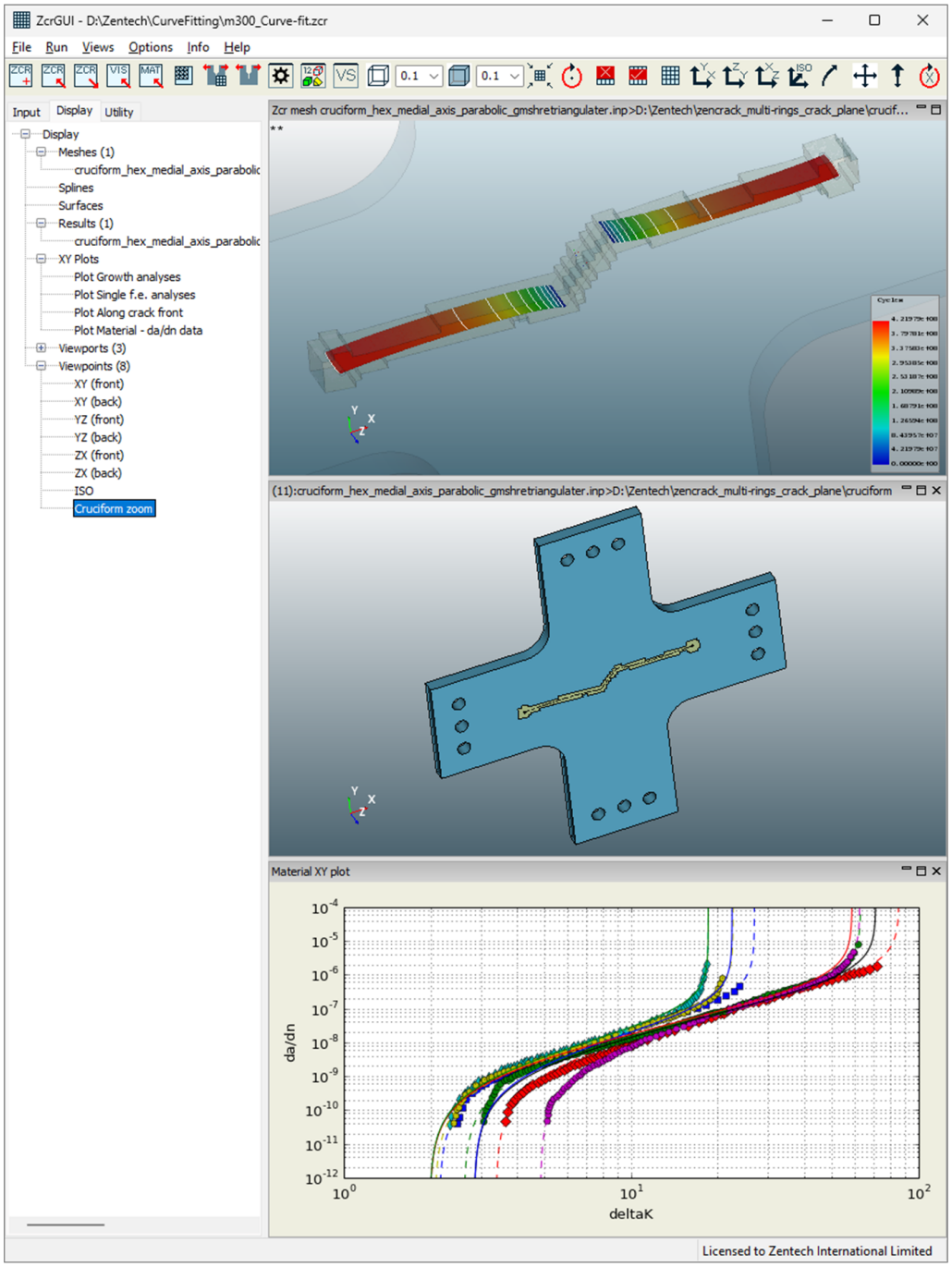
# Zencrack




# Installation And Execution

Version 9.5

ZENTECH

# Installation And Execution

Issue 9.5

The information in this document is subject to change without notice and **Zentech International Ltd.** assumes no responsibility for any errors that may appear in this document.

The ZENCRACK software described in this document is furnished under license and may be used or copied only in accordance with the terms of such license.

Zentech document no.: **i009/doc/950g**

All pages of this manual are at Revision 1.

This version of the manual is for use with the latest software version indicated below and may also be issued with subsequent software releases if updates are not required.

Software versions are identified by version number and build date.

The Zencrack version and build date are shown in the banner at the start of the output file (i.e. the .rep file). The Zencrack GUI version and build date are shown in the program Help>About menu.

| Program | Version | Build date | Manual version |
|---|---|---|---|
| Zencrack | 9.5-2 | 12 Dec 2025 | Issue 9.5 Revision 1, 59 pages |
| Zencrack GUI | 9.5-b | 12 Dec 2025 | |

## Disclaimer

The Zencrack analysis program (including associated utility programs), the Zencrack GUI and Zencrack Plug-ins for Abaqus/CAE are proprietary software products (Products) of Zentech International Ltd. (Zentech) and are offered under license for the commercial use of its customers. Zentech reserves all rights and makes no warranty, expressed or implied, as to the accuracy, validity or applicability of any results obtained through use of the Products; nor shall the fact of distribution constitute any such warranty or responsibility in connection therewith.

Full terms and conditions governing the use of the Products are available at:

https://zentech.co.uk/files/license_agreement.pdf

Zentech is continually improving the Products and welcomes suggestions and comments. Any error encountered in the Products or documentation should be reported as soon as possible.

Zentech International Ltd.
Registered Office:
590B Finchley Road
London
NW11 7RX
U.K.

E-mail: support@zentech.co.uk
Web: https://zentech.co.uk/

Abaqus is a trademark of Dassault Systèmes Simulia Corp. (SIMULIA), Providence, Rhode Island, U.S.A.

Website: https://www.3ds.com/products-services/simulia

Ansys is a trademark of SAS IP, Inc., a wholly owned subsidiary of Ansys Inc., Canonsburg, Pennsylvania, U.S.A.

Website: https://www.ansys.com

NASTRAN is a registered trademark of the National Aeronautics and Space Administration. Simcenter Nastran is an enhanced proprietary version developed and maintained by Siemens Product Lifecycle Management Software Inc.

Website: https://www.siemens.com

# Table of Contents

**1 Introduction** **4**
1.1 License types . . . 4
1.2 Hardware requirements . . . 5
1.3 Software requirements . . . 5
1.3.1 Finite element interfaces . . . 5
1.3.2 Fortran compiler . . . 6
1.3.3 License server . . . 6
1.3.4 Changes in software configurations . . . 6
1.4 User home folder . . . 7

**2 Installation - Zencrack Product** **8**
2.1 Windows . . . 8
2.1.1 To install the program and/or documentation files (Windows) . . . 9
2.1.2 Post-installation changes to the program files (Windows) . . . 10
2.1.3 To uninstall the program and documentation files (Windows) . . . 11
2.1.4 Remote execution of the finite element code . . . 11
2.1.5 Possible issues in older operating systems . . . 11
2.1.5.1 Program Compatibility Assistant warning . . . 11
2.1.5.2 Zencrack GUI fails to execute . . . 12
2.2 Linux . . . 12
2.2.1 To install the program and/or documentation files (Linux) . . . 13
2.2.2 To install the program files as root (Linux) . . . 15
2.2.3 Post-installation changes to the program files (Linux) . . . 15
2.2.4 To uninstall the program files (Linux) . . . 16

**3 Installation - License Server** **17**
3.1 Windows . . . 17
3.2 Linux . . . 18

**4 Setup Of Zencrack Product After Installation** **19**
4.1 The zencrack.ini file . . . 19
4.1.1 [ABAQUS] section . . . 20
4.1.2 [ANSYS] section . . . 21
4.1.3 [SIMCENTERNASTRAN] section . . . 23
4.1.4 [VERIFIED] section . . . 24
4.1.5 [LICENSE] section . . . 24
4.1.6 [FORTRAN_LINUX] section . . . 25
4.1.7 [FORTRAN_WINDOWS] section . . . 25
4.1.8 [REMOTEFE] section . . . 26
4.1.9 [RUNTIME] section . . . 26
4.1.10 [MISC] section . . . 27
4.1.11 [SETUP] section . . . 28
4.2 The zencrack_gui.ini file . . . 28

4.3 Local zencrack.ini and zencrack_gui.ini files . . . 29
4.4 Using Zencrack user subroutines . . . 30
4.5 Configuring the plug-ins for Abaqus/CAE . . . 31

**5 Running Zencrack** **34**
5.1 Command prompt setup in Windows . . . 34
5.2 Terminal window setup in Linux . . . 34
5.3 Execution using runzcr95 . . . 35
5.4 Running the Zencrack GUI . . . 35
5.5 Examples of command line execution . . . 36
5.6 Killing a Zencrack job during execution . . . 37
5.6.1 Windows . . . 37
5.6.2 Linux . . . 37

**6 Verifying An Installation** **38**

**7 Nodelocked and License Server (Network) Licensing** **40**
7.1 Information required to generate a license file . . . 40
7.2 Nodelocked license file . . . 40
7.3 Network license server . . . 41
7.3.1 License server files . . . 42
7.3.2 License server port and firewall information . . . 43
7.3.2.1 Overview of ports . . . 43
7.3.2.2 Port 2764 . . . 44
7.3.2.3 The zentechint server . . . 44
7.3.2.4 Changing ports . . . 44
7.3.2.5 Identify ports in use by the license server . . . 44
7.3.2.6 Firewall settings . . . 45
7.3.3 Starting the RLM server . . . 45
7.3.3.1 Running the RLM server as a service on Windows . . . 46
7.3.3.2 Starting the RLM server at system boot time on Linux systems . . . 47
7.3.4 Browser-based license administration . . . 47
7.3.4.1 Installing an updated RLM license file . . . 48
7.3.5 Releasing locked licenses . . . 49
7.3.6 Contents of the RLM license file . . . 50
7.3.7 Configuring a client machine . . . 50

**8 Remote Execution Of The Finite Element Analysis** **52**
8.1 Configuration . . . 52
8.2 Remote command timeout period . . . 56
8.3 Zencrack input file . . . 57
8.4 Execution of a Zencrack job with remote F.E. analysis . . . 58
8.5 Limitations of the remote transfer capability . . . 58

**References** **59**

# List of Figures

2.1 Program Compatibility Assistant warning (shown for Zencrack 8.0-1 on Windows 7) 12
2.2 Failure of execution of the Zencrack GUI on Windows 7 machine . . . . . 12
4.1 Zencrack command prompt (Windows) . . . . . 30
4.2 Plug-in access in Abaqus/CAE . . . . . 33
5.1 Zencrack command prompt (Windows) . . . . . 34
7.1 Typical license status screen after selecting 'Status' from the left side menu . . . . . 48
7.2 Typical server license status after selecting 'zentechint' from the Server Status of the main status screen . . . . . 48
7.3 Typical server usage status . . . . . 49

# 1 Introduction

This document describes installation, set-up and execution of Zencrack version 9.5-2 for Windows x86 and Linux x86 platforms. These are 64bit versions of Zencrack 9.5 which require x86 machines running 64bit Windows or Linux.

