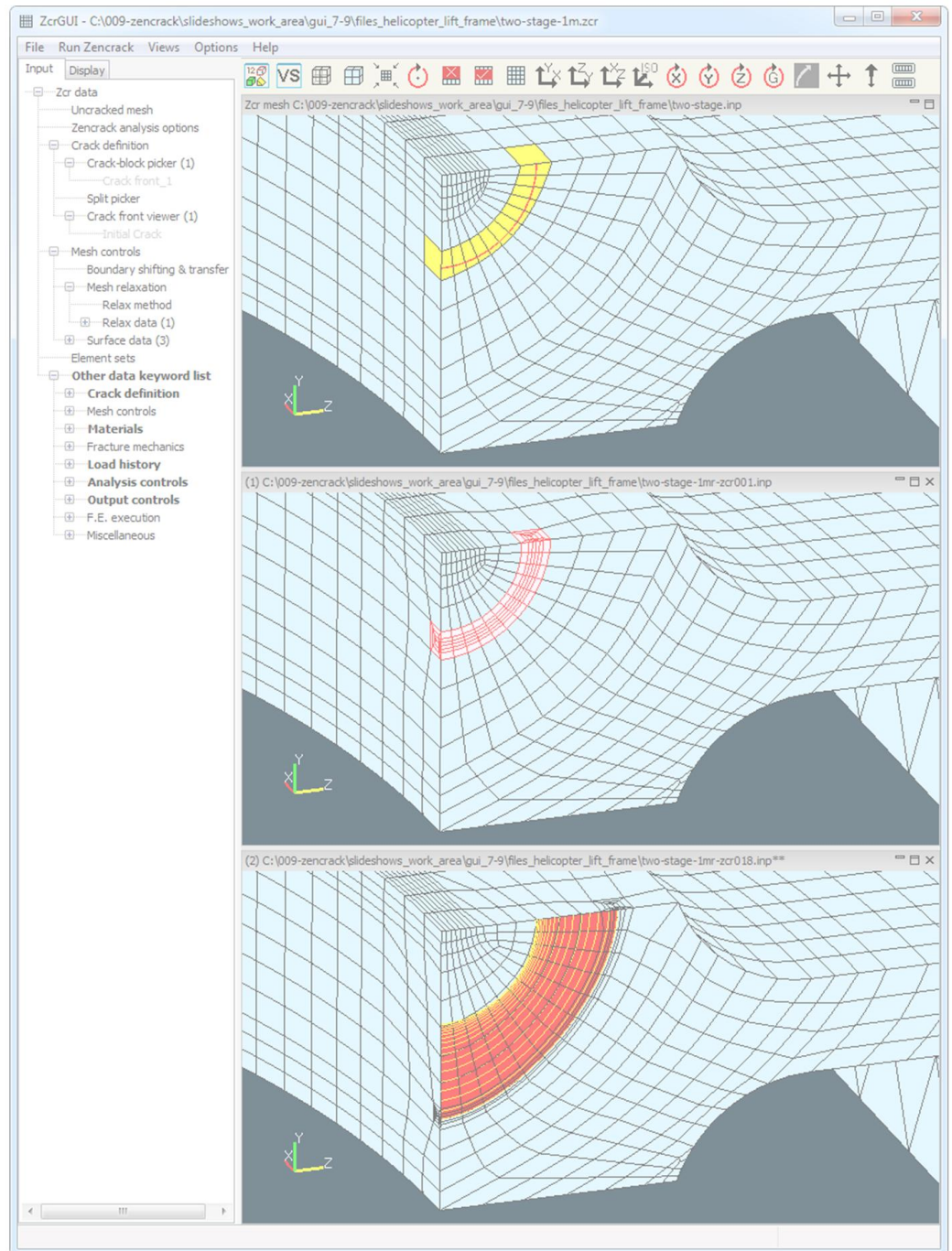# Zencrack

Installation And Execution
Version 7.9

ZENTECH

Zencrack 7.9 - Installation And Execution

Issue 7.9

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Version	Build date	Description
7.9-a	27 November 2013	Zencrack GUI
7.9-1	19 November 2013	Zencrack analysis program

Version Status for this manual:

This version of the manual is to be used with Zencrack program version 7.9-1 and Zencrack GUI version 7.9-a. The program version and build date are shown in the banner at the start of every Zencrack output file (i.e. the .rep file). The GUI version is shown in the program Help > About menu. All pages are at "Issue 7.9, Revision 0".

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Web site: http://www.reprisesoftware.com

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1.   Introduction

This document describes installation, set-up and execution of Zencrack version 7.9-1 for Windows x86 and Linux x86 platforms. The document includes installation of the Zencrack analysis product and GUI and the RLM license server (which is required for network licensing). For any sub-version (e.g. 7.9-2) the instructions in this document should be read with 7.9-1 replaced by the appropriate sub-version number. In some places a generic reference is made to version 7.9-x.

Version 7.9-1 has several changes in the installer compared to version 7.8-4 and earlier releases:

- Windows installers for 32 and 64 bit Windows are combined into a single file which installs the appropriate components for the target system.
- The Linux installer runs a setup program to configure the installation rather than the user being required to manually configure the setup file after installation (i.e. the Windows and Linux installers now behave in the same way).

A 32bit version of Zencrack 7.9 operates on x86 machines running Windows XP or later. A 64bit version is available for x86 machines running 64bit versions of Windows such as Windows XP x64 Edition or later. A 64bit version of Zencrack is also available for x86 machines running Linux.

Documentation uses Adobe Acrobat format pdf files (version 5) and requires a suitable reader. A reader can be downloaded from http://www.adobe.com/products/acrobat/readstep.html.

Up-to-date information on compatibility of different versions of the interfaced finite element codes is maintained on the Zencrack section of the Zentech website:

http://www.zentech.co.uk/zencrack.htm

If Zencrack user subroutines are to be used then an appropriate version of the Intel Fortran compiler must be installed. Up-to-date information on compatibility of compiler versions can also be found on the above website.

1.1   License types

Zencrack can be licensed using a nodelocked license file or using a token-based license server (i.e. network licensing) system. Both systems are based on the Reprise License Manager (RLM v8) [Ref. 1].

For a nodelocked system the software (either Zencrack Standard or Zencrack Professional) can only be executed on the machines(s) specified in the license file. The nodelocked method does not require installation of a license server – only the placement of the supplied license file into the license sub-folder of the Zencrack installation.

For network licensing, a license server must be installed on a specified machine. The license file declares this machine as the license server and contains information about the licensed products. All files required for the license manager are supplied by Zentech – there is no requirement to download files from the Reprise website. The Zencrack product is then installed on one or more client machines (one of which could be the server machine). When a Zencrack job is executed on a client machine a request is made to the server to check out the required number of tokens for the job. This manual covers the basics of installing, starting and using the RLM license server. Additional information can be found in the RLM End User Manual supplied as part of the license server installation and the Zencrack documentation.

1.2   Hardware requirements

The approximate disk space requirements for Zencrack installations are:

- 32bit Windows   260Mb
- 64bit Windows   275Mb
- Linux   105Mb
- License server (all platforms)   2Mb
- Documentation   40Mb

Memory requirements are governed by the requirements of the finite element analysis rather than by Zencrack so provided there is sufficient memory to run the finite element analyses of typical user models there should not be any memory issues for Zencrack.

The Zencrack analysis program is an "analysis engine" so there are no special hardware requirements. Input and output to the analysis program is via ASCII text files.

The Zencrack GUI is available for Windows 32 and 64 bit installations and allows reading, modification and writing of Zencrack input files as well as display of finite element meshes and results data. It requires OpenGL support on the graphics card.

The Zencrack plug-ins for Abaqus/CAE and Abaqus/Viewer have no special hardware requirements beyond any requirements for running /CAE or /Viewer.

THE RLM license server and client installations are available for Windows x86-32 or x86-64 machines or Linux x86-64 machines.

1.3   Software requirements

Zencrack is supplied as an installer that contains executables, object files and ancillary support files – no third party files are required to be installed other than the finite element code which the user intends to use with Zencrack.

1.3.1   Finite element interfaces

Zencrack is interfaced to Abaqus/Standard [Ref. 2] and Ansys/APDL [Ref. 3]. The Zencrack user license permits use with one or both of these finite element programs (which must be licensed separately from the appropriate vendor). The finite element program must be executed on the same machine as Zencrack unless the remote finite element execution option is activated. This capability is available if Zencrack is installed on a Windows PC with the finite element analysis required on a remote Linux or Unix machine.

It is generally expected that a machine on which Zencrack is to be installed already contains a local installation of Abaqus or Ansys. During the Zencrack installation procedure a setup program runs and requests user input about the Abaqus and/or Ansys version(s) to be used by Zencrack.

1.3.2   Fortran compiler

A Fortran compiler is only required if a Zencrack user subroutine option is to be used. When a job runs that requires a user subroutine, the Zencrack execution program automatically compiles the subroutine and links it with the supplied object files to create a new executable. This can be achieved using the -u command line option (see section 5.2). An Intel Fortran compiler is required. Updated information about compatibility with Intel Fortran versions is available at:

http://www.zentech.co.uk/zencrack_support_fortran.htm

If user subroutines are not used, there is no requirement to have an Intel Fortran compiler installed.

If there is uncertainty about the requirements for user subroutines at the time of installation, it is recommended that the "no compiler" option is selected during the

installation setup process. This can be changed at a later date by re-running the setup program.

Each installation of Zencrack contains a readme.txt file in its top-level directory that provides details of the operating system and compiler used to create that version of the software. If you have an earlier compiler version, you may need to upgrade to at least the compiler version used to create Zencrack, or have the necessary run-time files in place.

1.3.3   License server

For users with a license server arrangement all necessary files for the server installation are supplied in a separate license server installation file, i.e. one installation file for client product installation and one for license server installation.

1.3.4   Changes in software configurations

In the event of changes to the software configurations (for instance installing a newer version of Abaqus or Ansys, changes to the license server machine, installing a Fortran compiler), the Zencrack setup program may be re-run or the zencrack.ini file may be manually edited (see section 4).

2.   Installation - Zencrack Product

This section describes installation of the Zencrack product. This is applicable for nodelocked licenses and for client installations when using a network license server.

