PERMAS for Education

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1. Introduction
   • What is PERMAS for Education?
   • Content of EDU Edition
   • Limits, Rules, Basics

2. How to get the EDU Edition?
   • Registration, Download, Installation, Manuals, Forum, First Usage

3. Demonstration
   • PERMASCC, PERMAS, VisPER, Wizards
     • PERMAS4EDU Tutorial with Meshing (Movie)
     • Topology Optimization
     • Contact Analysis
Introduction

• What is PERMAS for Education?
  • Essentially the same functionality as PERMAS, but some limitations to prevent commercial use.
  • VisPER → GUI to PERMAS, Pre- and Postprocessor

• Benefits
  • Available on Windows and Linux
  • Based on Version 18
  • Almost all modules are available
  • Ideal for self-study and further training
  • Access to Reference Manuals
  • Access to a multitude of application examples
  • Trying out new modules, e.g. TOPOlogy optimization and Shape OPTimization
  • Interfaces to Abaqus and NASTRAN for a seamless transition to PERMAS
  • Enhanced Python Interpreter → pyINTES
  • User Forums hosted at INTES and Researchgate for the exchange with other users
Limitations

- Max. Number of Nodes: ~16K
- Max. Number of DOFs: ~65K
- Max. Number of Elements: ~32K
- Max. Number of point/line elements (e.g. BECOS, SPRING, MASS): 100
- Max. Number of Excitation Frequencies: 500
- Max. Number of Time Steps: 1000
- Max. Number of Load Cases: 1000
- Max. Number of Nonlinear Results Steps: 100
• Python has become the programming language of choice for certain research and industry projects
• We are aware of this development and offer an own Python environment
• UCI USER section
  • CALL TOOL6 P1 = ‘pyINTES <myscript.py> ’
• Examples
  • EMA1 – Experimental Modal Analysis MAC matrix visualization, Excel export
  • MNL17 – Fiber Reinforced Wheel
• numpy
• scipy
• sympy
• Matplotlib
• scikit-image
• mplcursors
• meshio
• numpy-stl
• python-pptx
• python-docx
• Xlsxwriter
• ... many more
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Registration Process

www.intes.de/EDU

- Activate the checkbox, i.e. accept the conditions for PERMAS4EDU
- EULA is available in pdf format
- Activate the checkbox I'm not a robot
- Push the Send Request button
- Instructions by E-Mail how to proceed
- A link to the user forum

Mandatory
- First Name
- Last Name
- Valid E-Mail address

Optional
- Organization
- Address
- Country
Requirements on Windows

• Target CPU: INTEL EM64t/I64 or AMD Opteron / Athlon 64
• 64-bit
• Build OS: Windows 10
• Target OS: Windows 10
• Memory Limit: 8000 MB
• Required Windows packages:
  • pdf viewer e.g. foxit, sumatra, acrobat reader DC
• Optional : INTEL Fortran Compiler
Download & Installation on Windows

• According to the received E-mail download the 3 Windows installers, i.e.
  • INTES_EDU_Base_v18.00.NNN_windows-x64.exe (244 MB)
  • INTES_EDU_Py38_v18_YYYYMMDD_windows-x64.exe (472MB)
  • INTES_EDU_PermVis_v18.00.NNN_IFORT20_windows-x64.exe (134MB)

• Copy the received license file to the directory containing the downloaded installers.

• Now run the Base installer and follow the instructions, i.e.
  • INTES_EDU_Base_v18.00.NNN_windows-x64.exe

• Launch intesedu
  • Click on the PERMAS4EDU icon
Entire Installation Process on Windows

- Real time installation process
- Base Installer
- License agreement (00:13)
- Installation directory
- Scratch directory for database (quick access time, i.e. SSD)
- License agreement Miniconda (01:48)
- Installing PERMAS/VisPER EDU binaries (6:40)
- Installation finished (7:20)
Requirements on Linux

• Target CPU: INTEL EM64t/I64 or AMD Opteron / Athlon 64
• 64-bit
• Build OS: CentOS 7
• Target OS: **64-bit** Linux with GNU 8 compiler suite
  • glibc 2.18 and gfortran/gcc/g++ 8 based
• Memory Limit: 8000 MB
• Required Linux packages: zlib-devel, gfortran, g++, gcc, pdf viewer, e.g. okular, qpdfview, envince, xpdf
Download & Installation on Linux

• According to the received E-mail download the 3 Linux installers, i.e.
  • INTES_EDU_Base_v18.00.NNN_linux-x64.sh (185MB)
  • INTES_EDU_Py38_v18_YYYYMMDD_linux-x64.sh (569 MB)
  • INTES_EDU_PermVis_v18.00.NNN_M9g8_linux-x64.sh (129 MB)

• Copy the received license file to the directory containing the downloaded installers.

• Now run all 3 installers, beginning with the Base installer and follow the instructions, i.e.
  • bash INTES_EDU_Base_v18.00.NNN_linux-x64.sh
  • bash INTES_EDU_Py38_v18_YYYYMMDD_linux-x64.sh
  • bash INTES_EDU_PermVis_v18.00.NNN_M9g8_linux-x64.sh
Installation Directory

- Absolute path is needed, e.g. /home/edu/intesEDU
- Absolute path is needed for the license file
Manuals

- PERMAS for Education UM705_EDU_V18
- PERMAS User’s Reference Manual UM450_EDU_V18
- PERMAS Example’s Manual UM550_EDU_V18
- VisPER User’s Manual UM470_EDU_V18
- PERMAS Tools User’s Manual UM491_EDU_V18
- PERMAS on Unix: Installation Manual
• Exchange with other users
• [https://www.intes.de/forum](https://www.intes.de/forum)
• [https://www.researchgate.net/topic/PERMAS](https://www.researchgate.net/topic/PERMAS)
• Hotline support is not available for EDU users
First Usage