This document includes installation of the Zencrack analysis product and GUI, and the RLM license server (which is required for network licensing). For any sub-versions 9.5-3 onwards that may be released, any explicit references to 9.5-2 in this document should be read with 9.5-2 replaced by the appropriate sub-version number. In some places a generic reference is made to version 9.5-x.

Documentation uses PDF files and requires a suitable reader which supports cross-document links. For Windows installations, if your PDF reader application does not support the use of cross-document links you may prefer to install and use an alternative such as Adobe Acrobat Reader or the lightweight open source Sumatra:

https://get.adobe.com/uk/reader

https://www.sumatrapdfreader.org/free-pdf-reader

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:

https://zentech.co.uk/software/zencrack-support

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 Zentech website:

https://zentech.co.uk/software/zencrack-support/user-subroutines

## 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) [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 License Administration Manual supplied as part of the license server installation and the Zencrack documentation.

## 1.2 Hardware requirements

Memory requirements are generally 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 (other than as noted below for command line execution of remeshing on Linux). Input and output to the analysis program is via ASCII text files.

The Zencrack GUI 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 GUI is also used in a command line mode (i.e. without display of GUI windows) when remeshing is performed by a full Zencrack run.

On Linux the Zencrack GUI requires that a valid DISPLAY environment variable is configured in order to create GUI windows. This applies whether the GUI is used interactively or in command line mode for remeshing during a full Zencrack run (in which case windows are required as part of the remeshing process regardless of whether they are displayed).

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 64bit machines or Linux 64bit 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.

For Windows platforms Windows 11 is recommended and Windows 10 is supported.

Support is no longer provided for Windows 7 and Windows 8. If attempting to use these operating systems, please check section 2.1.5 for known issues.

### 1.3.1 Finite element interfaces

Zencrack is interfaced to Abaqus/Standard [2], Ansys/APDL [3] and Simcenter Nastran [4]. The Zencrack user license permits use with one or more 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, Ansys or Simcenter Nastran. During the Zencrack installation procedure a setup program runs and requests user input about the f.e. version(s) to be used by Zencrack.

### 1.3.2 Fortran compiler

**Requirement for a Fortran compiler**

If Zencrack user subroutines are not going to be used, there is no requirement to have an Intel Fortran Compiler installed and configured.
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.

An appropriate version of the Intel Fortran compiler is required if a Zencrack user subroutine 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).

The Intel Compiler Classic, Version 2021.1 (part of Intel oneAPI 2021) is required if user subroutines are to be used. Later oneAPI compiler versions are compatible, including oneAPI 2025 onwards, for which the ifort compile command is discontinued and the ifx compile command must be used instead.

The Zencrack setup program configures the zencrack.ini file for user subroutines based on the latest compiler version found on the system. The setup program is the easiest way to set up Zencrack for using user subroutines and enforces the use of ifort for compiler versions 2024.x and earlier or ifx for compiler versions 2025 onwards. The settings in the .ini file that affect the compiler are described in sections 4.1.6 and 4.1.7 for Linux and Windows respectively.

Updated information about compatibility with Intel Fortran versions is available at:

https://zentech.co.uk/software/zencrack-support/user-subroutines

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 the interfaced f.e. code, 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. The settings in the zencrack.ini file in the installation folder may also be amended via entries in an additional zencrack.ini file in the user home folder.

Changes to the Zencrack GUI configuration may be made by manually editing the zencrack_gui.ini

file. The settings in the zencrack_gui.ini file in the installation folder may also be amended via entries in an additional zencrack_gui.ini file in the user home folder.

See section 4 for information on .ini files.

## 1.4 User home folder

The user home folder is a directory on a multi-user operating system containing files for an individual user account on the system.

For an account with name username the home folder path on Windows is:

```
C:\Users\username
```

On Linux the home folder can be referenced via a ~ symbol or by path:

```
/home/username
```

An interactive Zencrack GUI session defaults to creating log, err and tmp files in the user home folder (see section 4.2).

Optional local .ini files for Zencrack and the Zencrack GUI may be located in the user home folder (see section 4.3).

# 2 Installation - Zencrack Product

This section describes installation of the Zencrack product consisting of the main analysis program, the GUI and the documentation. This is applicable for nodelocked licenses and for client installations when using a network license server.

The user installing the program must have sufficient privilege to create files in the chosen installation location during installation.

It is recommended that the operating system should be up-to-date on any target machine before installing Zencrack.

As part of the program installation, a setup program is run to complete the configuration of the f.e. interface(s) and Fortran. This setup program searches for f.e. versions and Intel Fortran Compiler for oneAPI versions in default locations. If no suitable versions are found, options are provided to widen the search.

In the default installed configuration no files are created in the installation folder at run-time by either Zencrack or the Zencrack GUI. So the user account that runs Zencrack or the Zencrack GUI does not require write permission to the installation folder.

It is generally not recommended to create any other files within the Zencrack installation directories once the installation has been completed. It is also not recommended to run analyses within the installation folder. For example, the supplied examples should be copied to a different location and executed there in order to preserve the as-installed files.

## 2.1 Windows

The Zencrack product is supplied in one installer file:

- Zencrack_9-5-x_Windows-64.exe

The installer allows installation of the program (Zencrack analysis program and the Zencrack GUI) and/or the documentation. In general it is recommended to install both program and documentation files.

The default program top level installation location is c:\Zencrack\9.5-x. This default includes a version number to ensure this installation does not conflict with other versions that may be installed. If the top level folder is changed, it is highly recommended to include the Zencrack version within the folder path. The program and documentation files are installed in sub-folders of the top level folder. For example:

- c:\Zencrack\9.5-x\program
- c:\Zencrack\9.5-x\documentation

If multiple user accounts exist on the machine, any desktop shortcuts or Start Menu / Apps Page shortcuts are installed for the current (installing) user only.

### 2.1.1 To install the program and/or documentation 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. The installing user must have permissions to create files in the chosen installation location.
2. Run the Zencrack_9-5-x_Windows-64.exe setup program to install Zencrack.
3. Accept the license terms and then define parameters for the installation on a series of screens.
4. The default top level directory c:\Zencrack\9.5-x is used throughout the remainder of these instructions. If selected, an uninstaller executable, uninstall_9-5-x.exe, is created in the installation top level directory. It is recommended that an uninstaller is created.
5. The program files are installed in a folder called program inside the top level directory. This contains the following folders and files:

| | |
|---|---|
| bin | Zencrack executable, object and library files |
| crack | Crack-block files |
| defaults | Files with various default settings e.g. tol.dat |
| examples | 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 |
| fe_gmsh | Files related to remeshing |
| fe_simcenternastran | Files related to the Simcenter Nastran 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:<br>3dmesh : crack profile generator<br>MaterialCurveFitting : create Hartman-Schijve parameters from raw test data<br>process : creates a .csv data file for specified position(s) on crack front(s)<br>rainflow : rainflow cycle counting<br>tanh : creates tabular growth data from tanh growth equation data<br>T4eRexec: used for remote f.e. execution<br>T4eSSH : used for remote f.e. execution<br>examples directory for utility programs |
| readme.txt | Installation information |
| versions.txt | Version information |

6. The documentation files are installed in a folder called documentation inside the top level directory.

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

7. After placing files onto your hard disk the installer runs the final part of the 'Zencrack configuration' in a command prompt window. This configuration procedure requests information on the location of f.e. codes and of the Fortran environment (if any). It then configures the Zencrack .ini file accordingly.
8. Choose whether to create entries in the Start Menu/Apps Page and/or desktop shortcuts for the Zencrack command promt, Zencrack GUI and documentation.
9. This concludes the installation.

### 2.1.2 Post-installation changes to the program files (Windows)

The 'Zencrack configuration' detailed in step 7 above must be run at least once, either during the installation process or directly afterwards. If the 'Zencrack configuration' phase of the setup was not successfully run during the installation, it can be run manually:

- Open a command prompt window.
- 'cd' to the c:\Zencrack\9.5-x\program\tools directory.
- Issue the command 'runzcr95 setup'.
- The configuration procedure requests information on the location of f.e. codes and of the Fortran environment (if any) and license type. It then configures the Zencrack .ini file accordingly.

For nodelocked licenses put a copy of your license file (see section 7) into the license directory if this was not done during the installation process.

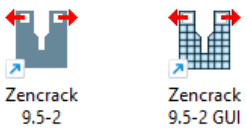
Some items in the zencrack.ini file can be manually modified after completion of installation. These items are described in section 4.

If no program desktop shortcut was selected, 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\9.5-x\program\tools directory and drag it onto your desktop. This shortcut is the file called 'Zencrack 9.5-x'. Depending upon the view setting for the folder, the file looks like this:

Details or List Icons Tiles Content

Select 'Copy here' or 'Create shortcut here'.
Repeat this process for the file c:\Zencrack\9.5-x\program\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 icons, a re-boot may be necessary.

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

Right-click on zencrack95_documentation.pdf file in the c:\Zencrack\9.5-x\documentation directory.

Drag it onto your desktop.

Select 'Create shortcut here'.

### 2.1.3 To uninstall the program and 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 installation process. The program and documentation files can then be uninstalled in one of two ways:

1. By selecting Zencrack 9.5-x from the standard Windows 'Uninstall a program / app' in the appropriate section of Control Panel or Settings. This is the recommended method.
2. By double-clicking the uninstall_9-5-x.exe file in the installation top level directory.

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

1. Delete files under the installation directory, e.g. c:\Zencrack\9.5-x in the above example, making sure to first make a backup copy of 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 and Start Menu entries that were created.

### 2.1.4 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.

### 2.1.5 Possible issues in older operating systems

#### 2.1.5.1 Program Compatibility Assistant warning

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

or 8 the Program Compatibility Assistant may appear at the end of an installation or uninstallation process e.g.:

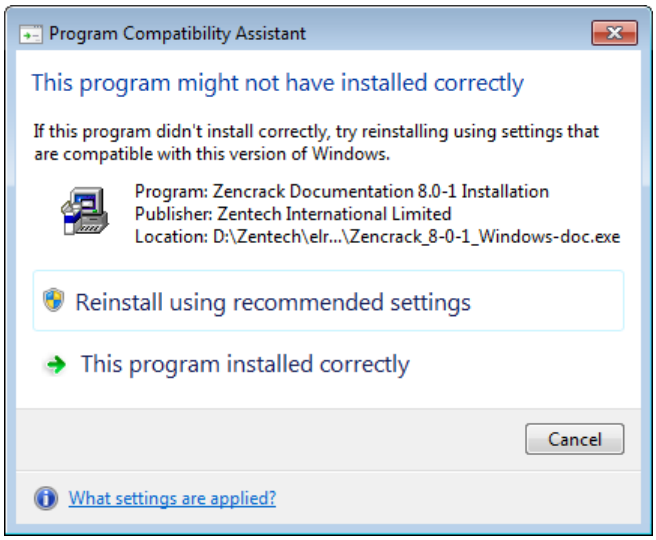



Figure 2.1: Program Compatibility Assistant warning (shown for Zencrack 8.0-1 on Windows 7)

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.

#### 2.1.5.2 Zencrack GUI fails to execute

On Windows 7 machines the Zencrack GUI for version 9.5-x may fail to execute after installation and give a message 'Failed to execute script zcrgui'. To resolve this issue please install the latest Microsoft Visual C++ Redistributable runtime files for Visual Studio 2017 (vc_redist.x64.exe) by searching at `https://support.microsoft.com/` for 'Visual C++ redistributable'.

