

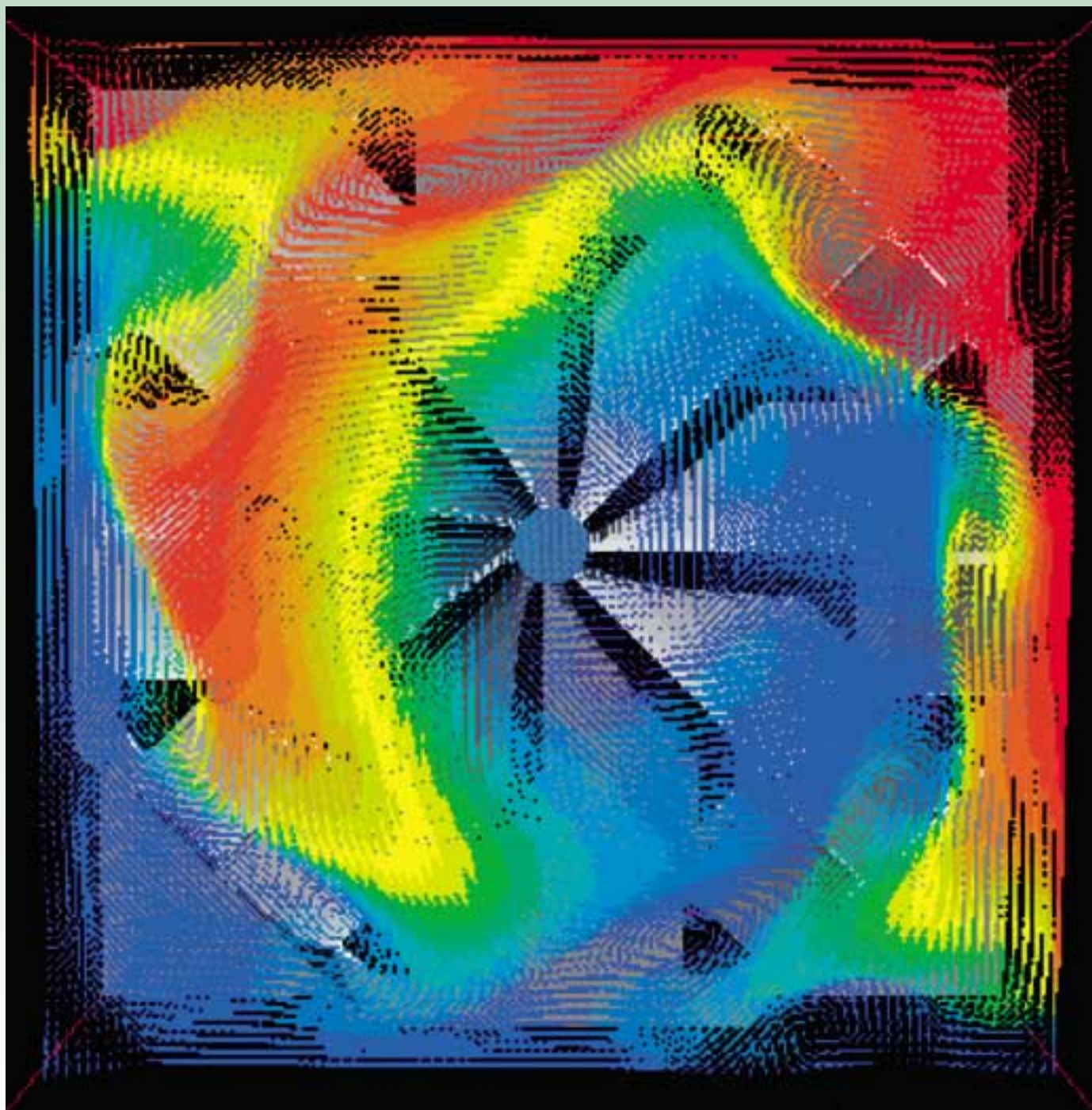
# PHOENICS

## news



CHAM

January 2000

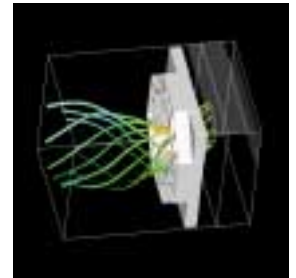


NEWS FROM THE WORLD OF COMPUTATIONAL FLUID DYNAMICS

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**Above & Front Cover:**  
 Head on view of mixing of hot and cold air through end and side vents behind an air blending vane.  
**Below:** Streamlines - side view.  
 Pictures courtesy of Air Blender Inc, Colorado, USA.