2.1   Windows

The Zencrack product is supplied as two files:

Zencrack_7-9-x_Windows.exe
>   setup program containing the analysis program files and GUI

Zencrack_7-9-x_Windows-doc.exe
>   setup program containing the documentation files

The default program installation location is c:\Zencrack\7.9-x but this may be changed if required. The user installing the program must have sufficient privilege to create files in the chosen location.

As part of the program installation, a setup program is run to configure the installation. During this configuration process the choice is made regarding location of finite element code(s), the Fortran environment and the licensing type.

The documentation can be installed before or after installation of the program. It is recommended that the documentation be installed into a sub-directory of the main Zencrack folder. For this reason the default documentation location is c:\Zencrack\7.9-x_document.

It is generally not recommended to run analyses or create any other files within the Zencrack installation directories. If this is done, such files will be left behind by the uninstaller when the program is uninstalled.

If Windows UAC (User Account Control) is running on the installation machine, there may be additional system messages generated when installing from these files. In particular, for Windows 7 the Program Compatibility Assistant may appear at the end of an installation or uninstallation process e.g.:
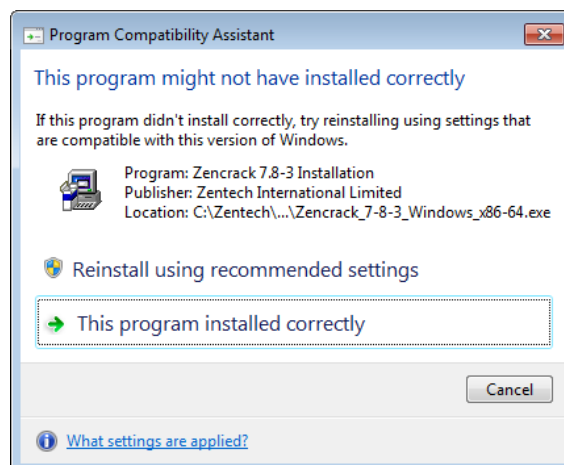

Figure 2-1 – Program Compatibility Assistant warning (Windows)

If this occurs, you may safely click on "This program installed correctly" or "Cancel":

- If you click on "This program installed correctly", Windows will create a registry entry to prevent this warning if you re-run the installer at a later date.

- If you click on "Cancel", Windows will not make any entry in the registry regarding this warning. This is the recommended option.

### 2.1.1   To install the program files (Windows)

1. Log in as the user required to execute Zencrack. Administrator privilege is not required but may reduce any system messages regarding UAC.

2. Run the Zencrack_7-9-x_Windows.exe setup program to install Zencrack. The default home directory c:\Zencrack\7.9-x is used throughout the remainder of these instructions.

3. Choose whether or not to create an uninstaller. If selected, an uninstaller executable, uninstall_7-9-x.exe, is created in the installation home directory. It is recommended that an uninstaller is created.

4. The following directory structure is created under the home directory:

bin	Zencrack executable, object and library files (Intel Fortran)
crack	Crack-block files
	Tolerance file tol.dat
demos	Example input files – see the readme.txt file in this directory
fe_abaqus	Files related to the Abaqus interface (including /CAE plug-in files).
fe_ansys	Files related to the Ansys interface
gui	Files related to the Zencrack GUI
license	Nodelocked license file should be placed here[1]
machine_id	Utility to extract details required to license Zencrack
tools	Execution file and location of the zencrack.ini file
utils	Utility programs:
	3dmesh : crack profile generator
	process : creates a .csv data file for specified node(s) on a crack front
	rainflow : rainflow cycle counting
	tanh : creates tabular growth data from tanh growth equation data
	T4eRexec: used for remote f.e. execution
	T4eSSH : used for remote f.e. execution
	examples directory for utility programs
readme.txt	Installation information
versions.txt	Version information

5. Choose whether or not to create an entry in the Start Menu and/or desktop shortcuts. The Start Menu entry includes a shortcut to the Zencrack command prompt (i.e. the same as the optional desktop shortcut), the Zencrack GUI and a shortcut to the uninstaller (if that option was selected at step 3).

6. If the "Zencrack configuration" phase of the setup was successfully run, this step can be skipped, otherwise open a command prompt window, "cd" to the c:\Zencrack\7.9-x\tools directory and issue the command "runzcr79 setup". This runs the setup procedure which requests information on the location of Abaqus and Ansys and also details of the Fortran environment (if any) and license type. It then configures the Zencrack .ini file accordingly.

7. For nodelocked licenses put a copy of your license file (see section 7) into the license directory.

8. Some items in the zencrack.ini file can be manually modified after completion of installation. These items are described in section 4.

If no desktop shortcut was selected at step 5 but a shortcut is desired at a later date, the following procedure can be used:

Right click on the Zencrack shortcut file in the c:\Zencrack\7.9-x\tools directory and drag it onto your desktop. This shortcut is the file called "Zencrack 7.9-1" (not the icon file "Zencrack791.ico"). Depending upon the view setting for the folder, the file looks like this (Windows 7):

---

[1] The nodelocked license file is supplied separately from the program installation files. See section 7.
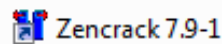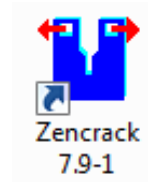
| Details or List | Icons | Tiles |

Select "Copy here" or "Create shortcut here".

Repeat this process for the file c:\Zencrack\7.9-x\gui\zcrgui.exe to create a shortcut for the Zencrack GUI.

The desktop shortcuts should look like this after completion:
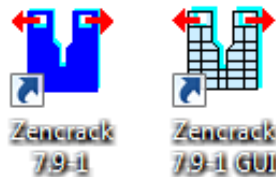
If the shortcuts do not display with these icon, a re-boot may be necessary.

Note: the setup program detailed in step 6 above must be run at least once, either during the installation process or directly as described in step 6.

2.1.2   To un-install Zencrack (Windows)

The installation process creates an entry in the standard Windows list of installed programs if the "Create uninstaller" option is used during the install process. The installation can then be uninstalled in one of three ways:

1.   By double-clicking the uninstall_7-9-x.exe file in the installation home directory.
2.   By using the "Zencrack 7.9-x / Zencrack uninstall" entry in the Start menu (if Start Menu entries were selected during installation).
3.   By selecting Zencrack 7.9-x from the standard Windows "Uninstall a program" list in Control Panel.

If an uninstaller was not created during the install process, the following procedure can be used to manually remove the installation:

1.   Delete files under the installation directory, e.g. c:\Zencrack\7.9-x in the above example, making sure to first backup any analysis files that may have been located there. It is not recommended to run analyses or create any other files within the Zencrack installation directories.
2.   Delete any desktop shortcuts that were created.

2.1.3   To install the documentation files (Windows)

It is recommended that the documentation be installed into a sub-directory of the main Zencrack folder. The documentation is in Adobe Acrobat version 5 format and requires a suitable reader.

1.   Double click on Zencrack_7-9-x_Windows-doc.exe to start the installation process. Specify a home directory for the installation. The documentation does not have to be installed in the same location as the program files. The default is:
        c:\Zencrack\7.9-x_document
2.   Choose whether or not to create an uninstaller. If selected, an uninstaller executable, uninstall_7-9-x_document.exe, is created in the installation home directory. It is recommended that an uninstaller is created.

3.   Choose whether or not to create an entry in the Start Menu and/or a desktop shortcut. The Start Menu entry includes a shortcut to the Zencrack unit conversion utility, the Zencrack documentation (i.e. the same as the optional desktop shortcut) and a shortcut to the uninstaller (if that option was selected at step 2).
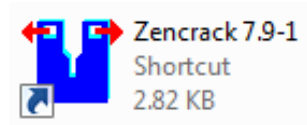
If no desktop shortcut was selected at step 3 but a shortcut is desired at a later date, the following procedure can be used:

Right click on zencrack79_documentation.pdf file in the c:\Zencrack\7.9-x_document directory.
Drag it onto your desktop.
Select "Create shortcut here".

2.1.4   To un-install the documentation files (Windows)

The installation process creates an entry in the standard Windows list of installed programs if the "Create uninstaller" option is used during the install process. The installation can then be uninstalled in one of three ways:

1.   By double-clicking the uninstall_7-9-x_document.exe file in the installation home directory.
2.   By using the "Zencrack Documentation 7.9-x / Zencrack Documentation uninstall" entry in the Start menu (if Start Menu entries were selected during installation).
3.   By selecting Zencrack Documentation 7.9-x from the standard Windows "Uninstall a program" list in Control Panel.

If an uninstaller was not created during the install process, the following procedure can be used to manually remove the installation:

1.   Delete files under the installation directory, e.g. c:\Zencrack\7.9-x_document in the above example.
2.   Delete any desktop shortcuts that were created.

2.1.5   Remote execution of the finite element code

A capability exists to allow remote execution of the finite element code on a Linux or Unix machine when Zencrack is installed on a Windows machine. This differs from the normal arrangement in which Zencrack and the finite element code are executed on the same machine. Please see section 8 for more information. The standard installation procedure described in the previous sections must be followed before configuration of remote execution of the finite element code is possible.

2.2   Linux

The Zencrack product is supplied as two files:

Zencrack_7-9-x_Linux_x86-64.exe
                setup program containing the program files

Zencrack_7-9-x_Linux_x86-doc.exe
                setup program containing the documentation files

The default program installation location is /home/Zencrack/7.9-x where /home is the home directory for the user installing the program. This may be changed if required. The user installing the program must have sufficient privilege to create files in the chosen location.

As part of the program installation, a setup program is run to configure the installation. During this configuration process the choice is made regarding location of finite element code(s), the Fortran environment and the licensing type.

The documentation can be installed before or after installation of the program. It is recommended that the documentation be installed into a sub-directory "document" of the main Zencrack installation.

It is generally not recommended to run analyses or create any other files within the Zencrack installation directories. If this is done, such files will be left behind by the uninstaller when the program is uninstalled.

