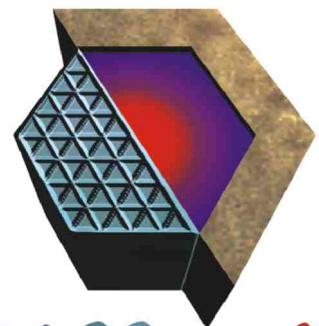


Closing the gap™

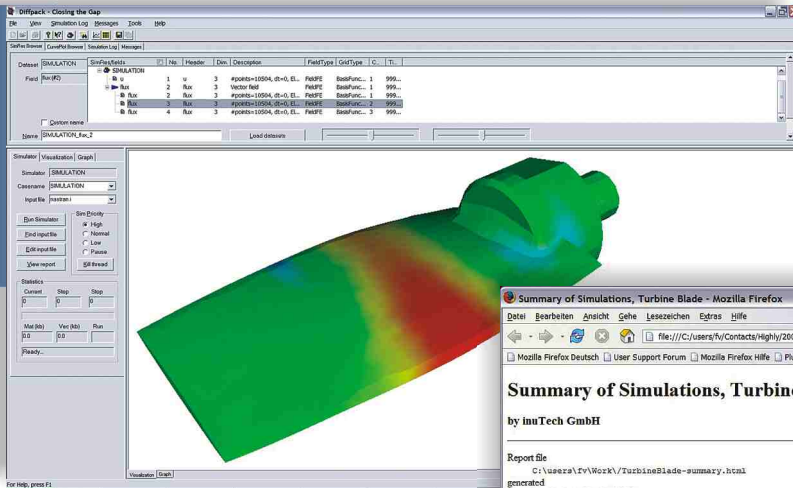
Dynamic tools designed to maximize your problem-solving abilities



Diffpack

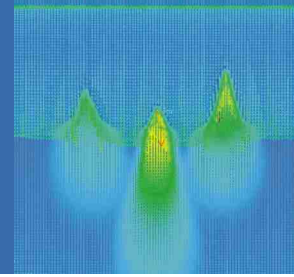
*inu*Tech

“Two-phase flow with hot spots saturation of the solutes and temperature distribution in a chemical reactor”

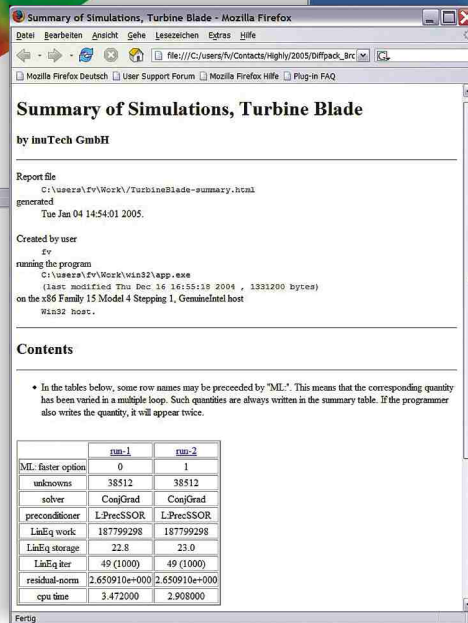


“Diffpack enables me to use the computer as an artists' canvas to try out my new ideas.”

William J. Bosl, Stanford University



“Heat conduction application with standard GUI, interactive visualization and web-aware result report”



“Diffpack unleashes the flexibility of object-oriented programming without sacrificing computational efficiency.”

“Diffpack means safer codes, shorter development cycles and reduced costs - it means more power and elegance, and more fun!”