### CHAM-UK

Bakery House  
 40 High Street, Wimbledon Village,  
 London, SW19 5AU, UK.  
 Tel / Fax: +44 208 947 7651 / +44 208 879 3497  
 Email: [phoenics@cham.co.uk](mailto:phoenics@cham.co.uk) / [sales@cham.co.uk](mailto:sales@cham.co.uk)  
 Web: <http://www.cham.co.uk>  
**Managing Director**  
 Professor D Brian Spalding / Email: [dbs@cham.co.uk](mailto:dbs@cham.co.uk)

### CHAM-Japan

406 Kojimachi Inteligent Bldg 4F,  
 3-5-4 Kojimachi, Chiyoda-ku,  
 Tokyo 102, Japan.  
 Tel / Fax: +81 (0) 352 10 93 56 / +81 (0) 352 10 53 59  
 Email: [info@phoenics.co.jp](mailto:info@phoenics.co.jp) / [customer@phoenics.co.jp](mailto:customer@phoenics.co.jp)  
 Web: <http://www.phoenics.co.jp>  
**General Manager**  
 Mr Z Kong / Email: [cham-j@phoenics.co.jp](mailto:cham-j@phoenics.co.jp)

### CHAM-MEI

Science-Service-Center (SSC)  
 Moscow Power Engineering Institute,  
 14 Krasnokazamennaya Street,  
 111250 Moscow, Russia.  
 Tel / Fax: +7(0) 95 362 6821 / +7(0) 95 918 1469  
**General Director**  
 Dr Alexey Ginevsky / Email: [alex@mons.mei.msk.ru](mailto:alex@mons.mei.msk.ru)

**ACADS-BSG**, Glen Iris, Victoria, Australia  
 Tel / Fax: +61 398 85 65 86 / +61 398 85 59 74

**ACFDA**, Montreal, Canada  
 Tel / Fax: +1 416 978 6727 / +1 416 978 8605

**ACT2000**, Seoul, Korea  
 Tel / Fax: +82 2 3412 7729 / +82 2 3412 7730

**Arcofluid**, Aix En Provence, France  
 Tel / Fax: +33 442 27 36 61 / +33 442 27 36 64

**ATOS**, Essen, Germany  
 Tel / Fax: +49 201 810 1927 / +49 201 810 1955

**C-DAC**, Bangalore, India  
 Tel / Fax: +91 080 558 4271 / +91 080 558 4893

**CHAM Shanghai**, Shanghai, China  
 Tel / Fax: +86 21 649 56833 / +86 21 648 36584

**Chemtech**, Rio de Janeiro, Brazil  
 Tel / Fax: +55 215 32 31 84 / +55 212 62 31 21

**CRC Research**, Tokyo, Japan  
 Tel / Fax: +81 356 34 58 33 / +81 356 34 73 37

**Cybron Technology**, Selangor, Malaysia  
 Tel / Fax: +60 3 793 6920 / +60 3 793 6984

**Flow Consult**, Vøyenenga, Norway  
 Tel / Fax: +47 67 15 07 00 / +47 67 15 07 55

**GEM Systems**, Espoo, Finland  
 Tel / Fax: +358 94 52 28 13 / +358 94 59 47 80

**Partment Technology**, Taipei, Taiwan  
 Tel / Fax: +886 2 2708 1277 / +886 2 2755 3747

**Sybillia**, Athens, Greece  
 Tel / Fax: +30 1 614 1244 / +30 1 614 1245

**Vortex De Mexico**, Tlaltan, Mexico  
 Tel / Fax: +52 5 622 3320 / +52 5 616 2164

# Remote Computing Service Commences

An opportunity to "Test Drive" the latest release of PHOENICS

The prototype Remote Computing Service (RCS) is now available for access by CHAM's customers.