2.2.1   To install the program files (Linux)

1.   Log in as any user with sufficient privilege to meet the requirements stated above.
2.   Run the Zencrack_7-9-x_Linux_x86-64.exe setup program to install Zencrack (the default home directory /home/Zencrack/7.9-x is used throughout the remainder of these instructions).
3.   Choose whether or not to create an uninstaller. If selected, an uninstaller executable, uninstall_7-9-x, is created in the installation home directory. It is recommended that an uninstaller is created.
4.   The following directory structure is created under the home directory:

bin	Zencrack executable, object and library files (Intel Fortran)
crack	Crack-block files
	Finite element keyword status files
	Tolerance file tol.dat
demos	Example input files – see the readme.txt file in this directory
fe_abaqus	Files related to the Abaqus interface (including /CAE plug-in files).
fe_ansys	Files related to the Ansys interface.
license	Nodelocked license file should be placed here[2]
machine_id	Utility to extract details required to license Zencrack
tools	Execution file and location of the zencrack.ini file
utils	Utility programs:
	3dmesh : crack profile generator
	process : creates a .csv data file for specified node(s) on a crack front
	rainflow : rainflow cycle counting
	tanh : creates tabular growth data from tanh growth equation data
	T4eRexec: used for remote f.e. execution
	T4eSSH : used for remote f.e. execution
	examples directory for utility programs
versions.txt	Version information

5.   If the "Zencrack configuration" phase of the setup was successfully run, this step can be skipped, otherwise open a terminal window, "cd" to the /home/Zencrack/7.9-x /tools directory and issue the command "runzcr79.exe setup". This runs the setup procedure which requests information on the location of Abaqus and Ansys and also details of the Fortran environment (if any) and license type. It then configures the Zencrack .ini file accordingly.
6.   For nodelocked licenses put a copy of your license file (see section 7) into the license directory.

The installation process creates a soft link runzcr79x which can be used to execute Zencrack jobs from a terminal window.

---

[2] The nodelocked license file is supplied separately from the program installation files. See section 7.

2.2.2   To un-install Zencrack (Linux)

The installation process creates an uninstaller in the installation home directory if the "Create uninstaller" option is used during the install process. The installation can then be uninstalled by double-clicking the file (uninstall_7-9-x).

To manually delete the installation, delete files under the installation directory, i.e. /home/Zencrack/7.9-x in the above example, making sure to first backup any analysis files that may have been located there. It is not recommended to run analyses or create any other files within the Zencrack installation directories.

2.2.3   To install the documentation files (Linux)

It is recommended that the documentation be installed into a sub-directory of the main Zencrack folder. The documentation is in Adobe Acrobat version 5 format and requires a suitable reader.

1.   Double click on Zencrack_7-9-x_Linux_x86-doc.exe to start the installation process. Specify a home directory for the installation. The documentation does not have to be installed in the same location as the program files. The default is:
        /home/Zencrack/7.9-x_document
2.   Choose whether or not to create an uninstaller. If selected, an uninstaller executable, uninstall_7-9-x_document, is created in the installation home directory.

2.2.4   To un-install the documentation files (Linux)

The installation process creates an uninstaller in the installation home directory if the "Create uninstaller" option is used during the install process. The installation can then be uninstalled by double-clicking the file (uninstall_7-9-x_document).

To manually delete the installation, delete files under the installation directory, i.e. /home/Zencrack/7.9-x_document in the above example.

3.   Installation - License Server

This section describes installation of the RLM license server. Installation of the license server is not necessary if you are using a nodelocked license file or if a suitable version of the RLM license server is already installed on your selected server machine.

The RLM license server is available for Windows x86 and Linux x86-64 machines. The client (i.e. Zencrack product) installations may be on any Windows x86-32 or x86-64, or Linux x86-64 machines with network access to the server.

The extraction and installation of the license server files is described below. For further information on configuring the license server and monitoring license usage, refer to section 7.3 and the RLM End User Manual.

The RLM End User Manual contains information that is oriented towards the person who installs and administers RLM. In general, as a Zencrack end-user, you should not need to refer to this manual. The RLM End User Manual is supplied as part of the Zencrack documentation and with the RLM install files. Note that:

- Some topics in the RLM End User Manual are not relevant to the licensing of Zencrack.
- The RLM version used by Zencrack 7.9 is v8, though the supplied RLM End User Manual also covers RLM v9.

3.1   Windows

The RLM files are supplied in one setup file, Zencrack_RLMv8_Windows_x86-nn.exe (where nn is 32 or 64 for 32bit or 64bit versions of Windows). The file contains:

- The generic license server rlm.exe.
- The Zentech International license server zentechint.exe.
- The RLM command line utilities rlmutil.exe.
- The RLM End-User Manual, RLM_Enduser.html.
- The license request program, machine_id.exe (see section 7.1).

If Windows UAC (User Account Control) is running on the installation machine, there may be additional system messages generated when installing from these files.

The license file is provided separately and can be placed in any location. However, the configuration is simpler if the license file is located in the same folder as the installed server binaries.

To install the license server
1.   Log in as an administrator.
2.   Run the setup program to extract the files into your chosen location on the server. The files are extracted into a sub-folder rlm in the chosen location.
          If the machine is also to contain a client installation, it is recommended that the server location is outside the folder of a specific Zencrack version e.g. c:\Zencrack would be appropriate but c:\Zencrack\7.9-x would not.
3.   Place the supplied server license file in the same rlm sub-folder as the extracted files.
4.   After placing the license file in the rlm sub-folder, refer to section 7.3.2 for information on starting the license server.

3.2   Linux

The RLM files are supplied in one setup file, Zencrack_RLMv8_Linux_x86-64.exe. The file contains:

- The generic license server rlm.
- The Zentech International license server zentechint.
- The RLM command line utilities rlmutil.
- The RLM End-User Manual, RLM_Enduser.html.
- The license request program, machine_id.exe (see section 7.1).

The license file is provided separately and can be placed in any location. However, the configuration is simpler if the license file is located in the same folder as the installed server binaries.

To install the license server
1.   Run the setup program to extract the files into your chosen location on the server. The files are extracted into an rlm sub-folder in the chosen location.
        If the machine is also to contain a client installation, it is recommended that the server location is outside the folder of a specific Zencrack version e.g. /home/Zencrack would be appropriate but /home/Zencrack/7.9-x would not.
2.   Place the supplied server license file in the same rlm sub- folder as the extracted files.
3.   After placing the license file in the rlm sub-folder, refer to section 7.3.2 for information on starting the license server.

Note that the programs rlm, rlmutil and machine_id.exe should be run from within a terminal window.

4.   Setup Of Zencrack Product After Installation

Zencrack requires that several variables be set up prior to executing the program. Other optional settings can also be made as part of the program configuration. The required and optional variables are defined in the zencrack.ini file in the tools sub-folder of the Zencrack installation. Additional notes on all items described in the following sections are contained in the zencrack.ini file itself.

The execution of the setup program during or after the installation process configures the variables highlighted in red in the following sections. The other variables described in the following sections must be configured by editing the zencrack.ini file.

The setup program can be re-run at any time to update the highlighted variables by using the command:

```
runzcr79 setup
```

Re-running the setup program and saving any values will create a new zencrack.ini file. Existing settings will either be retained or modified, depending upon the choices made when running the program. A backup of any existing zencrack.ini file is made before a new .ini file is created.

4.1   The zencrack.ini file

The zencrack.ini file is located in the tools folder of the Zencrack installation. It contains settings which are used by the Zencrack analysis program and the Zencrack GUI. The .ini file is split into "sections" with each section defining a series of "variables". Section names are enclosed in square brackets and variables have values assigned via an equal sign. Comments begin with a # character e.g.:

```
[LICENSE]
#
# Two licensing methods are available:
# network     - Network licensing using RLM license server
# nodelocked  - Nodelocked licensing using RLM license file
#
# The variable ZENCRACK_LICENSE defines the licensing method being used and
# should be set to NETWORK or NODELOCKED e.g.:
# ZENCRACK_LICENSE = NETWORK
# Additional information is contained in the following sections.
#
ZENCRACK_LICENSE = NETWORK
#
# Settings for network licensing using RLM license server
# #####################################################
#
# ZENCRACK_RLM_SERVER must be set to reference the license server machine.
# This can be done through a port number and IP address or a port number
# and machine name e.g.
# ZENCRACK_RLM_SERVER = 2764@192.168.1.1
# ZENCRACK_RLM_SERVER = 2764@SERVERNAME
#
ZENCRACK_RLM_SERVER = 2764@localhost
#
# The value of ZENCRACK_WAIT is the number of minutes that a job should wait
# in a queue to obtain license tokens if the tokens are being used by another
# job. The maximum allowed value is 9999 minutes. A value of 0 means that a
# job will stop immediately if no license tokens are available.
#
ZENCRACK_WAIT = 30
#
```

4.1.1   [ABAQUS] section

The variables in this section allow definition of the Abaqus version to be used by Zencrack. These variables must be set if the Zencrack license has an Abaqus interface.

ZCR_ABAQUS	the full location of the file abqxxx.exe provided as part of the Abaqus program installation and used to run Abaqus, where xxx refers to a version number, e.g. 610ef1, 6111, 6121 etc.
ZCR_ABAQUS_VER	the Abaqus version which may optionally include the sub-version, e.g. 6.12-1.
ZCR_ABAQUS_OPTIONS	defines command line options for running Abaqus. This must contain "interactive". Other Abaqus command line options may be added. For example the CPUS option can be added to specify how many CPUs are used by Abaqus jobs submitted by Zencrack, e.g.: ZCR_ABAQUS_OPTIONS = interactive cpus=4
ZCR_ABAQUS_SURFACE	The value of the SURFACE parameter on Abaqus *CONTOUR INTEGRAL requests is controlled by ZCR_ABAQUS_SURFACE. This will only have an effect for Abaqus 6.5 or later. It can be overridden for individual jobs by the SURFACE parameter on Zencrack keyword ENERGY RELEASE RATE. Values are omit, free or none. The value none is recommended.

The [ABAQUS] section defines the default Abaqus version to be used by Zencrack. If it is required to configure Zencrack for possible use with multiple Abaqus versions, then one or more additional Abaqus sections can be defined in the .ini file. Such additional sections must be named [ABAQUSXXX] where XXX represents a user chosen character string (e.g. an Abaqus version). All four of the variables named above must be defined in the [ABAQUSXXX] section even if they have the same value as the variables in the [ABAQUS] section.

To run a Zencrack job using a non-default Abaqus version the "-abaqus" option is used on the Zencrack command line followed by the value of the XXX string. The Zencrack GUI does not currently support the alternative Abaqus sections and always uses the default section.