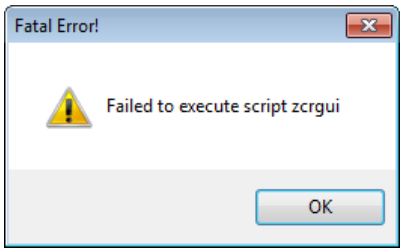



Figure 2.2: Failure of execution of the Zencrack GUI on Windows 7 machine

## 2.2 Linux

The Zencrack product is supplied in one installer file:

- Zencrack_9-5-x_Linux_64.exe

The default install mode is a GUI installation. This requires that a valid DISPLAY environment variable is set. If the GUI installer cannot be launched the installation falls back to a console installation.

A console installation is also possible if option '--mode console' is added after the installer name when executed from a terminal window:

```
./Zencrack_9-5-x_Linux-64.exe --mode console
```

The GUI installer allows installation of the program (Zencrack analysis program and the Zencrack GUI) and/or the documentation whereas the console installer always install program and documentation files. In general it is recommended to install both program and documentation files.

If installing as root, only a console installation is supported.

The default program top level installation location is ~/Zencrack/9.5-x where ~ is the home directory for the user installing the program. This default includes a version number to ensure this installation does not conflict with other versions that may be installed. If the top level folder is changed, it is highly recommended to include the Zencrack version within the folder path. The program and documentation files are installed in sub-folders of the top level folder. For example:

- ~/Zencrack/9.5-x/program
- ~/Zencrack/9.5-x/documentation

If installing as root, the default locations are in folder /usr/local/ rather than ~/.

### 2.2.1 To install the program and/or documentation files (Linux)

1. Log in as any user with sufficient privilege to meet the requirements stated above.
2. Run the Zencrack_9-5-x_Linux_64.exe setup program from a terminal window to install Zencrack. A GUI or console installation is started.
3. For a GUI installation, accept the license terms and then define parameters for the installation on a series of screens.

   For a console installation, define parameters for the installation on a series of prompts in the terminal window.
4. The default installation directory ~/Zencrack/9.5-x is used throughout the remainder of these instructions. If installing as root, the default folder is /usr/local/Zencrack/9.5-x.
5. The program files are installed in a folder called program inside the top level directory. This contains the following folders and files:

| | |
|---|---|
| bin | Zencrack executable, object and library files |
| crack | Crack-block files |
| defaults | Files with various default settings e.g. tol.dat |
| examples | 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 |
| fe_gmsh | Files related to remeshing |
| fe_simcenternastran | Files related to the Simcenter Nastran interface |
| gui | Files related to the Zencrack GUI |
| 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:<br>3dmesh : crack profile generator<br>MaterialCurveFitting : create Hartman-Schijve parameters from raw test data<br>process : creates a .csv data file for specified position(s) on crack front(s)<br>rainflow : rainflow cycle counting<br>tanh : creates tabular growth data from tanh growth equation data<br>examples directory for utility programs |
| versions.txt | Version information |

6. The documentation files are installed in a folder called documentation inside the top level directory.

7. After placing files onto your hard disk the installer runs the final part of the 'Zencrack configuration' (in a terminal window for a GUI installation). This configuration procedure requests information on the location of f.e. codes and of the Fortran environment (if any). It then configures the Zencrack .ini file accordingly.

8. This concludes the installation.

The installation process creates a soft link runzcr95x in the tools folder of the installation which can be used to execute Zencrack jobs from a terminal window.

Two entries, PATH and ZCR_DIR_TOOLS_952 (for version 9.5-2), are added to files in the user home folder by the installer. These entries are added into the following files if they exist:

~/.bashrc ~/.cshrc ~/.tcshrc ~/.zshrc ~/.kshrc ~/.profile

The entries are similar to the examples shown here:

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

```
PATH=$PATH:/home/engineer/Zencrack/9.5-2/program/tools;export PATH; # ADDED BY
INSTALLER - DO NOT EDIT OR DELETE THIS COMMENT - 049A27FB-85D7-A000-B009-
1E90ABF09521 5510A28B-9722-CCA4-BF36-27A805FBBE66

ZCR_DIR_TOOLS_952=/home/engineer/Zencrack/9.5-2/program/tools;export
ZCR_DIR_TOOLS_952; # ADDED BY INSTALLER - DO NOT EDIT OR DELETE THIS COMMENT -
049A27FB-85D7-A000-B009-1E90ABF09521 5510A28B-9722-CCA4-BF36-27A805FBBE66
```

### 2.2.2 To install the program files as root (Linux)

If the program installation is carried out as root, the default installation folder is modified as described in section 2.2.

The copying of files and execution of the 'Zencrack configuration' during the installation process is as described in section 2.2.1.

There are, however, no changes to system files to add the necessary environment variables that allow the installation to be used by users. Instead, two environment variable entries should be added to the appropriate file(s) in the home folder for the user. For example, the files may be:

~/.bashrc ~/.profile

Assuming the default installation folder for a root installation, the entries, shown in this example for version 9.5-2, are:

```
PATH=$PATH:/usr/local/Zencrack/9.5-2/program/tools;export PATH;

ZCR_DIR_TOOLS_952=/usr/local/Zencrack/9.5-2/program/tools;export ZCR_DIR_TOOLS_952;
```

The user can then run Zencrack from a new terminal window by using the runzcr952 link that the installer created in the /usr/local/Zencrack/9.5-2/program/tools folder.

Alternatively, these entries can be added to a system-wide configuration file to make them available to all users.

### 2.2.3 Post-installation changes to the program files (Linux)

The 'Zencrack configuration' detailed above must be run at least once, either during the installation process or directly afterwards. If the 'Zencrack configuration' phase of the setup was not successfully run during the installation, it can be run manually:

- Open a terminal window.
- Issue the command 'runzcr95x setup'.
- The configuration procedure requests information on the location of f.e. codes and of the Fortran environment (if any) and license type. It then configures the Zencrack .ini file accordingly.

For nodelocked licenses put a copy of your license file (see section 7) into the license directory if this was not done during the installation process.

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

### 2.2.4 To uninstall the program files (Linux)

The installation process for Linux does not create an uninstaller. Instead, uninstalling is a manual process:

- Delete the installed folder ~/Zencrack/9.5-x making sure to first make a backup copy of 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.
- Check in the user home folder for entries added into files by the installer. These entries may be added into these files if they exist:
  ~/.bashrc ~/.cshrc ~/.tcshrc ~/.zshrc ~/.kshrc ~/.profile
- Edit the files and remove the PATH and ZCR_DIR_TOOLS_952 variables created for Zencrack 9.5-2. The entries are similar to these examples:

```
PATH=$PATH:/home/engineer/Zencrack/9.5-2/program/tools;export PATH; # ADDED BY
INSTALLER - DO NOT EDIT OR DELETE THIS COMMENT - 049A27FB-85D7-A000-B009-
1E90ABF09521 5510A28B-9722-CCA4-BF36-27A805FBBE66

ZCR_DIR_TOOLS_952=/home/engineer/Zencrack/9.5-2/program/tools;export
ZCR_DIR_TOOLS_952; # ADDED BY INSTALLER - DO NOT EDIT OR DELETE THIS COMMENT -
049A27FB-85D7-A000-B009-1E90ABF09521 5510A28B-9722-CCA4-BF36-27A805FBBE66
```

# 3 Installation - License Server

This section describes installation of the RLM license server for Zencrack. 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 from a prior installation of Zencrack. However, any existing Zencrack license server using an RLM version earlier than v14 should be removed and upgraded with the current license server.

The RLM license server is available for Windows x86-64 and Linux x86-64 machines. The client (i.e. Zencrack product) installations may be on any Windows 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 License Administration Manual.

The RLM License Administration 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 License Administration Manual is supplied as part of the Zencrack documentation and with the RLM license server install files. Note that:

- Some topics in the RLM License Administration Manual are not relevant to the licensing of Zencrack.
- The RLM version used by Zencrack 9.5 is v14.

## 3.1 Windows

The RLM files are supplied in one setup file, Zencrack_RLMv14_Windows.exe. The file contains 64bit versions of the license server:

- The generic license server rlm.exe.
- The Zentech International license server zentechint.exe.
- The RLM command line utilities rlmutil.exe.
- The RLM License Administration Manual, RLM_License_Administration.pdf.
- 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_v14 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\9.5-x would not.

3. Place the supplied server license file in the same rlm_v14 sub-folder as the extracted files (either using the option provided during the installation or manually upon completion of the installation).

4. If the license file has been put in place during the installation process you will have the option to create and start a Windows service for the license server.

5. Make any necessary firewall changes on the license server machine to allow inbound connections to the license server - see section 7.3.2.6.

6. If selection of the license file was skipped, refer to section 7.3.3 for information on starting the license server.

## 3.2 Linux

The RLM files are supplied in one setup file, Zencrack_RLMv14_Linux-64.exe. The file contains 64bit versions of the license server:

- The generic license server rlm.
- The Zentech International license server zentechint.
- The RLM command line utilities rlmutil.
- The RLM License Administration Manual, RLM_License_Administration.pdf.
- 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_v14 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. ~/Zencrack would be appropriate but ~/Zencrack/9.5-x would not.

2. Place the supplied server license file in the same rlm_v14 sub-folder as the extracted files (either using the option provided during the installation or manually upon completion of the installation).

3. Make any necessary firewall changes on the license server machine to allow inbound connections to the license server - see section 7.3.2.6.

4. Refer to section 7.3.3 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 if their values need to be changed.

The setup program can be re-run at any time to update the highlighted variables in section 4.1 by using the command:

```
runzcr95 setup
```

for Windows

```
runzcr95x setup
```

for Linux

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 Abaqus executable file provided as part of the Abaqus program installation and used to run Abaqus. Prior to Abaqus 2016: abqxxx.exe, where xxx refers to a version number, e.g. 610ef1, 6111, 6121 etc.
For Abaqus 2016 to Abaqus 2021: abqlauncher.exe
From Abaqus 2022: smalauncher.exe

ZCR_ABAQUS_VER — the Abaqus version which may optionally include the sub-version, e.g. 6.12-1, 2018, 2022.
For version 2016 onwards the inclusion of Golden or Hotfix details are optional. They can be specified with 'Golden' or 'HotFix n' included. For example:
2018 Golden.
2018 HotFix 1 for Abaqus 3DEXPERIENCE R2018x HotFix 1 (FP1806).
Only the main version is included by the Zencrack setup program so the optional addition of Golden or HotFix versions must be specified by editing the zencrack.ini file.