- PERMAS Control Center
- Settings
- Emacs Gold for *.dat
  VisPER Tab PERMAS CC(Edit)
- **Code handling**: automatic
  Highlighting using the
  Pygments highlighter
- Direct access to manuals
- Get Example
  - Linear Statics LS1
  - Edit UCI (F1 button)
  - Start PERMAS Job
  - Open with VisPER
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PERMAS Web Conference 2020, July 1
PERMAS for Education - info@intes.de
Handling of STL Files in VisPER

- Raw, unstructured triangulated surface
- Support of ASCII format
- Binary format can be converted to ASCII format by using numpy-stl (Part of pyINTES)
- Direct import in VisPER
- Alternatively, READ STL FILE = geom1.stl within INPUT section of *.uci
- Remeshing is usually necessary due to poor element quality
- Volume meshing is supported in VisPER by an interface to netgen

Mesh *.dat ; STL; other FEM Formats, e.g. *.inp, *.bdf, *.unv

- Modeling (VisPER Pre)
- Solver (PERMAS)
- Postprocessing (VisPER Post)
Patch Meshing & Design Wizard

- VisPER tutorial: edu1
- Element quality PLOTA3
- PatchMeshing Tool
- Average Edge length: 5mm
- Edges are retained during remeshing
- Check element quality again
- Design Wizard
- Create Tet Mesh
- Check element quality TET4
- Export New Items
TOPO+LS+BA

Model Description

Objective function

\[ m = \int \rho \, dV = \sum_{i=1}^{n} \rho_i V_i \]  

(1)

Two Constraints

- STATIC

\[ K u = f, \quad c^T u \geq u_j \]  

(2)

- BUCKLING ANALYSIS MODES = 1 SIGN = POSITIVE

\[ K_\sigma(x) = \lambda K x, \quad s = -\frac{1}{\lambda}, \quad s \geq s \]  

(3)

https://iopscience.iop.org/article/10.1088/1757-899X/531/1/012082

26 x 52 QUAD4 elements
SPCs at corner nodes
Unit force applied
Material: Aluminum
R = 3000 mm
h = 260 mm
s = 520 mm
t = 2 mm
PERMAS is controlled by a stream of commands submitted by the User Control Interface (UCI)

! See PERMAS Examples manual "um550.pdf" for more informations.
!
! REQUEST MODULES = DA; LS; MOA; TOPO
!
NEW
INPUT
    READ PERMAS FILE = topo13_model.dat
    READ PERMAS FILE = topo13_topo.dat
RETURN
    TASK LOOPS = 80
EXEC
    ACT SIT = STATIC
    STATIC
    ACT SIT = BUCKLING
    BUCKLING ANALYSIS MODES = 1 SIGN = POSITIVE
    ACT SIT = TOPO
    TOPO METHOD = ACP
EXPORT
    ITEM CLEAR
    ITEM EFRATIO
    GO PERMAS BINARY FILE = topo13_efratio
TASK END
EXPORT
    ITEM CLEAR
    ITEM EFRATIO
    GO PERMAS BINARY FILE = topo13_efratio
EXPORT
    ITEM CLEAR
    ITEM XYDATA TYPE = SRHIS
    GO PERMAS ASCII FILE = topo13_tracking
    ITEM CLEAR
    ITEM XYDATA TYPE = OHIS
    ITEM XYDATA TYPE = OHIS
    ITEM XYDATA TYPE = ORHIS
    GO PERMAS ASCII FILE = topo13_histories
    ACT SIT = BUCKLING
    GO PERMAS FILE = topo13_modes
STOP

- Subsequent Steps in 3 Videos
  - PERMAS Control Center
  - How to get examples
  - Model completion
  - Export New Items
  - Launch modified TOPO13
- Postprocessing of TOPO results
  - xy-data by PERMASGraph
  - Objective Function HIStory
  - Relative Constraint HIStory (Possible violations?)
  - Evolution of Element Filling RATIOS by VisPER
  - Derive Data → Data Combination → ITEM EFRATIO
Model Completion by Wizards

- Wizard concept in VisPER
- User-friendly, guided way to create additional data
- Machine generated data
- Less error prone

- TOPO Situation
- Design element
- Initial filling ratio
- Lower and Upper Bounds
- Exponent for SIMP method
- Manufacturing Conditions
- Design variable filter
- Constraints
- Optimization Target
- Export New Items

SIMP : Solid Isotropic Material with Penalisation
• PERMAS CC
• Get Example TOPO13
• Edit UCI
• New Export section within TASK LOOP for intermediate results
• Run TOPO13
• Logfile output
Post-Processing of TOPO Results

- Postprocessing
- Import of selected results
- Permasgraph for xy-data
- Interpreting results
- VisPER
- Derive data
- Data combination
- Animation
Q&A

• Many thanks to my colleagues from the development department. Without them PERMAS4EDU wouldn’t exist.

• Feedback is welcome!

• Are you curious to use PERMAS4EDU?

• Don’t hesitate to contact us at any time → info@intes.de

• Follow our YouTube Channel

• Follow us on LinkedIn
Demo: Contact Analysis

• Based on example CA6
  • Pretension Wizard
  • CA-Wizard: CA-Check
  • Load History-Assistant: Editing
  • Postprocessing: Displacement, CA-Results
PERMAS4EDU

- Essentially the same functionality as PERMAS/VisPER
- Ideal for self-study and further training
- User Forums available
- Complete solution from mesh to postprocessing

- Free for noncommercial use
- Registration necessary: www.intes.de/EDU

- Available July 02, 2020 (tomorrow)
Thank You!
• Feel free to ask!
• Do you need more information about PERMAS: info@intes.de