Linkable Libraries

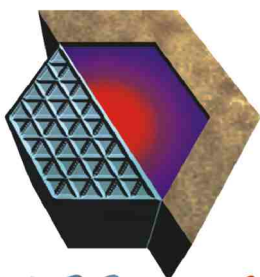
The Diffpack C++ libraries contain a wide selection of interchangeable and application-oriented components. The object-oriented design supports your abstractions and provides flexibility to address the full range of mathematical models. For you this means:

- an entry point closer to the solution of your specific problem
- power to construct full-scale industrial simulators
- an open door when your usual end-user application hits the wall
- the perfect platform for developing something really new and innovative

Development Framework

With Diffpack you are free to concentrate 100% on the numerics. By adding a couple of statements you release the Diffpack application GUI giving full interactive control of your simulator:

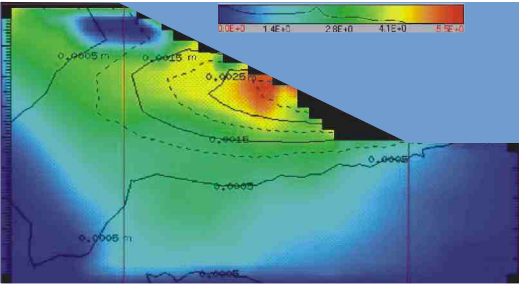
- state-of-the-art interactive graphics
- input editor and data export filters
- interactive choice of numerical methods, e.g. equation solvers, convergence monitors and finite element methods
- on-line browsing of HTML-based result reports
- monitoring of simulator output and error messages
- control over multiple threads



Diffpack

“A decade of focused research has made inuTech able to help clients ...”

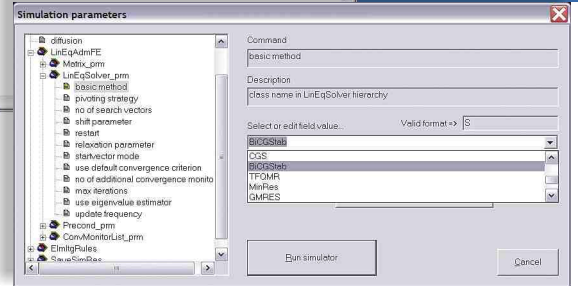
“Coupled hydro-mechanical simulation in porous media - movements at a mountainside due to the increase of the water table (courtesy of Colenco Power Engineering, Switzerland)”



```

galerkin.1 - Editor
Datei Bearbeiten Format Ansicht ?
set V parameters = 10 0
sub LinEqAdmFE
  sub Matrix_prm
    set matrix type = MatSparse
    set symmetric storage = false
    set pivoting allowed = false
    set threshold value = -1
    set reordering algorithm = 1
  ok
  sub LinEqSolver_prm
    set basic method = BicGStab
    set max iterations = 300
  ok
  sub Precond_prm
    set preconditioning type = [RILU & SSOR]
    set RILU relaxation parameter = 0.0
    set (SSOR) relaxation parameter = 1.0
    set inner steps = 1
  ok
  sub ConvMonitorList_prm
    sub Define ConvMonitor #1
      set #1: convergence monitor name = CMRelResidual
      set #1: residual type = ORIGINAL_RES
      set #1: convergence tolerance = 1.0e-6
      set #1: norm type = L2
      set #1: monitor mode = ON
      set #1: run time plot = OFF
      set #1: criterion mode = ON
      set #1: append at end of list = ON
      set #1: relational operator = CM_AND
      set #1: use spectral scaling = OFF
      set #1: relative to rhs = ON
      set #1: user base = 1.0
    ok
  ok
  ! activate reordering algorithm
  ! quit submenu matrix storage formats
  ! submenu for linear solvers
  ! choose the BicGStab Solver
  ! set maximum number of iterations
  ! leave submenu linear solvers
  ! enter preconditioner submenu
  ! multiple loop over RILU & SSOR preconditioning:
  ! perform two runs: One with RILU and the second
  ! one with SSOR preconditioner.
  ! choose RILU relaxation parameter
  ! choose (SSOR) relaxation parameter
  ! leave preconditioner submenu
  ! enter submenu for stop criteria
  ! stop criterion no. 1
  ! check convergence based on rel. residual
  ! eps
  ! quit the ConvMonitorList_prm submenu
  ! enter submenu for integration rules
  ! gauss quadrature 2. order
  !
ok
sub ElIntgRules
set integration point type = GAUSS_POINTS
set relative quadrature order = 2
set smoothing average type = ARITHMETIC
set basis for Moving LS smoothing = MultiLinPolyn
ok
sub SaveSimRes
set time points for plot = ALL
set time1: start = NONE
set time1: stop = NONE
set time2: resolution = 31
set time2: start = NONE
set time2: stop = NONE
  
```

“Pop-up menu system and command input file”



Today's Generation of Simulation Software

“Diffpack reduces error situations, minimizes debugging and lets you construct logical and readable codes.”