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 2022 is the default version and Abaqus 6.14-1 is an alternative version.

```
[ABAQUS]
ZCR_ABAQUS = c:\SIMULIA\EstProducts\2022\win_b64\code\bin\smalauncher.exe
ZCR_ABAQUS_VER = 2022
ZCR_ABAQUS_OPTIONS = interactive cpus=4
ZCR_ABAQUS_SURFACE = none
#
[ABAQUS614]
ZCR_ABAQUS = c:\simulia\abaqus\6.14-1\exec\abq6141.exe
ZCR_ABAQUS_VER = 6.14-1
ZCR_ABAQUS_OPTIONS = interactive cpus=4
ZCR_ABAQUS_SURFACE = none
```

To run Zencrack with Abaqus 6.14 instead of the default version 2022:

```
runzcr95 -j jobname -abaqus 614
```

### 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, for version 11.0, any service pack number, e.g. 11.0SP1, 16.0, 17.2, 19.0.<br>For versions since the '20XX Rx' naming convention the value required is the numeric equivalent as derived from the folder path for the version e.g. 19.4 for 2019R2, 22.2 for 2022 R2 etc. |
| 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.:<br>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 Ansys 2022 R1 is the default version and Ansys 2019 R2 and Ansys 14.5 are configured as alternative versions:

```
ZCR_ANSYS = c:\Program Files\ANSYS Inc\v221\ansys\bin\winx64\ansys221.exe
ZCR_ANSYS_VER = 22.1
ZCR_ANSYS_OPTIONS = -np 2
ZCR_ANSYS_CNV = AUTOMATIC
#
[ANSYS2019R2]
ZCR_ANSYS = c:\Program Files\ANSYS Inc\v194\ansys\bin\winx64\ansys194.exe
ZCR_ANSYS_VER = 19.4
ZCR_ANSYS_OPTIONS = -np 2
ZCR_ANSYS_CNV = AUTOMATIC
#
[ANSYS145]
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
```

To run Zencrack with Ansys 14.5 instead of the default version 2022 R1:

```
runzcr95 -j jobname -ansys 145
```

### 4.1.3 [SIMCENTERNASTRAN] section

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

ZCR_SIMCENTERNASTRAN
: the full location of the Simcenter Nastran executable provided as part of the stand-alone or package Simcenter installation being using.
Refer to the zencrack.ini file for examples of stand-alone, Simcenter3D and Femap package installations.

ZCR_SIMCENTERNASTRAN_VER
: the Simcenter Nastran version. Only version 10.0 and later are supported by Zencrack.
Refer to the zencrack.ini file for examples of stand-alone, Simcenter3D and Femap package installations.

ZCR_SIMCENTERNASTRAN_OPTIONS
: defines command line options for running Simcenter Nastran. The setting scratch=yes is strongly recommended to prevent creation of potentially large .DBALL and .MASTER files.
This may also include, for example, the number of processors used to run Simcenter Nastran e.g.:
ZCR_SIMCENTERNASTRAN_OPTIONS = scratch=yes parallel=4

ZCR_SIMCENTERNASTRAN_EXTRA
: not currently used.

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

To run a Zencrack job using a non-default Simcenter Nastran version the '-simcenternastran' 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 Simcenter Nastran sections and always uses the default section.

The example below shows a case where a stand-alone Simcenter Nastran 2021.2 installation is the default version and Simcenter Nastran 2022.1 is an alternative version available as part of an

NX2007 installation (line wrapping in this example is for formatting purposes only - each item should be on a single line in the .ini file):

```
ZCR_SIMCENTERNASTRAN = c:\Program Files\Siemens\SimcenterNastran_2021.2\
                                                              bin\nastran.exe
ZCR_SIMCENTERNASTRAN_VER = 2021.2
ZCR_SIMCENTERNASTRAN_OPTIONS = scratch=yes parallel=4
ZCR_SIMCENTERNASTRAN_EXTRA =
#
[SIMCENTERNASTRAN2022]
ZCR_SIMCENTERNASTRAN = c:\Program Files\Siemens\NX2007\NXNASTRAN\bin\nastran.exe
ZCR_SIMCENTERNASTRAN_VER = 2022.1
ZCR_SIMCENTERNASTRAN_OPTIONS = scratch=yes parallel=4
ZCR_SIMCENTERNASTRAN_EXTRA =
```

To run Zencrack with the Simcenter Nastran 2022.1 version instead of the default version 2021.2:

```
runzcr95 -j jobname -simcenternastran 2022
```

### 4.1.4 [VERIFIED] section

This section defines the versions of the interfaced finite element codes that were verified at the time of release of the Zencrack version. Compatibility with later versions of the finite element codes cannot be guaranteed. If a later version is detected when a Zencrack job runs, a warning is generated in the .rep file.

It is recommended that the entries in this section are not modified unless a later version of the f.e. code is known to not cause compatibility issues.

ZCR_ABAQUS_VER_VERIFIED — the version of Abaqus up to which this Zencrack version was verified at the time of release.

ZCR_ANSYS_VER_VERIFIED — the version of Ansys up to which this Zencrack version was verified at the time of release.

ZCR_SIMCENTERNASTRAN_VER_VERIFIED — the version of Simcenter Nastran up to which this Zencrack version was verified at the time of release.

### 4.1.5 [LICENSE] section

This section defines items for licensing. If using nodelocked licensing 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. |

### 4.1.6 [FORTRAN_LINUX] section

This section contains Fortran configuration information for Linux installations. ZCR_FORTRAN and ZCR_FORTRANSTRING are the only variables which should need to be changed - this change is best achieved via the setup program (on installation or later by runzcr95x setup).

| | |
|---|---|
| ZCR_FORTRAN | This variable defines the location of the setvars.sh file for initialising the latest version of the Intel Fortran compiler that is available on the system. |
| ZCR_FORTRANSTRING | This string defines the system command to invoke the Fortran compiler. On installation this is 'ifort'. The supplied object files are built using ifort and are compatible with Intel ifort and ifx compilers. The setup program sets ifort as the compiler command for compiler versions 2024.x and earlier, and ifx for compiler versions 2025 onwards. |
| ZCR_FORTRAN64 | This string is used by Zencrack when compiling/linking a user subroutine - it should not be modified. |

### 4.1.7 [FORTRAN_WINDOWS] section

This section contains Fortran configuration information for Windows installations. ZCR_FORTRAN and ZCR_FORTRANSTRING are the only variables which should need to be changed - this change is best achieved via the setup program (on installation or later by runzcr95 setup).

| | |
|---|---|
| ZCR_FORTRAN | This variable defines the location of the setvars.bat file for initialising the latest version of the Intel Fortran compiler that is available on the system. |

ZCR_FORTRANSTRING — This string defines the system command to invoke the Fortran compiler. On installation this is 'ifort /traceback'. The supplied object files are built using ifort and are compatible with Intel ifort and ifx compilers. The setup program sets ifort as the compiler command for compiler versions 2024.x and earlier, and ifx for compiler versions 2025 onwards.

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.

#### 4.1.8 [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.

#### 4.1.9 [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.

```
runzcr95 -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:

```
runzcr95 -j jobname -f mesh
```

### 4.1.10 [MISC] section

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

ZCR_INI_USERHOME

Defines whether or not to look for additional settings in a zencrack.ini file in the user home folder. Value 'yes' is set at installation. This can be changed to 'no'.

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>\program\bin\zcr95.exe | Windows |
| <install folder>/program/bin/zcr95.exe | Linux |

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

```
runzcr95 -j jobname -e mysavedZcrExecutable.exe
```

ZCR_DEFAULT_LIB

The default Zencrack library location. This is:

| | |
|---|---|
| <install folder>\program\bin\zcr95_library.lib | Windows |
| <install folder>/program/bin/libzcr95.a | Linux |

ZCR_DEFAULT_OBJ

The default Zencrack object location. This is:

| | |
|---|---|
| <install folder>\program\bin\zencrack.obj | Windows |
| <install folder>/program/bin/zencrack.o | Linux |

### 4.1.11 [SETUP] section

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

```
VERSIONname = 9.5-2
RUNZCRFILE = runzcr95.exe
FILEPATH = zcrpath952.bat
EXESTEM = zcr95
HELPFILE = help_command_line.txt
```

## 4.2 The zencrack_gui.ini file

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 execution of the Zencrack GUI.

However, 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.

When the GUI initialises it creates a startup log file. This is intended to capture early events and configuration of the GUI prior to opening the main log file. For an interactive GUI session the startup log file is created in the user home holder with a timestamped name in the format zcrgui_log_startup_yyyy_mm_dd_hh_mm_ss.txt. For a command line remeshing run the startup log is created in the job folder with a name based on the underlying Zencrack job output name e.g. testr_zcrgui_log_startup.txt. The startup log file contains:

- DISPLAY environment variable confirmation on Linux
- list of command line parameters for GUI execution
- list of all .ini file values and whether the values are from a local user home folder .ini file or the Zencrack install folder file
- list of important folders for the session

Contents of the startup log file are moved into the main log file when the main log file is opened - the startup log file is then removed. For interactive GUI sessions the main log file, an error file and a temporary input file are located by default in the user home folder. This location can be changed to be the GUI sub-folder of the Zencrack installation by variable [SETTINGS]LOCATION in the zencrack_gui.ini file. Further control over the location of the three files is possible via three parameters in the zencrack_gui.ini file. These parameters default to blank indicating the standard location and names should be used:

```
#Location = userhome     # Default location of log, error and tmp files.
                         # This may be set to use the user home directory
                         # or the Zencrack install folder.
                         # Value: userhome/install.
                         # Default if omitted = userhome
#Logfile =               # Name of GUI log file (including path).
```

```
                        # Default if omitted:
                        # If Location is userhome the default is:
                        # <home>\zcrgui_log.txt.
                        # If Location is install the default is:
                        # <Zencrack install folder>\gui\zcrgui_log.txt.
#Errfile =              # Name of GUI error file (including path).
                        # Default if omitted:
                        # If Location is userhome the default is:
                        # <home>\zcrgui_log.txt.
                        # If Location is install the default is:
                        # <Zencrack install folder>\gui\zcrgui_err.txt.
#TMPSAVEDIR =           # Location of intermediate .zcr files which are
                        # saved with extension .tmp.
                        # This defines a directory in which
                        # zencrack_gui.zcrX.tmp files are created.
                        # Default if omitted:
                        # If Location is userhome the default is:
                        # <home>\zencrack_gui.zcrX.tmp.
                        # If Location is install the default is:
                        # <Zencrack install folder>\gui\zencrack_gui.zcrX.tmp.
```

## 4.3 Local zencrack.ini and zencrack_gui.ini files

The .ini files for Zencrack and the GUI are located in the Zencrack install folder (tools\zencrack.ini and gui\zencrack_gui.ini respectively). The user home folder may contain additional .ini files whose parameters take precedence over the files in the installation folder. This allows user-level control over settings without the need to modify files in the installation folder. Two levels of local .ini files are allowed:

- zencrack.ini and zencrack_gui.ini
  values in these 'generic' files are used by any Zencrack version which supports local .ini files.
- zencrack_9X.ini and zencrack_gui_9X.ini
  values in these 'versioned' files are used by the Zencrack 9.X-x version which they reference, as denoted by the upper case 'X'. For example, zencrack_gui_95.ini could be used by versions 9.5-1, 9.5-2 etc.

When processing the .ini files the installation folder file is checked first. This is expected to contain a full set of parameters. The generic local file is checked next. Any entries in this file take priority over entries from the installation folder file. The versioned local file is checked last. Any entries in this file take priority over entries from the installation folder file and the generic local file. The generic and versioned local .ini files do not need to contain a full set of parameters - they can contain only those parameters which are to be modified compared to lower priority .ini files.

Entries in the .ini files can be used to prevent or allow the use of subsequent local files:

- In zencrack.ini:

```
[MISC]
# Whether or not to look for additional settings in a zencrack.ini file in
# the user home folder.
# Values: yes/no.
```

```
ZCR_INI_USERHOME = yes
```

- In zencrack_gui.ini:

```
[SETTINGS]
#Gui_Ini_UserHome = yes  # Whether or not to look for additional settings in
                         # a zencrack_gui.ini file in the user home folder.
                         # Values: yes/no.
                         # Default if omitted = yes.
```

Setting these options to No in the installation folder files prevents any use of the respective local files. Setting the value to No in the generic local files prevents use of the respective versioned local files.

## 4.4 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 zcrpath95x.bat is created in the Zencrack .\program\tools directory. 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 zcrpath95x.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.:

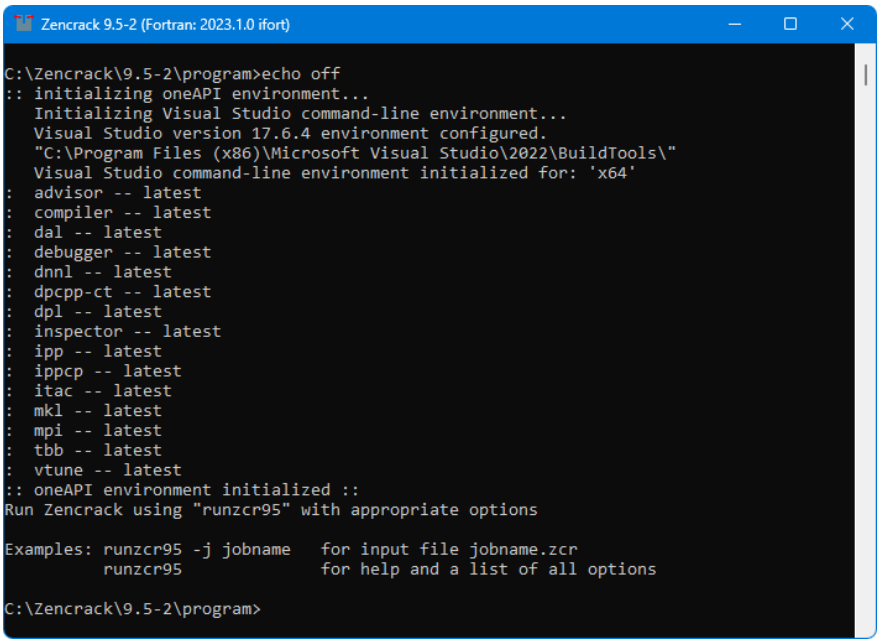



Figure 4.1: Zencrack command prompt (Windows)

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 for oneAPI 21.1.1:

```
source /opt/intel/oneapi/compiler/21.1.1
runzcr95x -j myjob -u myusersubs.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 zcr95_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.:

```
runzcr95 -j myjob_new -e zcr95_user.exe
```

for Windows

```
runzcr95x -j myjob_new -e ./zcr95_user.exe
```

for Linux

## 4.5 Configuring the plug-ins for Abaqus/CAE

Use of the plug-ins for Abaqus/CAE for creating and maintaining Zencrack input files is replaced by the Zencrack GUI from version 7.9-1 onwards. The plug-ins now provide a capability to import splines and crack front profiles from Zencrack .zcr and .vis files to display in Abaqus/CAE. 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 are provided for Abaqus version 6.10 and later. Compatibility with Abaqus versions later than Abaqus 2024 cannot be guaranteed.

Due to changes in the Python version between various Abaqus releases, three sets of files are provided in the Zencrack installation - one for Abaqus 6.10 to 6.13, one for Abaqus 6.14 to 2023 and one for Abaqus 2024 and later.

The plug-in files are installed with the Zencrack product and need to be copied into the Abaqus environment. The Zencrack installation contains a folder fe_abaqus with sub-folders:

- zencrackplugins_6-10_6-13 for Abaqus 6.10 to 6.13

- zencrackplugins_6-14_2023 for Abaqus 6.14 to 2023
- zencrackplugins_2024_onwards for Abaqus 2024 and later.

There are a number of options available for configuring Abaqus plug-ins, so each user should consult their Abaqus administrator and/or the relevant section of the Abaqus/CAE User's Manual. However, the following summarises the options that are available.

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

- *abaqus_dir*\abaqus_plugins, or *abaqus_dir*\CAE\plugins\xxxx, depending upon the Abaqus version, where *abaqus_dir* is the Abaqus parent directory and xxxx is a version number e.g. 2024. Simply copy the entire zencrackplugins_xx folder into this location. This is the easiest method.
- Define *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\\9.5-x\\program\\fe_abaqus\\zencrackplugins_2024_onwards"
```

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 Interface To Abaqus Manual.

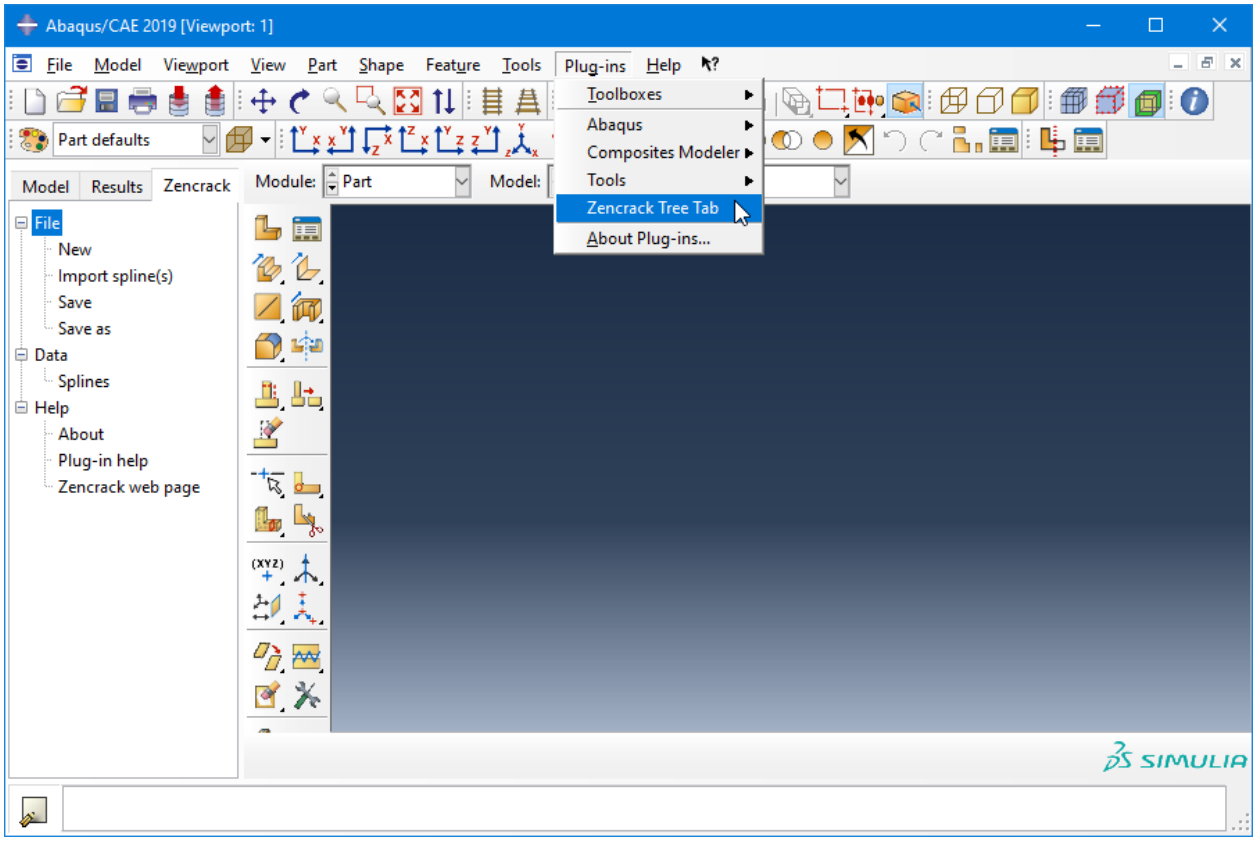



Figure 4.2: Plug-in access in Abaqus/CAE

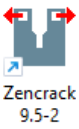
# 5 Running Zencrack

Zencrack is executed using the runzcr95 executable located in the tools directory of the Zencrack installation. This section describes the execution options in detail.

When using the Zencrack GUI, an analysis can be started from the Run Zencrack drop-down menu. The screen input collects the necessary information to run the job, starts a command prompt or terminal session and runs the jobs. Refer to the GUI Manual for more information.

## 5.1 Command prompt setup in Windows

Zencrack is executed from a command prompt session. A Zencrack shortcut is included in the Start Menu/Apps Page or on the desktop (if these options were selected during installation). If not, a shortcut is included in the .\program\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 .\program\tools directory. The session is also set up for Fortran if it is installed, e.g.:

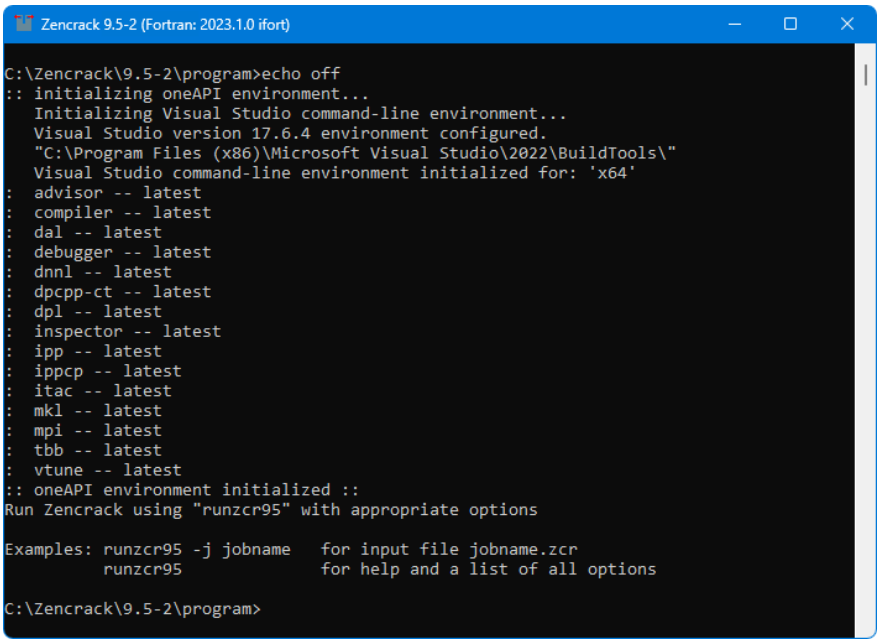



Figure 5.1: Zencrack command prompt (Windows)

## 5.2 Terminal window setup in Linux

The Zencrack installation creates an environment variable and soft link to the runzcr95.exe file which allow Zencrack to be executed from any terminal window.

Note that to allow sub-versions to be installed, the default command used to run Zencrack on Linux

includes the sub-version number i.e. runzcr951 for version 9.5-1, runzcr952 for version 9.5-2 etc. The generic runzcr95x is used for Linux examples in other sections of this document.

## 5.3 Execution using runzcr95

The program is run using the runzcr95 command for Windows or runzcr95x 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.

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 noted in the help_command_line.txt file in the tools folder of the Zencrack installation. See section 5.5 for examples of command line execution.

A number of screen messages are generated when the runzcr95 command is executed. These show some of the options that are set for the job. For example, for the job n01a described in section 6 executed with a network license the following is seen under Windows (with similar for Linux):

```
C:\Zencrack\9.5-2\program\examples\crack-block\abaqus\verify>runzcr95 -j a01a
Getting settings from .ini file: C:\Zencrack\9.5-2\program\tools\zencrack.ini
Skipping C:\Users\engineer\zencrack.ini : this local file does not exist
Skipping C:\Users\engineer\zencrack_95.ini : this local file does not exist

ZENCRACK 9.5-2
--------------

Running Zencrack analysis.