The example below shows a case where Abaqus 6.11-1 is the default version and Abaqus 6.12-1 is an alternative version:

```
[ABAQUS]
ZCR_ABAQUS = c:\simulia\abaqus\6.11-1\exec\abq6111.exe
ZCR_ABAQUS_VER = 6.11-1
ZCR_ABAQUS_OPTIONS = interactive cpus=4
ZCR_ABAQUS_SURFACE = none
#
[ABAQUS612]
ZCR_ABAQUS = c:\simulia\abaqus\6.12-1\exec\abq6121.exe
ZCR_ABAQUS_VER = 6.12-1
ZCR_ABAQUS_OPTIONS = interactive cpus=4
ZCR_ABAQUS_SURFACE = none
```

To run Zencrack with Abaqus 6.12 instead of the default version 6.11:

```
runzcr79 –j jobname –abaqus 612
```

4.1.2   [ANSYS] section

The variables in this section allow definition of the Ansys version to be used by Zencrack. These variables must be set if the Zencrack license has an Ansys interface.

ZCR_ANSYS   the full location of the file ansys.exe provided as part of the Ansys program installation and used to run Ansys. To use a non-default Ansys product, ensure that "-p productname" is included in the definition of ZCR_ANSYS_OPTIONS (see below).

ZCR_ANSYS_VER   the Ansys version must include the sub-version and any service pack number, e.g. 11.0SP1, 14.0.

ZCR_ANSYS_OPTIONS   defines command line options for running Ansys. This may include, for example, the number of processors used to run Ansys jobs or a specific Ansys licensed product, e.g.: ZCR_ANSYS_OPTIONS =-np 4 -p prf.

ZCR_ANSYS_CNV   defines the default type of Ansys uncracked mesh file. The default is "automatic" for automatic determination of the type as normal or solid model. The other allowed values are "normal" or "solidmodel". This setting is overridden for individual jobs by the "-a" command line option. It is recommended that the value "automatic" be used.

The [ANSYS] section defines the default Ansys version to be used by Zencrack. If it is required to configure Zencrack for possible use with multiple Ansys versions, then one or more additional Ansys sections can be defined in the .ini file. Such additional sections must be named [ANSYSXXX] where XXX represents a user chosen character string (e.g. an Ansys version). All four of the variables named above must be defined in the [ANSYSXXX] section even if they have the same value as the variables in the [ANSYS] section.

To run a Zencrack job using a non-default Ansys version the "-ansys" option is used on the Zencrack command line followed by the value of the XXX string. The Zencrack GUI does not currently support the alternative Ansys sections and always uses the default section.

The example below shows a case where Ansys14.5 is the default version and Ansys 14.0 is an alternative version:

```
[ANSYS]
ZCR_ANSYS = C:\Program Files\ANSYS Inc\v145\ansys\bin\winx64\ansys145.exe
ZCR_ANSYS_VER = 14.5
ZCR_ANSYS_OPTIONS = -np 2
ZCR_ANSYS_CNV = AUTOMATIC
#
[ANSYS140]
ZCR_ANSYS = C:\Program Files\ANSYS Inc\v140\ansys\bin\winx64\ansys140.exe
ZCR_ANSYS_VER = 14.0
ZCR_ANSYS_OPTIONS = -np 2
ZCR_ANSYS_CNV = AUTOMATIC
```

To run Zencrack with Ansys 14.0 instead of the default version 14.5:

```
runzcr79 -j jobname -ansys 140
```

4.1.3   [LICENSE] section

This section defines items for licensing. If nodelocked licensing is being used only ZENCRACK_LICENSE needs to be defined – the license file is then placed into the license folder of the Zencrack installation.

ZENCRACK_LICENSE   the type of licensing being used, either NETWORK or NODELOCKED. This must always be defined.

ZENCRACK_RLM_SERVER   the location of the RLM license server specified in the form port@IPaddress if network licensing is being used. The port number is stated in the license file on the license server. The IP address is the LAN address of the server machine. This variable does not need to be defined for nodelocked licenses.

ZENCRACK_WAIT   the number of minutes that a job should wait in a queue to obtain license tokens if the tokens are being used by another job. The maximum allowed value is 9999 minutes. A value of 0 means that a job will stop immediately if no license tokens are available. This variable does not need to be defined for nodelocked licenses.

4.1.4   [FORTRAN_LINUX] section

This section contains Fortran configuration information for Linux installations. ZCR_FORTRAN is the only variable which should need to be changed - this change is best achieved via the setup program (on installation or later by runzcr79x setup).

ZCR_FORTRAN   This variable defines the command used to initialise the Fortran compiler.

ZCR_FORTRANSTRING   This string defines the system command to invoke the Fortran compiler. On installation this is "ifort".

ZCR_FORTRAN64   This string is used by Zencrack when compiling/linking a user subroutine – it should not be modified.

4.1.5   [FORTRAN_WINDOWS] section

This section contains Fortran configuration information for Windows installations. ZCR_FORTRAN is the only variable which should need to be changed - this change is best achieved via the setup program (on installation or later by runzcr79 setup).

ZCR_FORTRAN   This variable defines the location of the ifortvars.bat file for initialising the Fortran compiler.

ZCR_FORTRANSTRING   This string defines the system command to invoke the Fortran compiler. On installation this is "ifort /traceback".

ZCR_FORTRANLINK   This string is used by Zencrack when compiling/linking a user subroutine – it should not be modified.

ZCR_FORTRAN64   This string is used by Zencrack when compiling/linking a user subroutine on 64bit Windows systems– it should not be modified.

ZCR_FORTRAN32   This string is used by Zencrack when compiling/linking a user subroutine on 32bit Windows systems – it should not be modified.

4.1.6 [REMOTEFE] section

This section contains setting for remote execution of the f.e. analysis on a Linux or Unix machine when Zencrack is installed on a Windows machine. This capability and the variables which need to be defined are described in section 8.

4.1.7 [RUNTIME] section

This section contains modifiable defaults for run-time options.

ZCR_OVERWRITE   Defines whether or not previous output files are overwritten when a job runs. Value "no" is set at installation, i.e. if a job identifies that previous output files exist it will abort without overwriting the existing files. This can be changed to "yes".

For individual jobs, the value of ZCR_OVERWRITE can be overridden by using the "-o" command line option e.g.

```
runzcr79 -j jobname -o yes
```

All jobs executed from the Zencrack GUI use "-o yes" regardless of the value of ZCR_OVERWRITE.

ZCR_FE_TYPE   Value "input" is set at installation meaning "use the f.e. analysis type defined on the OPTIONS keyword of the .zcr file". This default value in the .ini file should not generally be changed – use the "-f" command line option for individual jobs instead. The values for ZCR_FE_TYPE and the "-f" command line options are:
= input   to follow the definition in the .zcr file
= mesh   to force a mesh-only analysis (no f.e. execution)
= check   to force a datacheck f.e. analysis
= full   to force a full f.e. analysis

For example, to force a "mesh-only" analysis the command line option would be:

```
runzcr79 -j jobname -f mesh
```

4.1.8 [MISC] section

This section contains other modifiable defaults. The exe, lib and obj locations would not normally need to be modified.

ZCR_DEFAULTOUT   Defines the default string applied to the input zcr filename to generate the output filenames when the OUTPUT parameter is omitted from the FILES keyword. The default is "r". For example:
if   DEFAULTOUT = _crack
and the zcr file is   example.zcr
then the output files are example_crack.* (e.g. example_crack.rep)

ZCR_DEFAULT_EXE   The default Zencrack executable location. This is:
                          <install folder>\bin\zcr79.exe   Windows
                          <install folder>/bin/zcr79.exe   Linux

For individual jobs, an alternative Zencrack executable can be used by using the "-e" command line option e.g.

```
runzcr79 -j jobname -e mysavedZcrExecutable.exe
```

ZCR_DEFAULT_LIB   The default Zencrack library location. This is:
                         <install folder>\bin\zcr79_library.lib   Windows
                         <install folder>\bin\libzcr79.a   Linux

ZCR_DEFAULT_OBJ   The default Zencrack object location. This is:
                         <install folder>\bin\zencrack.obj   Windows
                         <install folder>/bin/zencrack.o   Linux

4.1.9   [SETUP] section

The variables in this section define aspects of the program version and configuration and should not be modified.

```
VERSIONname = 7.9-1
RUNZCRFILE = runzcr79.exe
FILEPATH = zcrpath791.bat
EXESTEM = zcr79
HELPFILE = help_command_line.txt
```

4.2   The Zencrack GUI

The Zencrack GUI uses the main zencrack.ini file for those items which it shares with the Zencrack analysis program. Once the zencrack.ini file is configured, there is no additional configuration required for the Zencrack GUI.

A separate zencrack_gui.ini file exists in the gui folder of the Zencrack installation to allow control over certain aspect of the GUI behaviour. This file is described in the Zencrack GUI Manual.

4.3   Using Zencrack user subroutines

A Zencrack user subroutine is included in an analysis by using the "-u" command line option as described in section 5.2.

Zencrack on Windows is configured for use with user subroutines as follows:

- When the Zencrack setup program is executed it requests details of the required Fortran environment. Upon completion of the setup a file zcrpath791.bat is created in the Zencrack tools folder. This file contains an initialisation for Fortran. This should not need to be modified by the user.
- When the Zencrack shortcut is used to start a Zencrack command prompt session, the zcrpath791.bat file is used to configure the command prompt window. The title bar of the command prompt window includes details of the Fortran environment and the initialisation of the Fortran compiler is reported in the window, e.g.:
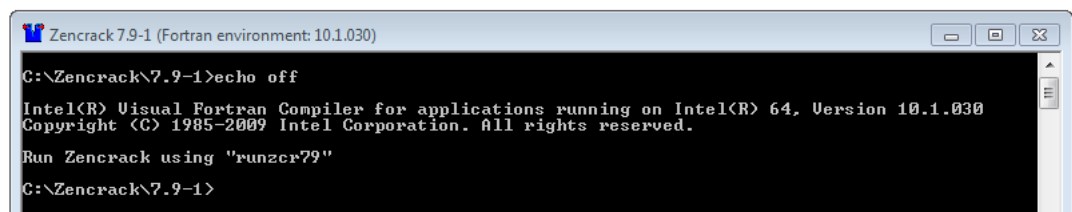

Figure 4-1 – Zencrack command prompt (Windows)

Zencrack on Linux is configured for use with user subroutines as follows:

- The zencrack.ini file contains a variable called ZCR_FORTRANSTRING which is set to the default string to execute for the target system, e.g. ifort
- If you use a non-standard command line name to execute your Fortran compiler, you should change this variable.