Functionality

The Diffpack libraries are layered and contain the building blocks you need to efficiently construct customized applications:

BASIC TOOLS

Low level numerical and non-numerical utilities

LINEAR ALGEBRA

Comprehensive set of tools for linear and non-linear algebraic equations

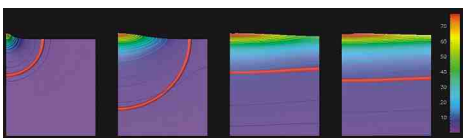
PDE FUNCTIONALITY

Interchangeable components for meshes, fields, elements, FEM, FDM algorithms, etc.

EXTENSIVE DOCUMENTATION

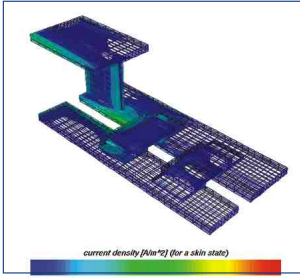
User's Guide on Springer-Verlag, reports, scientific papers, Internet documentation and broad selection of application examples.

“Black hole simulation in computational astronomy - transition from black hole to black string in 5 dimensional spacetime domain. (courtesy of Matt Anderson, Louisiana State University)”

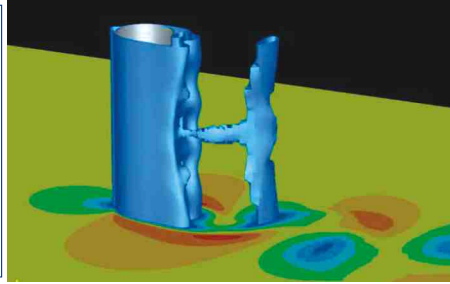


... maximize their problem-solving abilities, closing the gap between the perfect solutions and the best ideas”

“Transient electromagnetic simulation of an interconnect structure-current distribution at a skin effect state”



“Viscous 3D flow around a cylinder (Courtesy of SINTEF, Applied Mathematics)”



“I am very satisfied with Diffpack - it has improved my productivity dramatically.”

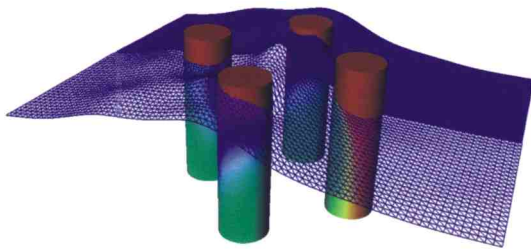
Engelbert Tjiskens,
Katholieke Universiteit Leuven

In a market survey,
9 out of 10
respondents stated:
“Diffpack is an
appropriate tool for
PDE problems in my
organization”.

Sample Applications

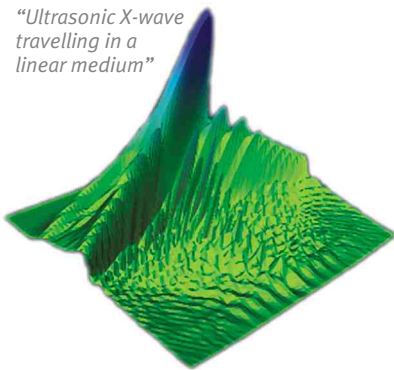
Diffpack is a stable and well proven software covering a wide range of application fields. Diffpack may very well be used to solve traditional engineering PDE problems; however, it is typical for current customers that they use Diffpack to solve special problems that can be characterized as “non-standard” and outside the mainstream engineering areas. Such problems often occur in pure research contexts or in the context of problems involving a variety of mutually dependent physical effects. Diffpack has no inherent restrictions on the types of PDEs that can be solved. For instance, Diffpack has been used to implement simulators for:

- The Laplace, Poisson, Helmholtz, Maxwell, heat and wave equations
- Stefan problems in heat transfer
- Newtonian fluid flow
- Hele-Shaw non-newtonian fluid flow
- Metal solidification
- Linear/non-linear elasticity
- Elasto-plastic models
- Elasto-viscoplastic models
- Thermo-elasto-viscoplastic models
- Fiber spinning
- Control of continuous systems
- Lubrication, elasto-hydrodynamic contact
- Compositional models for chemical reactors
- Electrical activity in the human heart
- Pennes Bioheat equation (treatment planning for MI energy-based cancer therapies)
- Computational astronomy (Einstein equation)
- Solid oxide fuel cells
- Stochastic advection
- Stochastic groundwaterflow
- Fluid-structure interaction
- Sound in flowing media (acoustic/fluid coupling)
- Random vibrations of structures
- Stability estimates for reservoir models
- Welding
- Direct chill casting of alloys
- Continuous casting
- Aluminium extrusion
- Computational finance
- Fully nonlinear 3D water waves
- Water wave power plant design
- Weakly dispersive/non-linear water waves
- Geological basin modeling
- Transient electromagnetics
- Hydro-mechanics in porous media
- Multi-phase flow in oil reservoir
- Semiconductor modeling

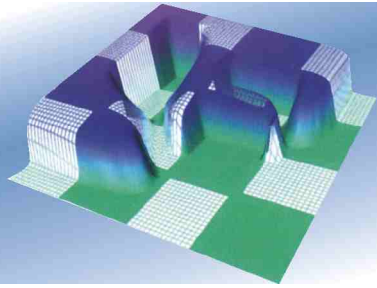


Wave impact on offshore oil platforms

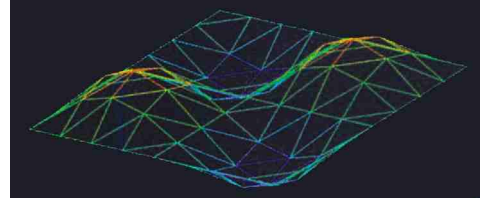
“Ultrasonic X-wave travelling in a linear medium”



"Parallel two-phase
oil reservoir simulation
on 16 processors"

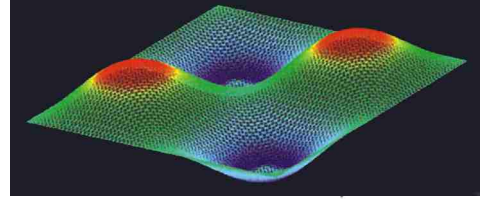
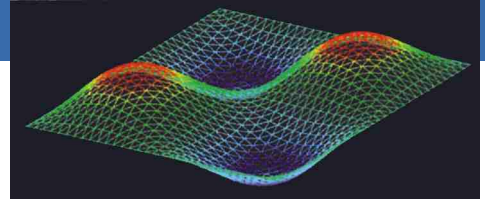
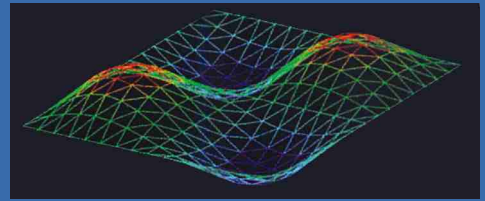


Multigrid solution of a PDE



" I suspect there is little you cannot do with this
package in the field of numerical modeling"

J. More, *Linux Journal*



Today's Project Demands

"The Diffpack Toolboxes
plug in the power you need
to address the most
challenging problems in
science and engineering."

Adaptivity Toolbox

State-of-the-art functionality for adaptive mesh construction. Flexible criteria for mesh refinements. Benefits are vast performance improvements and increased accuracy.

Parallel Computing Toolboxes I & II

Revolutionary software technology for parallel computing. Without extra work, it plugs in to transform any Diffpack application to a full powered parallel code.

Toolbox I: parallelization on linear algebra level.