Job               : a01a.zcr
Time              : 04-12-2025 16:05:14

Using RLM network licensing method.
Attempting checkout of license for ZENCRACK Standard with interface to Abaqus.
1 token is required.
Successfully acquired 1 token from localhost.
Starting  mesh generation
Completed mesh generation
*** Zencrack job completed without any errors
Time: 04-12-2025 16:05:15
```

## 5.4 Running the Zencrack GUI

The Zencrack GUI can be started on Windows via a Start Menu shortcut, a desktop shortcut or via the runzcr95 command in a command prompt window.

The Zencrack GUI can be started on Linux via the runzcr95x command in a terminal window. A valid DISPLAY environment variable is required.

```
runzcr95 gui
```

for Windows

```
runzcr95x gui
```

for Linux

## 5.5 Examples of command line execution

The program is run from the command line using the runzcr95 command for Windows or runzcr95x for Linux (see section 5.2). Examples of command lines are listed below.

Help and configuration information (this echoes the contents of the help_command_line.txt file and lists parameters that are set in the current configuration):

```
runzcr95 help
```

Run job example:

```
runzcr95 -j example
```

Run job example with forced overwrite of any previous results files:

```
runzcr95 -j example -o yes
```

Run job example with 4 processors for the Abaqus finite element runs:

```
runzcr95 -j example -fe "cpus=4"
```

Run job example with 4 processors for the Ansys finite element runs:

```
runzcr95 -j example -fe "np -4"
```

Run job submodel using the Abaqus global model results file called global:

```
runzcr95 -j submodel -fe "globalmod=global"
```

Run job myanalysis using Zencrack user subroutine user_dadn.f:

```
runzcr95 -j myanalysis -u user_dadn.f
```

Run job myanalysis using Zencrack user subroutine user_dadn.f and save the executable as user_dadn.exe:

```
runzcr95 -j myanalysis -u user_dadn.f -e user_dadn.exe
```

Run the gui:

```
runzcr95 gui
```

Run utility program 3dmesh:

```
runzcr95 3dmesh
```

Run utility program for Hartman-Schijve material curve fitting:

```
runzcr95 MaterialCurveFitting
```

Run utility program process:

```
runzcr95 process
```

## 5.6 Killing a Zencrack job during execution

The preferred option for killing a Zencrack job is to kill the job during the finite element analysis phase, as described in the following sections. When the f.e. analysis terminates, the Zencrack process should continue, fail to find the expected results, and report an error in the .rep file to that effect (i.e. the Zencrack process should finish normally). If the Zencrack process itself must be stopped, the same procedures can be followed as below, but should instead be applied to the zcr95.exe process. However, note that a remeshing job starts a sub-process which may continue in the background after the Zencrack executable is terminated.

### 5.6.1 Windows

A finite element analysis is best terminated via Task Manager. In the Search box on the Start menu, enter "Task Manager" and start the task manager by selecting from the resulting list of options. On the Processes tab of Task Manager, identify the finite element executable job that is running as part of the Zencrack process, select that row, and click on 'End task'.

### 5.6.2 Linux

From a terminal window enter 'ps aux' to list running processes. Identify the process id number for the finite element executable. Issue the command 'kill xxxx' where xxxx is the process id number.

# 6 Verifying An Installation

Once the program is ready for execution, the supplied examples in the crack-block\<fe interface>\verify subdirectory of the examples 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>\examples\crack-block\<fe interface>\verify).

  Run job:

  - a01a for Abaqus users:

    ```
    runzcr95 -j a01a
    ```

  - n01a for Ansys users:

    ```
    runzcr95 -j n01a
    ```

  - x01a for Simcenter Nastran users:

    ```
    runzcr95 -j x01a
    ```

  To confirm that the analysis completes successfully, check the a01ar.rep, n01ar.rep or x01ar.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, n01ar.ans or x01ar.dat.

  Sample output is contained in the examples\<crack-block>\<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:

    ```
    runzcr95 -j a01c
    ```

– n01c for Ansys users:

```
runzcr95 -j n01c
```

– x01c for Simcenter Nastran users:

```
runzcr95 -j x01c
```

To confirm that the analysis completes successfully, check the a01cr.rep, n01cr.rep or x01cr.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 examples\crack-block\<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 subdirectory 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 the licensing method 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 that due to the way that information is placed into the license file there are restrictions on the number of characters allowed for certain fields. The machine_id program checks that these limits are not exceeded:

- organisation name - 64 characters or fewer
- address lines 1, 2 and 3 (combined) - 62 characters or fewer
- address line 4 and phone number (combined) - 35 characters or fewer

Note that 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' subdirectory 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 allowing use of all three finite element interfaces is shown below, note that the last 'License' line allows Zencrack Professional to be run - without this in a nodelocked file only Zencrack Standard is licensed.

```
### Zencrack 9.5
LICENSE zentechint zencrack 9.5 31-jan-2026 single hostid=43e6d71e7d28
  start=01-feb-2025 issuer="U.K.\+44 (0)5603 641516\\Commercial"
  customer="Zentech International Limited" contract="590B Finchley
   Road\London\NW11 7RX" _ck=fa0fb9b48d sig="60P0453TJFBVADEHAW7K55RSC
  4C5QV44AMK2EVR22HSU81XSEC35W2DT9HR2TVQQ788XHGKHDV"
### ZCRGUI 9.5
```

```
LICENSE zentechint zcrgui 9.5 31-jan-2026 single hostid=43e6d71e7d28
  start=01-feb-2025 issuer="U.K.\+44 (0)5603 641516\\Commercial"
  customer="Zentech International Limited" contract="590B Finchley
   Road\London\NW11 7RX" _ck=3d0fb90d5b sig="60PG4580PA559JDM6S60CGJ72
  1YGWQ5KK6ADENU208A0T9TC62B42T6YEFSD1T6A116BXGEUKYWG"
### ZCRREMESH 9.5
LICENSE zentechint zcrremesh 9.5 31-jan-2026 single
  hostid=43e6d71e7d28 start=01-feb-2025 issuer="U.K.\+44 (0)5603
   641516\\Commercial" customer="Zentech International Limited"
  contract="590B Finchley Road\London\NW11 7RX" _ck=7c0fb90a5b sig="60
  P04520S3F2K9CMSN5WN5V88352S7XCFJ57FM022HND18CEVXQUCJWR6S82JQC5UXJXVN
  PS2M"
### ZCRMATERIALCURVEFITTING 9.5
LICENSE zentechint zcrmaterialcurvefitting 9.5 31-jan-2026 single
  hostid=43e6d71e7d28 start=01-feb-2025 issuer="U.K.\+44 (0)5603
   641516\\Commercial" customer="Zentech International Limited"
  contract="590B Finchley Road\London\NW11 7RX" _ck=610fb935ff sig="60
  PG4580MVE6HCKSS23YCFFAJ78XC76E2D7TERN808A7W30H9AR8MPPTYBBGUVSDMEWEGX
  B689R0"
### ZCRABAQUS 9.5
LICENSE zentechint zcrabaqus 9.5 31-jan-2026 single
  hostid=43e6d71e7d28 start=01-feb-2025 _ck=750fb9e132 sig="60P0450XK0
  W0QGTPX8C8VX17323DUMU9RRV8QTG22HS0WH3J7X0PJAKHFS419M52NQ8KMRS44C"
### ZCRANSYS 9.5
LICENSE zentechint zcransys 9.5 31-jan-2026 single hostid=43e6d71e7d28
  start=01-feb-2025 _ck=260fb90e2d sig="60P04528XPN4FTE91R3FY20QKDHYDW
  40S7BA87G22HYQQ3NEAMJ4X3HQ9Y9M1PN71K4JFFKYCR"
### ZCRSIMCENTERNASTRAN 9.5
LICENSE zentechint zcrsimcenternastran 9.5 31-jan-2026 single
  hostid=43e6d71e7d28 start=01-feb-2025 _ck=b90fb9bc90 sig="60P04500UN
  Y8HQJFMPKFEF2VXRRAFDRQG1XRC3822GFPVGTV954HT9VQNUVEUN1G9KX1H4YDJG"
### ZENCRACKPROF 9.5
LICENSE zentechint zencrackprof 9.5 31-jan-2026 single
  hostid=43e6d71e7d28 start=01-feb-2025 _ck=b10fb9d158 sig="60PG4510TM
  GJ2S08U7N7579N2KRAG1F1DVGANE822M0BB02JBVGJ2TQDQT2GCNB248CNC1M4Q7Z0"
```

## 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 allowing use of all three finite element interfaces is shown below, note that the 'HOST' line specifies the server machine hosting the license.

```
### Zencrack 9.5
HOST JUPITER cbad8a5e8756 2764
ISV zentechint
LICENSE zentechint zencrack 9.5 31-jan-2026 30 start=01-feb-2025
  issuer="U.K.\+44 (0)5603 641516\\Commercial" customer="Zentech
   International Limited" contract="590B Finchley Road\London\NW11
   7RX" _ck=fa08b96f65 sig="60P04536NT511HVF3MRNQVPEAVG8DKKE0N7WTR822G
  EE1NNUAJVH45GUAC4K299XRWXD6QA55C"
### ZCRGUI 9.5
LICENSE zentechint zcrgui 9.5 31-jan-2026 30 start=01-feb-2025
  issuer="U.K.\+44 (0)5603 641516\\Commercial" customer="Zentech
   International Limited" contract="590B Finchley Road\London\NW11
   7RX" replace _ck=3d084d1900 sig="60P04534R39WKV74P435VKY6UX1PT298HY
  KM4T822H9FVJ69MQQU3SXEPH0S3DMU1HEDURY6FV"
### ZCRREMESH 9.5
LICENSE zentechint zcrremesh 9.5 31-jan-2026 30 start=01-feb-2025
  issuer="U.K.\+44 (0)5603 641516\\Commercial" customer="Zentech
   International Limited" contract="590B Finchley Road\London\NW11
   7RX" replace _ck=7c088c5405 sig="60PG4580H1YCBA158M22H38DPRR7AEXJA6
  HJN76708A7UC66DYDX0MDAR8UCU1W83CBV725D99Q0"
### ZCRMATERIALCURVEFITTING 9.5
LICENSE zentechint zcrmaterialcurvefitting 9.5 31-jan-2026 1
  start=01-feb-2025 issuer="U.K.\+44 (0)5603 641516\\Commercial"
  customer="Zentech International Limited" contract="590B Finchley
   Road\London\NW11 7RX" replace _ck=61d67109d1 sig="60PG4580G2MF13PKU
  JAMR6219RVSX9AY55458U9M08A3FV8UQBDMTHTTK0J27UW5WXANPBP5XBKG"
### ZCRABAQUS 9.5
LICENSE zentechint zcrabaqus 9.5 31-jan-2026 1 start=01-feb-2025
  replace _ck=67d68589e3 sig="60P0452TFSCUUR12VCYCD98U8Q19D3XVAR3PBV02
  2HYPD1RCWD5TGDTN92X0YMG23YB4FERA9C"
### ZCRANSYS 9.5
LICENSE zentechint zcransys 9.5 31-jan-2026 1 start=01-feb-2025
  replace _ck=26d63647d5 sig="60Q04580H6QWKGB2XDBR99DXPRG9AUWFH7SAXA4X
  08AG179J0GT0K2YHR447H99NPV1HEETKMGDW0"
### ZCRSIMCENTERNASTRAN 9.5
LICENSE zentechint zcrsimcenternastran 9.5 31-jan-2026 1
  start=01-feb-2025 replace _ck=b9d6c9bd96 sig="60P0450TXY2MAJEUHEBYF7
  M3K0DXH894SHDFY1022G0VFQHW0TD1FBKFN4AWKKCVSK9C80VSN0"
```

### 7.3.1 License server files

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 License Administration Manual, RLM_License_Administration.pdf.

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 License server port and firewall information

When using the license server there are two port numbers associated with operation of the server. Usually these ports do not need to be changed. The information in this section explains more about the ports and what to do if they need to be changed.

#### 7.3.2.1 Overview of ports

The license server contains two main components which operate via two TCP ports:

- rlm.exe - the rlm server. This defaults to using port 2764. This port number can be changed on the HOST line in the license file. Each client installation must reference this port number in their zencrack.ini file in order to obtain a license, so if the port number is changed from the default, all client installations must be changed to be consistent.
- zentechint.exe - the ISV server. This defaults to using a random system assigned port number. The port number can be set to a fixed value on the ISV line in the license file. Client installations do not need to know this port number.

If the license server is running, then the RLM web browser utility, described in section 7.3.4 should be available on port 5054 on the license server machine. Selecting Status in the left-hand pane will show information similar to that in Figure 7.1. The two port numbers being used in the example in Figure 7.1 are:

- Port 2764 - Associated with the rlm server itself. The default port number defined in the license file.
- Port 53751 - Associated with the zentechint ISV server. A random system assigned port number.

As noted above, both of these ports can be defined in the license file. Each license file contains one HOST line and one ISV line. For example:

```
HOST JUPITER cbad8a5e8756 2764
ISV zentechint
```

When issuing license files we ALWAYS include port 2764 on the HOST line and NEVER include a port number on the ISV line. The system then assigns a port for the zentechint ISV server component. To include a specific port for the zentechint component of the server on the ISV line the license file may be edited and a port= option added. For example, to ensure that port 49600 is always used:

```
HOST JUPITER cbad8a5e8756 2764
ISV zentechint port=49600
```

#### 7.3.2.2 Port 2764

Port number 2764 on the HOST line in the license file that we supply to you is for the rlm server.

This value is required in the zencrack.ini file on client machines to tell client installations how to find the license server on the network. The zencrack.ini file is located in the tools sub-folder of the client installation. Port number 2764 is placed into the zencrack.ini file by the client installation process - the port number cannot be changed during a client installation. An entry in the zencrack.ini file after installation may look like this:

```
ZENCRACK_RLM_SERVER = 2764@192.168.1.10
```

where the license server network address is 192.168.1.10.

If you change the HOST line in the license file to use a different port, you must edit the zencrack.ini file on each client machine after the installation process completes to set the consistent alternative port number on the ZENCRACK_RLM_SERVER line.

In general, there should be no reason to change this port number.

#### 7.3.2.3 The zentechint server

The license server contains an executable zentechint.exe which operates on a system assigned port number if no value is specified on the ISV line in the license file.

If a specific port= entry is added to the license file, as described in section 7.3.2.1, and the license server restarted, the port specified in the license file would be used and show on the Status page of the RLM web browser utility.

It may be required to set this port to a fixed value if the port method is used in firewall settings, as described in the section 7.3.2.6.

#### 7.3.2.4 Changing ports

It may be necessary for a customer to specify ports if they want to control port access on the server machine (for example to satisfy firewall restrictions).

Setting port numbers on the HOST or ISV lines of the license file does not affect the validity of the file.

If you change port settings in the license file you must remember to make the same changes if you receive a new license file e.g. for a new Zencrack version or for a lease extension.

#### 7.3.2.5 Identify ports in use by the license server

Using the RLM web browser utility to verify the two ports that are being used by the license manager is the simplest method of confirming the ports. The web browser utility is described in section 7.3.4.

Alternatively, if the license server is being run directly as an executable, rather than as a service, the ports are shown during the startup of the license server. If the license server is running as a service, this startup information can be found in the server log file.

#### 7.3.2.6 Firewall settings

In order for client machines to be able to access the license server, any firewall on the license server must allow appropriate inbound connections.

For a license server on a Windows machine, the Windows Defender Firewall can be configured in one of two ways:

- Define a Program Exception to allow inbound connections for rlm.exe.
- Define a Port Exception to allow inbound connections for the ports used by the rlm server and zentechint ISV server.

The first method is the simplest as the port method additionally requires that a fixed port number is defined for the ISV server on the ISV line in the license file.

To set a Program Exception inbound firewall rule for rlm.exe requires administrator access and these steps:

1. Search for, and open, **Windows defender firewall with advanced security** from the Start menu.
2. In the column on the left, select **Inbound Rules**.
3. In the column on the right, click on **New Rule...**.
4. Select **Program** for the type of rule that you would like to create. Then click **Next**.
5. Select **This program path:** and use the **Browse...** button to locate the rlm.exe file that was installed as part of the license server installation. Then click **Next**.
6. Select **Allow the connection**. Then click **Next**.
7. Check the **Domain** and **Private** profiles, and, if you require it, the **Public** profile. Then click **Next**.
8. Enter a name and description for the rule. Then click **Finish**.

To use the alternative port method, a similar process should be followed to allow access via a port rule, selecting Port at step 4, followed by setting the TCP ports of the rlm server and zentechint ISV server as **Specific local ports**.

### 7.3.3 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
```

Note that this startup method must be repeated every time the license server machine is rebooted.

#### 7.3.3.1 Running the RLM server as a service on Windows

The RLM server can be installed as a service on Windows during the installation process with service name 'rlm_v14-Zencrack'. If skipped during installation, it can be done later in a command window. Once installed as a service, it remains installed until the service is deleted. The service may be started by the installer, via the Windows Services control panel if installing manually, and thereafter at boot time. Manual installation of the service uses the RLM program itself, with special arguments.

Note that all actions to install, modify and delete a Windows service require Administrator rights. If the installer is executed without Administrator rights it will be unable to create the service and will instead report an error.

If the service is not created during installation, manual creation of the service after installation can be done in an elevated (i.e. 'Run as Administrator') command prompt window. After 'cd' to the installed RLM folder, an example of the command line to install the service is:

```
rlm -install_service -service_name rlm_v14-Zencrack -dlog
    c:\Zencrack\rlm_v14\server.log -c c:\Zencrack\rlm_v14\yourlicense.lic
```

Note that this is a single command line, wrapped onto two lines for the purposes of documentation.

This example installs RLM as a service under the name 'rlm_v14-Zencrack'. When the service starts, RLM will be passed the '-c c:\Zencrack\rlm_v14\yourlicense.lic' arguments, and it will write debug log information to the file c:\Zencrack\rlm_v14\server.log. Note: if no '-c' argument is given, the RLM program will read all licence files (.lic) present in the RLM installation directory.

To start the service after installing it manually:

Start > Control Panel > Administrative tools > Services
Locate rlm_v14-Zencrack. Right-click > Properties > Start
The service should now start.

The full set of options for the rlm -install_service command are:

```
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.

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

```
rlmutil rlmstat
```

Alternatively the browser-based utility described in section 7.3.4 may be used to monitor the license server.

If it is required to remove the service it is necessary to first stop the service:

Start > Control Panel > Administrative tools > Services
Locate rlm_v14-Zencrack. Right-click > Properties > Stop
The service should now stop.

Then from an elevated (i.e. 'Run as Administrator') command prompt window, after 'cd' to the installed RLM folder:

```
rlm -delete_service -service_name rlm_v14-Zencrack
```

#### 7.3.3.2 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 License Administration Manual.

### 7.3.4 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 set the address bar of your browser to port 5054 of the license server machine using the server name, IP address or, if accessing on the license server itself, using the value localhost. For example:

```
JUPITER:5054
```

```
192.168.1.10:5054
```

```
localhost:5054
```

For further information please refer to the RLM License Administration Manual.

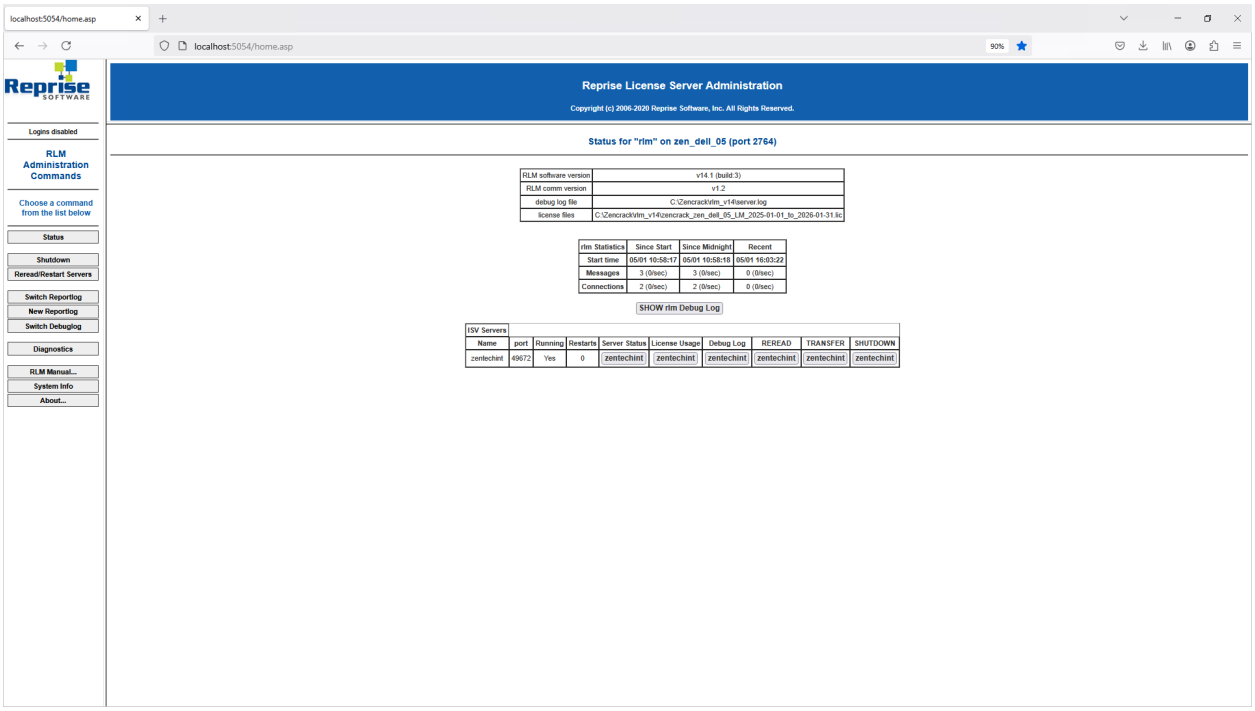



Figure 7.1: Typical license status screen after selecting 'Status' from the left side menu

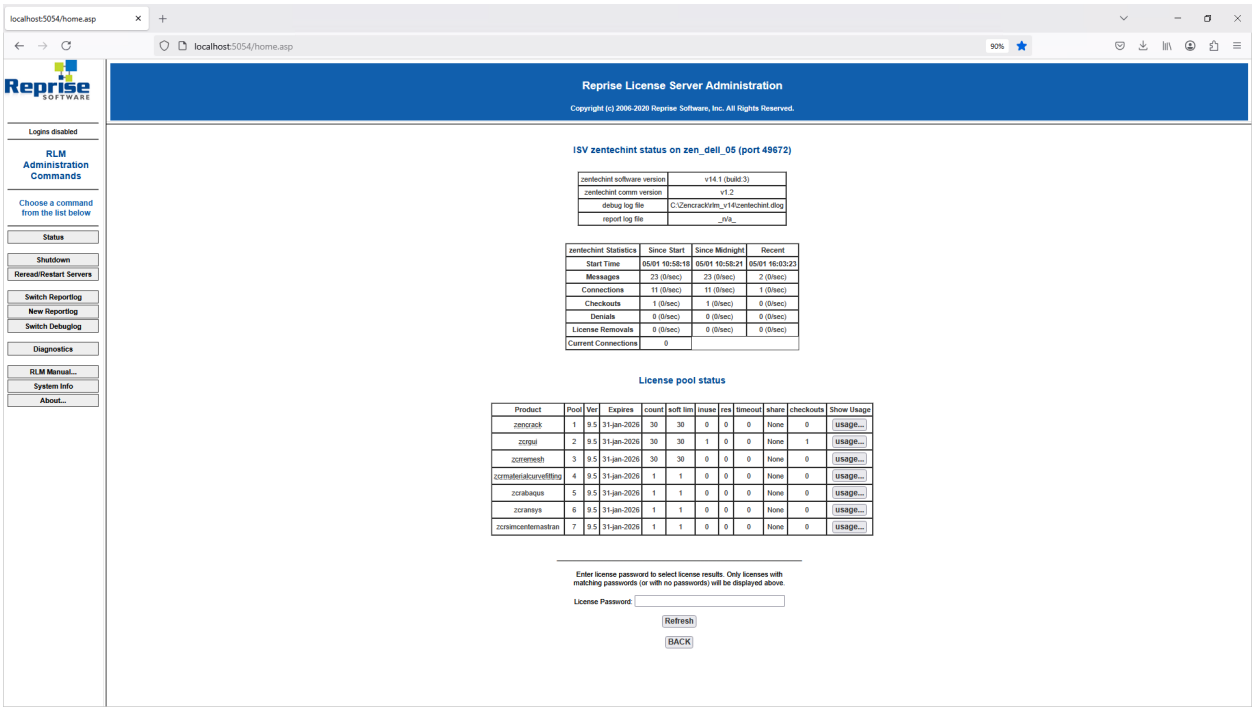



Figure 7.2: Typical server license status after selecting 'zentechint' from the Server Status of the main status screen

#### 7.3.4.1 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 7.3.4 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 Releasing locked licenses

Occasionally the license server may hold onto license tokens if a job ends in an unexpected system-related way, or there may be a need to forcibly remove a license that is in use. To release locked tokens:

- Select ‘Status’ from the left pane.
- In the server table select ‘zentechint’ in the ‘Server Status’ column. This shows a screen similar to the one in Figure 7.2.
- In the ‘License pool status’ table, click on ‘usage’ in a row which has non-zero checkout. This shows a screen similar to the one in Figure 7.3.
- Click on ‘Remove’ to release licenses.

Alternatively:

- Select ‘Status’ from the left pane.
- In the server table select ‘zentechint’ in the ‘License Usage’ column.
- Select Get License Usage on the next screen. This shows a screen similar to the one in Figure 7.3.
- Click on ‘Remove’ to release licenses.

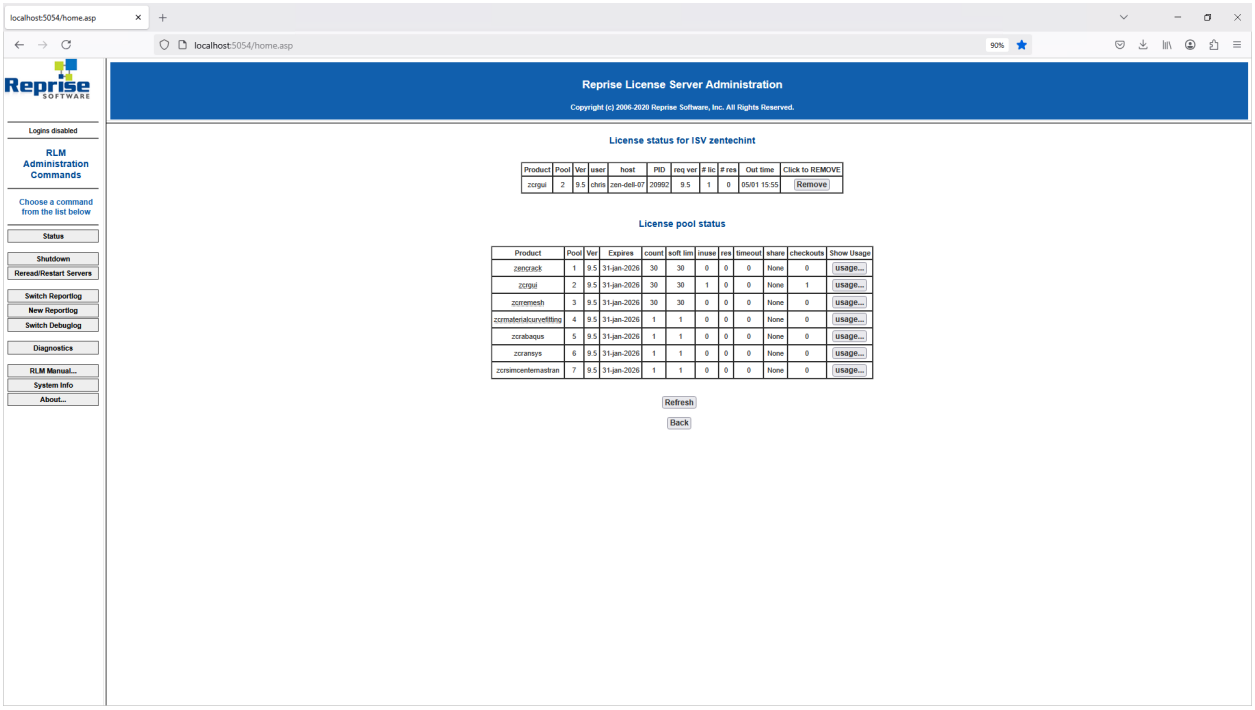



Figure 7.3: Typical server usage status

### 7.3.6 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 7.3.

### 7.3.7 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 file 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_LICENSE = NETWORK
```

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:

```
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.

```
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.

# 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 [5], T4eRexec.exe or T4eSSH.exe executables [6] 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 zencrack.ini 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 .\program\tools directory. 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_SIMCENTERNASTRAN_REMOTE =
ZCR_SIMCENTERNASTRAN_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:

```
runzcr95 -j jobname -r yes
```

ZCR_ABAQUS_REMOTE

This is analogous to 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 ZCR_ABAQUS_VER used for local execution. It defines the Abaqus version 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_ANSYS_REMOTE
: This is analogous to 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 ZCR_ANSYS_VER used for local execution. It defines the Ansys version 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_SIMCENTERNASTRAN_REMOTE
: This is analogous to ZCR_SIMCENTERNASTRAN used for local execution. It defines the location of the Simcenter Nastran executable on the remote machine.
This can be left blank if Simcenter Nastran is not available on the remote machine or if Simcenter Nastran is not a licensed interface for the Zencrack installation.

ZCR_SIMCENTERNASTRAN_VER_REMOTE
: This is analogous to ZCR_SIMCENTERNASTRAN_VER used for local execution. It defines the Simcenter Nastran version on the remote machine.
This can be left blank if Simcenter Nastran is not available on the remote machine or if Simcenter Nastran 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 username that is used to log into the remote machine.

LOGINPWD
: This is the password for username 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. |
| 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.<br>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. |

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.

A sample configuration for remote execution using T4eSSH may be:

```
ZCR_ABAQUS_REMOTE = /usr/SIMULIA/EstProducts/2020/linux_a64/code/bin/ABQLauncher
ZCR_ABAQUS_VER_REMOTE = 2020
ZCR_ANSYS_REMOTE = /ansys_inc/v211/ansys/bin/ansys211
ZCR_ANSYS_VER_REMOTE = 21.1
ZCR_SIMCENTERNASTRAN_REMOTE = /home/nxnastran/x86_64linuxl/nastran
ZCR_SIMCENTERNASTRAN_VER_REMOTE = 10.0
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 using plink may be:

```
ZCR_ABAQUS_REMOTE = /usr/SIMULIA/EstProducts/2020/linux_a64/code/bin/ABQLauncher
ZCR_ABAQUS_VER_REMOTE = 2020
ZCR_ANSYS_REMOTE = /ansys_inc/v211/ansys/bin/ansys211
ZCR_ANSYS_VER_REMOTE = 21.1
ZCR_SIMCENTERNASTRAN_REMOTE = /home/nxnastran/x86_64linuxl/nastran
ZCR_SIMCENTERNASTRAN_VER_REMOTE = 10.0
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 i.e.:

```
ZCR_LOGIN_EXTRA = -a 9999
```

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.:

```
runzcr95 -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.:

```
runzcr95 -j jobname -r yes
```

## 8.5 Limitations of the remote transfer capability

In the current implementation for Abaqus, the .odb file is always transferred from the remote machine if analysis results are extracted from the .odb file. The extraction of the results then takes place on the local machine. This requires that the same version of Abaqus be installed on the local machine as is on the remote machine. If this is not the case, the attempt to process the .odb file will generate an error message 'Error opening .odb file' on the screen and the analysis stops. In this situation the analysis must instead be set to extract results from the Abaqus .dat or .fil files (see parameter **RESULTS** on *ENERGY RELEASE RATE). In these cases there is no requirement for any Abaqus version to be installed on the local machine.

## References

[1] Reprise License Manage v14 from Reprise Software, Inc.
Website: https://reprisesoftware.com

[2] Abaqus, version 2025. Abaqus is a trademark of Dassault Systèmes Simulia Corp. (SIMULIA), Providence, Rhode Island, U.S.A.
Website: https://www.3ds.com/products-services/simulia

[3] Ansys, version 2025R1. Ansys is a trademark of SAS IP, Inc., a wholly owned subsidiary of Ansys Inc., Canonsburg, Pennsylvania, U.S.A.
Website: https://www.ansys.com

[4] Simcenter Nastran, version 2506. NASTRAN is a registered trademark of the National Aeronautics and Space Administration. Simcenter Nastran is an enhanced proprietary version developed and maintained by Siemens Product Lifecycle Management Software Inc.
Website: https://www.siemens.com

[5] PuTTY utility.
Website: https://www.chiark.greenend.org.uk/~sgtatham/putty

[6] Utilities from Tools4ever.
Website: https://www.tools4ever.com

# Zencrack

Version 9.5

Zencrack is proprietary software of Zentech International Limited.
Registered office:590B Finchley Road, London, NW11 7RX, U.K.
All documentation © Zentech International Limited.

E-mail: info@zentech.co.uk
On-line: https://zentech.co.uk/software/zencrack

ZENTECH