- When a job is executed that requires a Zencrack user subroutine, the Fortran environment must be configured in the terminal window from which the job is executed in addition to defining the variable ZCR_FORTRANSTRING, e.g. for Linux with Intel Fortran 10.1.025:
  ```
  source /opt/intel/fce/10.1.025/bin/ifortvars.sh
  runzcr79 -j myjob -u myusersub.f
  ```

If a Zencrack user subroutine is used and the compilation and linking process is successful, the newly created executable is saved in the job folder. On both Windows and Linux the file is zcr79_user.exe. This executable can be used for subsequent jobs via the –e command line option. On Linux the specification of the executable in a local folder requires a "./" before the executable name e.g.:

```
runzcr79 -j myjob_new -e zcr79.exe          Windows

runzcr79 -j myjob_new -e ./zcr79.exe        Linux
```

4.4   Configuring the plug-ins for Abaqus/CAE

Use of the plug-ins for Abaqus/CAE for creating and maintaining Zencrack input files is largely replaced by the Zencrack GUI in version 7.9-1. The recommended approach is to use the Zencrack GUI. The plug-ins for Abaqus/CAE are an optional additional installation item which must be configured manually as described in this section.

The Abaqus/CAE plug-ins are available on all platforms on which Zencrack is supported. They require Abaqus version 6.8 or later. The plug-ins will report an error if they are executed within an earlier version of Abaqus. Abaqus extended functionality (EF) releases are supported but compatibility with pre-release (PF) versions is not guaranteed.

Due to a change in the Python version between Abaqus 6.9 and 6.10 there are two sets of files provided with each installation – one for Abaqus 6.8/6.9 and one for Abaqus 6.10 or later. (In these version descriptions, 6.x also includes 6.x-EF). The availability of a Zencrack license for the plug-ins is checked when Abaqus/CAE or Abaqus/Viewer is started. If no license is available an error will be generated and Abaqus/CAE or Abaqus/Viewer will load without the plug-ins.

The plug-in files are installed with the Zencrack product and need to be moved into the Abaqus environment. The Zencrack installation contains a folder fe_abaqus with a sub-folder zencrackplugins_6-8_6-9 for Abaqus 6.8/6.9 and zencrackplugins_6-10 for Abaqus 6.10 or later. There are a number of options available for configuring Abaqus plug-ins so each user should consult their Abaqus administrator and/or the section "The Plug-in toolset" of the Abaqus/CAE User's Manual. Note that some relevant sub-sections of this part of the Abaqus/CAE manual are available in the HTML version of the Abaqus documentation but not the PDF version.

When Abaqus/CAE starts it searches for plug-in files in a number of locations. The two suggested possible locations for the Zencrack plug-ins are:

- *abaqus_dir*\abaqus_plugins, where *abaqus_dir* is the Abaqus parent directory. Simply copy the entire zencrackplugins_xx folder into the *abaqus_dir*\abaqus_plugins folder.
- *plugin_dir*, where *plugin_dir* is a directory specified in the Abaqus environment file by the environment variable plugin_central_dir. Using this method you can store plug-ins in a central location that can be accessed by all users at your site if the directory to which plugin_central_dir refers is mounted on a file system that all users can access. Alternatively if the only additional Abaqus plug-ins that you are using are the Zencrack plug-ins you can set this variable to point to the zencrackplugins folder in the Zencrack installation, e.g.:
  ```
  plugin_central_dir = "c:\\Zencrack\\7.9\\fe_abaqus\\zencrackplugins_6-10"
  ```

The plug-ins must also be aware of the Zencrack license settings. The file zencrack_plugin.ini in the zencrackplugins folder must be configured to reference either the directory containing the license file for nodelocked licenses, or the license server port and hostid for license manager licencing.

The zencrack_plugin.ini file may contain comment lines starting with a # character. Currently, only a "SETTINGS" section is configured with a required entry to identify the license. An optional entry, relevant to Linux machines, forces the crack-block names into a given case. For example:

```
##############################
# About zencrack_plugin.ini  #
##############################
#
# This file controls aspects of the Zencrack Abaqus plug-in's behavior.
# It must be named 'zencrack_plugin.ini' and located in the plugin folder.
#
# Whitespace and anything after a # is ignored.
#
# Directives are specified as directive = value
#
# In the [SETTINGS] section:
# LICENCE
# Zencrack license server (eg: 2764@192.168.1.5) or the directory containing
# the nodelocked license file (eg: c:\Zencrack\x.x-x\license)
# CBCASE
# Force case of crack-block names on input & output (lower or upper)
#
[SETTINGS]
LICENCE = 2764@192.168.1.5
CBCASE = lower
```

Once configured the plug-in is available from the Abaqus plug-ins menu and appears as an additional tab named 'Zencrack' as shown in Figure 4-2. For more information on the plug-in refer to the Plug-in for Abaqus/CAE Manual.
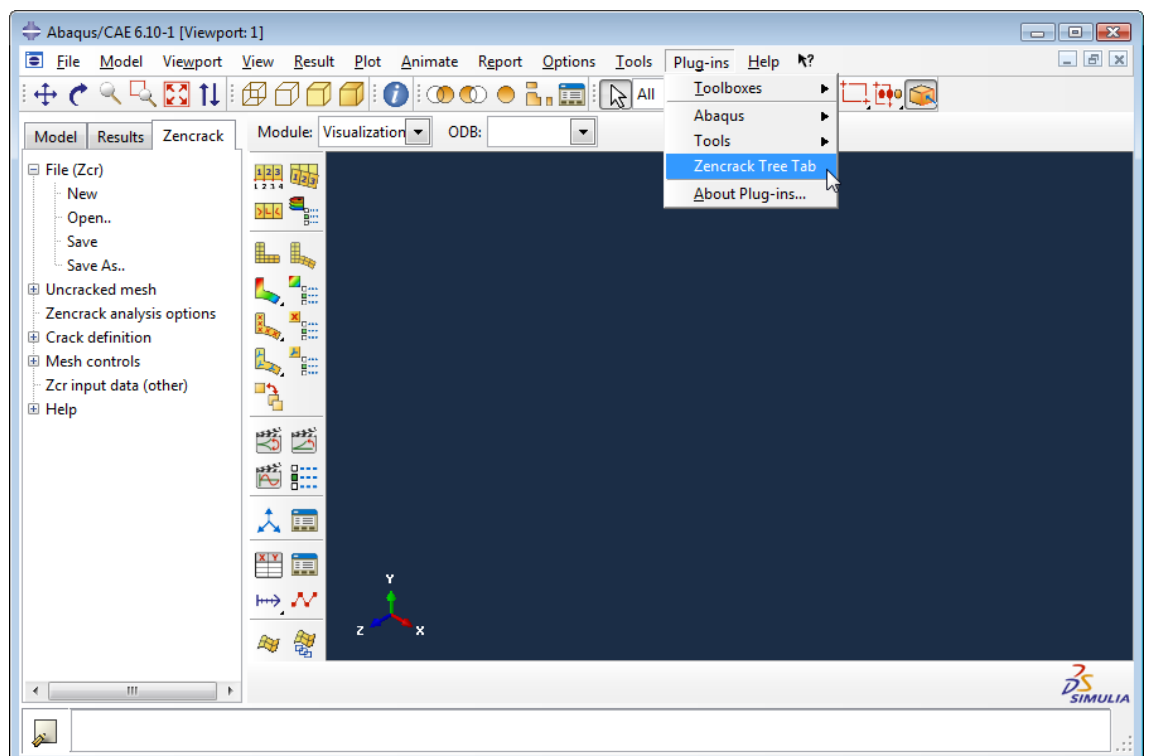

Figure 4-2 – Plug-in access in Abaqus/Viewer

5.   Running Zencrack

Zencrack is executed using the runzcr79 executable located in the tools directory of the Zencrack installation. This section describes the execution options in detail.

5.1   Command prompt setup in Windows

Zencrack is executed from a command prompt session. A Zencrack shortcut is included in the Start Menu or on the desktop (if these options were selected during installation). If not, a shortcut is included in the .\tools directory. This can be copied to the desktop as described in section 2.1.1. The shortcut icon looks like this:
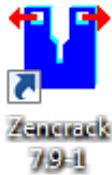
The Zencrack shortcut starts a command prompt session that is set up to execute Zencrack. The session is created with a PATH that includes the Zencrack .\tools directory. The session is also set up for Fortran if it is installed, e.g.:

Figure 5-1 – Zencrack command prompt (Windows)

5.2   Terminal window setup in Linux

The Zencrack installation creates an environment variable and soft link to the runzcr79.exe file which allow Zencrack to be executed from any terminal window.

Note that to allow sub-versions to be installed later, the default command used to run Zencrack on Linux includes the sub-version number i.e. runzcr791 for version 7.9-1, runzcr792 for version 7.9-2 etc.

5.3   Execution using "runzcr79"

The program is run using the runzcr79 command for Windows or runzcr79x for Linux (see section 5.2). This command must be executed in a command prompt or terminal window from the directory containing the .zcr input file. Attempting to run the executable directly generates an error.

There are seven command line options for the script that can be used in combination and five "stand-alone" options:

Command line options that can be used in combination are:

-j job -u user -e exe -o overwrite -f fetype -r remote -fe fecmdline -a ansyscnv -abaqus ver -ansys ver -ini file

where :

-j job	job is the Zencrack job name (without .zcr extension)
-u user	user is the name of a Zencrack user subroutine. If this option is used the -e option cannot be used.
-e exe	exe is the Zencrack executable to be used. The pathname for this executable should not contain spaces. If this option is used the -u option cannot be used.

-o overwrite   overwrite is "yes" to automatically overwrite old output files
             is "no" to stop if previous output files exist.

-f fetype   fetype is "input" for analysis as defined in the input file.
             is "mesh " for mesh-only analysis.
             is "check" for datacheck/sizing f.e. analysis.
             is "full" for full f.e. analysis.

-r remote   remote is "yes" to run f.e. analyses on a remote computer.
             is "no" to run f.e. analyses on the local computer.