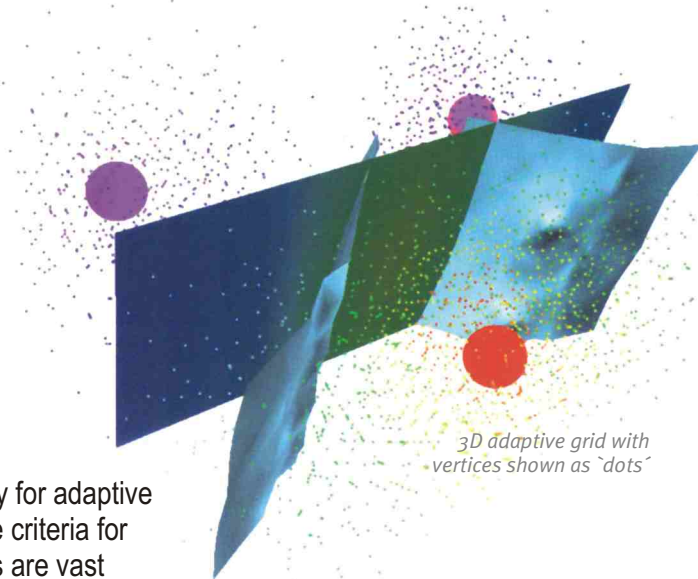
Toolbox II: parallelization by domain decomposition (additive Schwarz technique)

Multilevel Toolbox

Iterative linear solvers with optimal performance characteristics. Use as pre-conditioners or directly as solvers. Facilitates latest developments in multigrid and domain decomposition theory.

Datafilter Toolbox

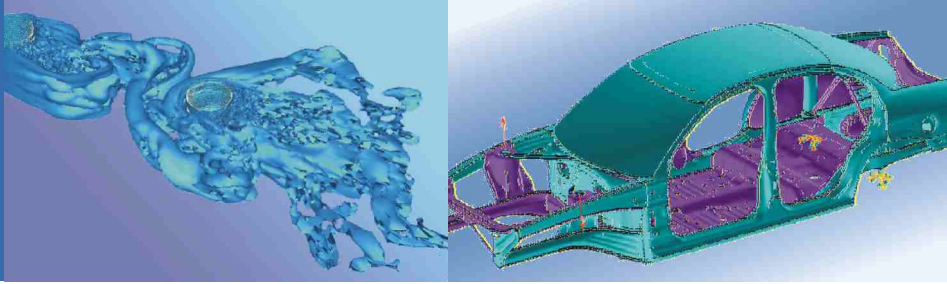
Easy and safe import of third party computational meshes. Use as stand alone file-to-file converters or as integral part of application.



3D adaptive grid with
vertices shown as "dots"

maximize their problem-solving abilities, closing the gap between the perfect solutions and the best ideas"

*“Large-eddy simulation of flow around two objects
in a tandem arrangement
(Courtesy of SINTEF, Applied Mathematics)”*



inuTech

inuTech - Innovative Numerical Technologies

inuTech develops and markets the Diffpack Product Line for numerical modeling and simulation. Our team consists of innovative and highly qualified employees, possessing many years of research and development experience in the area of mathematical and numerical modeling with PDEs, optimization, optimal control, etc. ... Our extensive experience in R&D as well as our intensive cooperation with industry and with scientific institutions always ensure innovative and practical relevant solutions.

Diffpack is complementary to Main-Stream Analysis

Diffpack is a problem-solving environment designed to provide maximum modelling flexibility for construction of highly customized FEM solvers. For users of FEM-applications like ANSYS, CFX, FLUENT, NASTRAN, ABAQUS, LS-DYNA, etc. ... Diffpack offers a complementary approach which can give significant benefits for solving problems with special model features.

Diffpack is used world-wide

There are hundreds of customers in more than 30 countries worldwide, including major industrial enterprises, consulting companies, software vendors, and research institutes. Among Diffpack customers are industrial and academic leaders such as Bosch, Cambridge, Canon, CEA, Cornell, DaimlerChrysler, Furukawa, Intel, Mitsubishi, Natexis Banque, NASA, Nestlé, Shell, Siemens, Stanford, Statoil, Petrobras, Veritas, and XEROX, just to mention a few. The customer activities span from simple prototype applications to projects involving several man-years of simulator development.

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www.diffpack.com

“Export Tools for Expert Problems”

“The Diffpack product line is available on Windows and all major Unix platforms, including HP, IBM, Sun, SGI, and Linux. © Copyright by inuTech GmbH. All rights reserved.”