-fe fecmdline   fecmdline is a string of options for the f.e. analysis command line in addition to options defined in the zencrack.ini file by ZCR_ABAQUS_OPTIONS or ZCR_ANSYS_OPTIONS.

-a ansyscnv   ansyscnv defines the type of Ansys model:
         "automatic"   for automatic detection of a normal or solid model file.
         "normal"   for a normal batch input.
         "solidmodel"   for a solid model input.

-abaqus ver   ver defines the section in the .ini file to be used to define the Abaqus version. The default is to use settings in section [ABAQUS]. This option looks for settings in [ABAQUSver]. ver would be expected to be an Abaqus version number e.g.
           -abaqus 6.12 would extract information from section [ABAQUS6.12].

-ansys ver   ver defines the section in the .ini file to be used to define the Ansys version. The default is to use settings in section [ANSYS]. This option looks for settings in [ANSYSver]. ver would be expected to be an Ansys version number e.g.
           -ansys 14.5 would extract information from section [ANSYS14.5].

-ini file   file defines the .ini file to be used in place of the zencrack.ini file.
         If the .ini file is not in the current folder, a full path must be given.

Command line options that can be used on their own are:

setup	to run the Zencrack setup program (to configure some items in zencrack.ini)
gui	to run the Zencrack GUI (Windows only)
3dmesh	to run utility 3dmesh
process	to run utility process
rainflow filename	to run utility rainflow with an input file called filename
tanh filename	to run utility tanh with an input file called filename
help	to view help/configuration information

A number of screen messages are generated when the runzcr79 command is executed. These show some of the options that are set for the job. For example, for the job a01a described in section 6 executed with a network license the following is seen under Windows (with similar for Linux):

```
C:\Zencrack\7.9-1 test\demos\abaqus\verify>runzcr79 -j a01a

ZENCRACK 7.9-1
--------------

Running Zencrack analysis.

Job             : a01a.zcr
Time            : 04-11-2013 10:24:19

Using RLM network licensing method.
1 token is required.
Successfully acquired 1 token from 2764@localhost.
Starting  mesh generation
*** Zencrack job completed without any errors
*** There are input warnings - check the .rep file
Time: 04-11-2013 10:24:26
```

5.4   Examples

The program is run using the runzcr79 command for Windows or runzcr79x for Linux (see section 5.2). Examples of command lines are:

runzcr79 -j example
Run job example.

runzcr79 -j example -o yes
Run job example with forced overwrite of any previous results files.

runzcr79 -j example –fe "cpus=4"
Run job example with 4 processors for the Abaqus finite element runs.

runzcr79 -j example –fe "np -4"
Run job example with 4 processors for the Ansys finite element runs.

runzcr79 -j submod -fe "globalmod=global"
Run job submod using the Abaqus global model results file called global.

runzcr79 -j myanalysis -u user_dadn.f
Run job myanalysis using Zencrack user subroutine user_dadn.f.

runzcr79 3dmesh
Run utility program 3dmesh

runzcr79 process
Run utility program process

6. Verifying An Installation

Once the program is ready for execution, the supplied examples in the <fe interface>\verify sub-directory of the demos program directory can be executed to verify the installation. These examples are based on the ex01 files described in section 2 of the Examples Manual. It is recommended that all example files are copied to a new location before being executed, thus ensuring that a virgin copy of the files is retained in the Zencrack directory. The following is suggested after copying the files to a new location:

- Run a mesh generation example to confirm that Zencrack is running:

  Windows users should start a Zencrack command prompt window by double-clicking the "Zencrack" shortcut icon.
  Change to the directory containing the example files (e.g. <user location of installed files>\demos\<fe interface>\verify).
  Run job:

  - a01a for Abaqus users   runzcr79 -j a01a
  - n01a for Ansys users   runzcr79 -j n01a

  To confirm that the analysis completes successfully, check the a01ar.rep or n01ar.rep output file. The banner at the top of the file should correctly identify the customer and license details from the license file. At the end of the output file there should be a message:

  ```
  New mesh created.
  ***ANALYSIS COMPLETE***
  ```

  The cracked mesh should be created as a01ar.inp or n01ar.ans.
  Sample output is contained in the demos\<fe interface>\verify\output directory for comparison purposes.

- Run an initial crack analysis to confirm that the f.e. interface is set up correctly:

  Run:

  - a01c for Abaqus users   runzcr79 -j a01c
  - n01c for Ansys users   runzcr79 -j n1c

  To confirm that the analysis completes successfully, check the a01cr.rep or n01cr.rep output file. The banner at the top of the file should correctly identify the customer and license details from the license file. At the end of the output file there should be a message:

  ```
  Analysis of initial crack only.
  ***ANALYSIS COMPLETE***
  ```

  Sample output is contained in the demos\<fe interface>\verify\output directory for comparison purposes.

7. Nodelocked and License Server (Network) Licensing

Zencrack is licensed using the Reprise License Manager (RLM) with either a nodelocked license file or a network license server system. The following sections describe these options.

7.1 Information required to generate a license file

The Zencrack installation contains a sub-directory called "machine_id" containing an executable that can be used to collect and report the information required before a license file can be issued. (This machine_id executable is also included with the installation of the RLM license server files). The machine_id program must be run on either:

- for a nodelocked license, the machine on which Zencrack is to be run

  or,

- for network licensing, the machine (server) on which the license manager will run

The program requests identification of the organisation to be licensed, contact details, which finite element interfaces are required and what licensing method is to be used. Upon completion a file called zencrack.txt is generated which should be sent to Zentech for creation of the license file. The file should not be edited so, if corrections are necessary, the machine_id program should be re-executed.

Note - a Zencrack Professional license also permits Zencrack Standard jobs to be run.

7.2 Nodelocked license file

A nodelocked license allows Zencrack to be executed only on the machines(s) specified in the license file and allows only one Zencrack run at a time. This file must be located in the "license" sub-directory of the Zencrack installation and may be given any name as long as it has a .lic extension.

This method requires the setting ZENCRACK_LICENSE=NODELOCKED in the zencrack.ini file. A sample license file (for a license with Abaqus and Ansys interfaces) is shown below, note that the last 'License' line allows Zencrack Professional to be run - without this only Zencrack Standard is licensed.

```
### main zencrack 7.9
LICENSE zentechint zencrack 7.9 31-dec-2013 single hostid=001422fa3e75
  start=01-nov-2013 issuer=UK\\\Commercial customer="Zentech
  International Ltd" contract="590b Finchley Road\London\NW11 7RX"
  _ck=dba4b6b084 sig="60Q04580NU3TQDXCNAU5F5DY0Y14R2FVG7GKGP1K08AG1BY5
  5ERNNHP4V929K2K0VCT7XAPB955Q4"
### main zcrgui 7.9
LICENSE zentechint zcrgui 7.9 31-dec-2013 uncounted
  hostid=001422fa3e75 start=01-nov-2013 _ck=1ea3b3e229 sig="60P0452F1N
  KV7PU9BDU2MXYXNK40JWK6ECQJJ6R22H630GJS0BFEQELG5ASST2J5YM28FFDYBR"
### main zcrabaqusgui 7.9
LICENSE zentechint zcrabaqusgui 7.9 31-dec-2013 uncounted
  hostid=001422fa3e75 start=01-nov-2013 _ck=9bb3b62830 sig="60PG4580GB
  BNTT30X3XM85E6Y30S9A34WWU6DACP04A6B3S8PJ51952BA3M3HGW4HTN0738R9T8G"
### enabling zcrAbaqus 7.9
LICENSE zentechint zcrabaqus 7.9 31-dec-2013 single
  hostid=001422fa3e75 start=01-nov-2013 _ck=56c4b611fb sig="60P0452H6E
  3BHGXVWGXWC5L9MY4B5W34QU0RKAW22H331D3WTTQ9J0YBRDET54KRT170KTM7FG"
### enabling zcrAnsys 7.9
LICENSE zentechint zcransys 7.9 31-dec-2013 single hostid=001422fa3e75
  start=01-nov-2013 _ck=07a4b60805 sig="60P045391B197TXPV97N40B2MVFVX8
  RP1F7SRP822GSTJQ60Q1B2YC6UF36CWRGYJ7AGPAXP80"
### enabling zencrackprof 7.9
LICENSE zentechint zencrackprof 7.9 31-dec-2013 single
  hostid=001422fa3e75 start=01-nov-2013 _ck=92a4b60a2b sig="60P0450XA8
  HGY4D72FW0DG3DS08YMENJ2D93QD022GJ6KRTV3AWR7NQRDRUMWCUB1A740KR2DM"
```

7.3   Network License server

A network license requires the Reprise License Manager (RLM) system to be running on a network server. Under this method of licensing the Zencrack product is installed on one or more client machines on the same network as the server (or on the server itself). The necessary license server files are supplied by Zentech – there is no requirement for end users to download files directly from the Reprise website. Installation of the license server files is described in section 3. This section describes the configuration and use of the license server.

The license file supplied for use with the license server is valid to run only on the specified server machine and is configured with a number of "tokens" and a list of licensed finite element interfaces. When a Zencrack job is executed on a client machine, a request is made to the server to check out the required number of tokens for the job:

- Zencrack Standard analysis requires 1 token
- Zencrack Professional analysis requires 3 tokens

In addition the finite element interface for the job is checked against the licensed finite element interfaces. If the interface is allowed and sufficient tokens are available the job executes. If tokens have been taken by another job that is still executing the job waits and re-checks for available tokens every 10 seconds. If, after a user specified time, the tokens are still unavailable the job exits.

This method requires the setting ZENCRACK_LICENSE=NETWORK in the zencrack.ini file. A sample license file (for a license with Abaqus and Ansys interfaces) is shown below, note that the first 'HOST' line specifies the server machine hosting the licenses.

```
HOST COMPUTERNAME b8bc6fca46e0 2764
ISV zentechint
### main zencrack 7.9
LICENSE zentechint zencrack 7.9 31-dec-2013 12 start=01-nov-2013
  issuer="U.K.\01252 376388\\Commercial" customer="Zentech
  International Limited" contract="590B Finchley Road\London\NW11
  7RX" replace _ck=db0616f31e sig="60PG451ATDG86YAKDRSE0RH99TORCJ8NKP
  U4HG022M0APQ97402CD5XARDAPYBSKE85PQ66PYM20"
### main zcrabaqusgui 7.9
LICENSE zentechint zcrabaqusgui 7.9 31-dec-2013 99 start=01-nov-2013
  replace _ck=9b17a6ef28 sig="60P0453DUKSQKVPVL417NEFV2JEU5XDYH5YPRFR2
  2GWVWJ3UQYNC6GFGAFS1DCHXWN45F4M5D0"
### main zcrgui 7.9
LICENSE zentechint zcrgui 7.9 31-dec-2013 99 start=01-nov-2013 replace
  _ck=1e1751eb32 sig="60PG45803N6RYAHQJ2D1BTPGTEDWKM2HCB2QHF1W08A2ECGG
  RFDGQMSH570DP6N7XGJHSSJHE2J0"
### enabling zcrAbaqus 7.9
LICENSE zentechint zcrabaqus 7.9 31-dec-2013 1 start=01-nov-2013
  replace _ck=51d691df07 sig="60P045SDSDT7EQE7UHHXW1MKBUYBJJGN0QAMNT82
  2G0KVEQ47KY8RX3RJ0DMHDDNO6Q5HR05N4"
### enabling zcrAnsys 7.9
LICENSE zentechint zcransys 7.9 31-dec-2013 1 start=01-nov-2013
  replace _ck=07d6126bee sig="60PG450N1HJOJ74WE5N8JHNVFT6HBMFRFV40F7R2
  2M0BCSXCPWQ3A65GRMXBCKRPN8MF2AHJGRT0"
```

7.3.1   Configuring the license server

Five files are supplied for the license server machine:

- The generic license server, rlm on Linux, rlm.exe on Windows.
- The Zentech International license server, zentechint on Linux, zentechint.exe on Windows.
- The RLM utilities, rlmutil on Linux, rlmutil.exe on Windows.
- The license file, with extension .lic, that describes the user rights to the Zencrack product.
- The RLM End-User Manual, RLM_Enduser.html.

The supplied files are installed as described in section 3. It is recommended that the license file be installed in the same folder as the RLM license server files.

7.3.2 Starting the RLM server

It is recommended that RLM is configured as a service on Windows and to start at bootup on Linux machines.

If this is not done the license server can simply be started by executing the rlm command in the license server folder (provided that the license file is in the same folder):

```
rlm > output_file
```

7.3.2.1 Running the RLM server as a service on Windows

Installing RLM as a service is done in a command window. Once installed as a service, it remains installed until it is explicitly deleted as a service. Installing RLM as a service does not start RLM; services are started via the Windows Services control panel, and at boot time. RLM is installed using the RLM program itself, with special arguments:

```
rlm -install_service -dlog [+]logfile [-service_name sname] <rlm runtime args>
```

where logfile   is the pathname for the server debug log. This parameter is required. If preceded by the '+' character, the logfile will be appended, rather than created.

sname   is an optional name for the installed service. If not specified, sname defaults to "rlm". If sname contains embedded whitespace, it must be enclosed in double quotes.

 <rlm runtime args> are any other command line arguments to be passed to rlm when it is started.

Example:
```
rlm -install_service -service_name rlm-zencrack -dlog
c:\Zencrack\rlm_v8\server.log -c c:\Zencrack\rlm_v8\yourlicense.lic
```

This installs RLM as a service under the name "rlm-zencrack". When started via the Services control panel or at boot time, RLM will be passed the "-c c:\Zencrack\rlm_v8\yourlicense.lic" arguments, and it will write debug log information to the file c:\Zencrack\rlm_v8\rlm-zencrack.log.

To start the service after installing it:

> Start > Control Panel > Administrative tools > Services
> Locate rlm-zencrack. Right click > Properties > Start
> The service should now start.
> Click OK or Cancel to leave the Properties screen.

The server status can be checked from the command line using:
```
rlmutil rlmstat
```

Alternatively the browser-based utility described in section 7.3.3 may be used to monitor the license server.

If it is required to remove the service it is necessary to first stop the service via Control Panel > Administrative tools > Service. Then from the command line:

```
rlm -delete_service -service_name rlm-zencrack
```

7.3.2.2 Starting the RLM server at system boot time on Linux systems

On most Unix and Linux systems, system services are started at boot time, usually via startup scripts located in /etc/rc.<something>. For further information and a sample script that defines the necessary RLM variables please refer to the RLM End-User Manual.

7.3.3   Browser-based license administration

The RLM server contains an embedded Web Server that can be used to perform most administration of the RLM server itself. The web server allows you to retrieve server and license status, cause the servers to re-read the license files, switch debug or report log files, move the current report log file to a new name, or shut down the license servers. Using this web-based interface, you can administer the license servers from any platform, and you do not need to install the RLM utilities - you only need a web browser.

The web server is started automatically on port 5054 when rlm is started. To use the web server, simply point your browser to: http://ServerHostName:5054 (or use the server network IP address, e.g. http://192.168.3.4:5054) and select the operation you would like to perform. You will be prompted for any required information. Typical status screens are shown in Figure 7-1 and Figure 7-2. Note: the previous version of RLM web server used for Zencrack 7.6 used port 9000 by default.

For further information please refer to the RLM End-User Manual.

Figure 7-1 – Typical license status screen after selecting "Status" from the left side menu

Figure 7-2 – Typical server license status after selecting "zentechint" from the Server Status of the main status screen

7.3.4   Installing an updated RLM license file

If it is required to install a new license file, the file should first be placed in the same folder as the existing license file. The browser-based license administration facility described in section 7.3.3 can then be used to re-read the license file:

- Select "Reread/Restart Servers" from the left pane.
- Set the ISV box to "all" or "zentechint" and select REREAD LICENSES.

7.3.5   Contents of the RLM license file

The server license file contains information that configures the license server and describes all the licenses granted from Zentech International to the end-user. License files have 3 types of lines: HOST, ISV and LICENSE.

The HOST line specifies the license server machine (by ethernet address) and includes the port through which clients can access the license server.

The ISV line specifies that the license server information is for ISV "zentechint"

The LICENSE lines describe license grants from Zentech International to the end-user. All license files (except evaluation licenses) contain a license grant for product "zencrack". This specifies the total number of license tokens available, the license expiry date and includes details about the customer (e.g. company name, address, etc). Other parameters (e.g. a license start date) may also be included. One or more additional license lines are present depending upon the licensed finite element interfaces. A sample license file is shown in section 0.

7.3.6   Configuring a client machine

The Zencrack program is installed on the client machine following the procedure in section 2.

Zencrack configuration is contained in a file zencrack.ini as described in section 4.1. Three variables are defined in this files for use with the license server:

ZENCRACK_LICENSE
This variable is set to NETWORK to indicate that a network license server should be used.

ZENCRACK_RLM_SERVER
This variable specifies the license server machine using the syntax port@Ipaddress. The port number is contained in the license file installed on the license server. The IP address is the LAN address of the license server machine. For example, if the license server is machine 192.168.1.10:

Windows   ZENCRACK_RLM_SERVER = 2764@192.168.1.10

Linux   ZENCRACK_RLM_SERVER = 2764@192.168.1.10

In the special case that the license server and the client machine are the same machine, the special "localhost" name may be used without the need to use the actual machine name or IP address i.e. 2764@localhost.

ZENCRACK_WAIT
This variable defines the number of minutes that a job should wait for license tokens to become available if they are in use by another job. The availability of tokens is checked every 10 seconds while the job is waiting.

Windows   ZENCRACK_WAIT = 30

Linux   ZENCRACK_WAIT = 30

This option is not the same as a strict queue option available with license managers. If several jobs are in a "wait" state at the same time the first job to continue execution is the first one to check for license tokens when they become available rather than the first job that reached a wait condition.
Note - the RLM end user environment variable for queuing (RLM_Queue) must not be set as this option is not supported within Zencrack. Setting this option with the previous RLM version (v4) causes an indefinite queuing of a Zencrack license check out.

8. Remote Execution Of The Finite Element Analysis

This section describes the configuration and use of the "remote f.e." capability in Zencrack. This capability allows users with Zencrack on a Windows platform to execute the finite element part of a Zencrack job on a Linux or Unix machine on the same network.

The "remote f.e." capability in Zencrack uses the following procedures:

- FTP to copy files from the local to the remote machine.
- An Rexec or SSH command to run a script on the remote machine. The script runs the finite element program on the remote machine.
- FTP to copy files from the remote to the local machine.

The capability utilises the plink.exe [Ref. 4], T4eRexec.exe or T4eSSH.exe executables [Ref. 5] to establish the remote connection. T4eRexec is a utility that is similar to the Windows REXEC command except that it allows a password as input. To run commands on a Rexec compatible operating system, such as Linux, the Rexec daemon has to be running on the target system. Note that passwords are transmitted in clear text. A more secure option is the plink or T4eSSH utility. These are secure implementations of the SSH protocol to allow access to a UNIX/Linux operating system. The plink.exe, T4eRexec.exe and T4eSSH.exe files are supplied with Zencrack in the utils folder of the Zencrack installation and should not be moved from that folder. In addition, the full PuTTY.zip file, of which plink.exe is a part, is also included.

The three utilities plink, T4eRexec and T4eSSH are provided for convenience – only one needs to be selected and used when configuring the remote f.e. capability.

Note that passwords for access to the remote machine are set up in clear text in the runzcr78.bat file.

It is necessary to ensure that any firewalls allow the necessary communication between the local and remote machines. On the local machine plink.exe, T4eRexec.exe or T4eSSH.exe and the FTP daemon must be able to communicate with the remote machine. The Rexec protocol must be enabled on the target machine if using T4eRexec. The FTP daemon must also be running on the remote machine. Please consult your system documentation for information on these processes.

8.1 Configuration

Zencrack should be installed on the target Windows machine and the setup program run in the usual way (see section 2.1). If there is to be a local f.e. capability in addition to the remote f.e. capability, it is suggested that the installation is verified before commencing with the remote f.e. configuration.

Zencrack is configured via the zencrack.ini file in the program tools folder. This file must be edited (e.g. using Notepad) to configure the remote f.e. execution. The as-installed file contains the following section:

```
[REMOTEFE]
#
# Items for remote f.e. execution.
#
# These options define variables required to run the f.e. analysis on a remote
# computer. ZCR_REMOTE_FE can be modified on the command line by the -r
option.
#
ZCR_REMOTE_FE = no
#
ZCR_ABAQUS_REMOTE =
ZCR_ABAQUS_VER_REMOTE =
ZCR_ANSYS_REMOTE =
```

```
ZCR_ANSYS_VER_REMOTE =
ZCR_LOGIN_UTIL =
ZCR_LOGIN_NAME =
ZCR_LOGIN_PWD =
ZCR_LOGIN_PATH =
ZCR_LOGIN_IP =
ZCR_LOGIN_SHELL =
ZCR_LOGIN_SCRIPT =
ZCR_LOGIN_EXTRA =
```

Some of these items must be set and others may be left blank, depending upon the f.e. interface and options required for the chosen remote execution utility. The items are described below.

ZCR_REMOTE_FE	This item defines the default status for f.e. execution. If it is set to "no", then by default all f.e. jobs will be executed on the local machine. If it is set to "yes", then by default all f.e. jobs will be executed on the remote machine.
	This option can be overridden for an individual Zencrack analysis by using the –r command line option, which has values yes or no. For example, if ZCR_REMOTE_FE is set to "no" but it is required to run a specific job with remote f.e. execution, the command line would be: `runzcr79 -j jobname -r yes`
ZCR_ABAQUS_REMOTE	This is analogous to variable ZCR_ABAQUS for local execution. It defines the location of the Abaqus executable on the remote machine.
	This can be left blank if Abaqus is not available on the remote machine or if Abaqus is not a licensed interface for the Zencrack installation.
ZCR_ABAQUS_VER_REMOTE	This is analogous to variable ZCR_ABAQUS_VER used for local execution. It defines the Abaqus version on the remote machine. It may optionally include the sub-version, e.g.:
	ZCR_ABAQUS_VER_REMOTE = 6.13-1
	This can be left blank if Abaqus is not available on the remote machine or if Abaqus is not a licensed interface for the Zencrack installation.
ZCR_ANSYS_REMOTE	This is analogous to variable ZCR_ANSYS used for local execution. It defines the location of the Ansys executable on the remote machine.
	This can be left blank if Ansys is not available on the remote machine or if Ansys is not a licensed interface for the Zencrack installation.
ZCR_ANSYS_VER_REMOTE	This is analogous to variable ZCR_ANSYS_VER used for local execution. It defines the Ansys version on the remote machine. It should include the sub-version and service pack if there is one, e.g.:
	ZCR_ANSYS_VER_REMOTE = 14.5
	This can be left blank if Ansys is not available on the remote machine or if Ansys is not a licensed interface for the Zencrack installation.
LOGINUTIL	The utility for remote execution of commands. This must be set to one of plink, t4erexec or t4essh.

LOGINNAME	This is the user name that is used to log into the remote machine.
LOGINPWD	This is the password for user name LOGINNAME on the remote machine.
LOGINPATH	This is the path on the remote machine into which all analysis files will be placed. The remote f.e. analysis will be executed in this directory. This item should include the trailing / on the path definition. The path can be a full path or a relative path in which case it is relative to the home directory for user LOGINNAME.
LOGINIP	This is the network IP address of the remote machine.
LOGINSHELL	By default (if this item is blank) Zencrack uses the ksh shell when executing the script file that runs the finite element analysis on the remote machine. An alternative script, e.g. bash, can be set using this variable.
LOGINSCRIPT	This item defines the name of a script located in the LOGINPATH folder that should be run before execution of the finite element analysis. This is optional and should be left blank if no script is to be executed.
LOGINEXTRA	This item defines any additional command line options that should be used with the chosen plink, T4eRexec or T4eSSH utility.

LOGINEXTRA (continued):

Notes for T4eRexec or T4eSSH:

- A timeout should be defined by including "-a 9999" in LOGINEXTRA. This defines a timeout period of 9999 seconds during which a remote session command remains active if there is no response from the remote machine. See section 8.2 for more information regarding the timeout period.
- In some cases the "-A password" option may need to be included when the T4eSSH utility is being used. (This "–A password" option contains the word password rather than any user or system password). This option defines the authentication method.

Notes for plink:

- The first time that the utility is used on the local machine, the user may be prompted to save a key for the remote machine in the PuTTY cache. Replying yes to this prompt should ensure the prompt does not appear again.

A special case exists to allow the full command line for plink, T4eRexec or T4eSSH to be specified using LOGINEXTRA. If the value of LOGINEXTRA starts with "fullcommandline" then the remainder of the string is used as the full command line string for plink, T4eRexec or T4eSSH. The values of LOGINNAME and LOGINPWD are ignored for execution of commands on the remote machine (but are still used for ftp file transfers). The full command line option should generally not be required and is provided mainly for troubleshooting purposes. The full list of command line options for the utilities is available by

typing plink, T4eRexec or T4eSSH at a Zencrack command prompt.

A sample configuration for remote execution of Abaqus and Ansys using T4eSSH may be:

```
ZCR_ABAQUS_REMOTE = /abaqus/6.11-1/exec/abq6111.exe
ZCR_ABAQUS_VER_REMOTE = 6.11-1
ZCR_ANSYS_REMOTE = /ansys_inc/v140/ansys/bin/ansys140
ZCR_ANSYS_VER_REMOTE = 14.0
ZCR_LOGIN_UTIL = t4essh
ZCR_LOGIN_NAME = myusername
ZCR_LOGIN_PWD = mypassword
ZCR_LOGIN_PATH = /usr/test_remote/
ZCR_LOGIN_IP = 192.168.1.15
ZCR_LOGIN_SHELL = bash
ZCR_LOGIN_SCRIPT =
ZCR_LOGIN_EXTRA = -a 9999 -A password
```

A sample configuration for remote execution of Abaqus and Ansys using plink may be:

```
ZCR_ABAQUS_REMOTE = /abaqus/6.11-1/exec/abq6111.exe
ZCR_ABAQUS_VER_REMOTE = 6.11-1
ZCR_ANSYS_REMOTE = /ansys_inc/v140/ansys/bin/ansys140
ZCR_ANSYS_VER_REMOTE = 14.0
ZCR_LOGIN_UTIL = plink
ZCR_LOGIN_NAME = myusername
ZCR_LOGIN_PWD = mypassword
ZCR_LOGIN_PATH = /usr/test_remote/
ZCR_LOGIN_IP = 192.168.1.15
ZCR_LOGIN_SHELL = bash
ZCR_LOGIN_SCRIPT =
ZCR_LOGIN_EXTRA =
```

8.2   Remote command timeout period

The timeout issue described in this section relates to the T4eRexec and T4eSSH utilities. There is no such timeout period for the plink utility.

When a command is executed on the remote machine using T4eRexec or T4eSSH, the local machine has a timeout period in which it expects some response from the remote machine. If there is no response within the timeout period the execution will stop and the following error is reported to the screen:

```
ERROR: Timeout while waiting for data
```

The LOGINEXTRA option should include parameter "-a 9999" to set the timeout period to the maximum allowed value of 9999 seconds.

During the solution phase of the finite element analysis on the remote machine there is a period of no response. If the solution phase exceeds the timeout setting then the command will time out and the Zencrack analysis will fail. The timeout period therefore sets an upper limit on the elapsed duration of a phase of the finite element analysis. For Abaqus, for example, the pre.exe and standard.exe phases are separate and each may run for an elapsed time of up to the defined timeout period.

For Abaqus analyses which exceed 9999 seconds elapsed runtime but which have increments less than 9999 seconds, a solution to prevent the timeout is to include a simple Abaqus urdfil subroutine which writes to the screen upon completion of every increment:

```
      subroutine urdfil(lstop,lovrwrt,kstep,kinc,dtime,time)
      include 'aba_param.inc'
      character*8 crray(513),nset
```

```
      dimension array(513),jrray(nprecd,513),time(2)
      equivalence (array(1),jrray(1,1))
      equivalence (crray(1),jrray(1,1))
      write(*,10) kstep,kinc,time(2)
   10 format('Processing .fil file: step ',i4,' increment ',i4,
    &          ' : total time ',1pe14.8)
      return
      end
```

At least one request for data to be written to the .fil file should be made in the uncracked mesh (i.e. *NODE FILE or *EL FILE with FREQ=1 in step 1). The subroutine is referenced via the Zencrack USER keyword in the .zcr input file.

8.3   Zencrack input file

One Zencrack keyword is relevant to remote f.e. execution: REMOTE TRANSFER. By default, all necessary files are transferred to and from the local machine. This keyword can be used to specify transfer of additional files.

The SAVE keyword operates in the normal way on files that are present on the local machine. So, for example, if SAVE, ODB=YES is specified, the remote ODB files are transferred to the local machine after each f.e. analysis and are then renamed and saved locally on the machine.

For remote f.e. analyses there are also issues related to case sensitivity in filenames. Care should be taken when specifying filenames in the input file.

In addition, other system / f.e. related issues may arise. For example, Abaqus user subroutines require an extension of .for on Windows and .f on Unix and Linux.

8.4   Execution of a Zencrack job with remote F.E. analysis

If the ZCR_REMOTE_FE variable described in section 8.1 is set to "yes", then all jobs are automatically sent for remote f.e. execution. No additional options are required. In this configuration a local f.e. analysis can be forced for an individual Zencrack job by using the "-r no" option, e.g.:

```
runzcr79 -j jobname -r no
```

If the ZCR_REMOTE_FE variable described in section 8.1 is set to "no", then all jobs are automatically sent for local f.e. execution. In this configuration a remote f.e. analysis can be forced for an individual Zencrack job by using the "-r yes" option, e.g.:

```
runzcr79 -j jobname -r yes
```

9.   References

Ref. 1   Reprise License Manage v8 from Reprise Software, Inc., http://www.reprisesoftware.com.

Ref. 2   Abaqus is a trademark of Dassault Systèmes Simulia Corp. (SIMULIA), Providence, Rhode Island, U.S.A.
Web site: http://www.simulia.com.

Ref. 3   Ansys is a trademark of SAS IP, Inc., a wholly owned subsidiary of Ansys Inc., Canonsburg, Pennsylvania, U.S.A.
Web site: http://www.ansys.com.

Ref. 4   PuTTY utility from http://www.chiark.greenend.org.uk/~sgtatham/putty.

Ref. 5   Utilities from Tools4ever, http://www.tools4ever.com.

Zencrack

Version 7.9

E-mail: info@zentech.co.uk
On-line: http://www.zentech.co.uk/zencrack.htm

ZENTECH