CHAM has dedicated a four-processor system to permit access to PHOENICS via CHAM's web site (<http://www.cham.co.uk>). CHAM clients are encouraged to "test drive" the latest release of the code for themselves using this, presently, free service, and to report their experiences to the RCS supervisor, Dr John Heritage (email: [jrh@cham.co.uk](mailto:jrh@cham.co.uk)).

At Present, the service is restricted to an "EARTH only" facility, with the pre- and post-processor handled on clients' own local machines. In due course, the VR-Editor and VR-Viewer will be operational via the web.

The RCS is the precursor to the full Internet service to be launched by Simuserve Limited, as a partial consequence of the 3-year EU-funded 'Adelfi' initiative (A model for

Deployment of high-performance solutions on Internet/Intranets).

In due course, Simuserve will enlarge CHAM's simulation services by enabling computations to be performed with software other than PHOENICS, and at computer centres other than CHAM.



For more information about Simuserve, contact Mrs Frith Hooton, General Manager, Simuserve Ltd & Administrative Officer EU Projects, email: [fmh@cham.co.uk](mailto:fmh@cham.co.uk).

## STOP PRESS! STOP PRESS! STOP PRESS! STOP PRESS!

### USA and German Contact Changes

CHAM (USA) is relocating - Details will be advised shortly. During the interim, all US clients are advised to contact CHAM (UK), as follows:

General Inquiries: Dr J Z Wu, email: [jzw@cham.co.uk](mailto:jzw@cham.co.uk)  
24Hr Technical Support Hotline: +44 78 7968 8697  
Support Inquiries: Dr M R Malin, email: [support@cham.co.uk](mailto:support@cham.co.uk)  
Maintenance/upgrade queries: Mrs M J Lyle, email: [ml@cham.co.uk](mailto:ml@cham.co.uk)

### New contact points for German clients:

Drs M Megahed and H Mindt are moving from Atos to PDV, but will continue to provide technical support services for PHOENICS from their new address, as follows: PDV GmbH, Harpener Feld 14, D-44805 Bochum, Germany  
Tel (Megahed): +49 234 / 95 93 252, Tel (Mindt): +49 234 / 95 93 213  
Fax: +49 234 / 95 93 255

New contact points at Atos GmbH will be announced shortly. In case of doubt, contact CHAM (UK).

## Shareware moves from strength to strength

Since its re-instatement last May, Shareware (1999) has generated over 1,800 new PHOENICS users world-wide. Congratulations to the Shareware Download Team.

PHOENICS Shareware is available with 5 levels of power, namely:-

**Level 1** - FREE - Non-recompilable PHOENICS 1.5 plus version 2 VR & POLIS

**Level 2** - US\$99 - As above, with 2-phase, BFC's & PHOTON

**Level 3** - US\$199 - As above, with access to open source (user-programmable)

**Level 4** - US\$499 - As above, with basic "PLANT" facility

**Level 5** - US\$999 - As above, with super "PLANT" facility (which has more flow modelling capabilities than most commercially available CFD packages!)

For more information about Shareware, access CHAM's web site: <http://www.cham.co.uk/shareware>, or contact the Shareware Download Team via email: [shareware@cham.co.uk](mailto:shareware@cham.co.uk)

## The PHOENICS Journal

is a quarterly publication to promote and exchange knowledge and skills amongst PHOENICS user world-wide. Data input files and FORTRAN routines, for GROUNDstation implementation, are published alongside mathematical models and computational results. Contributions to the journal are subject to review by independent referees.

Price: £140 per year (UK)  
£165/\$265 (Elsewhere).

Journal Manager: Mrs Sylvie Stevens



To subscribe to the PHOENICS Journal, please provide full details to: Joan Garretty, CHAM Librarian, via email: [library@cham.co.uk](mailto:library@cham.co.uk). Payment by Visa/Mastercard accepted.

# Announcing GeoGrid-CSI

## A new interactive preprocessing system for PHOENICS-3.3

**GeoGrid-CSI, a new preprocessing software system developed by Computational Sciences, is now available for use with PHOENICS. GeoGrid-CSI provides an integrated environment for model construction, BFC mesh generation, boundary condition assignment, and automated Q1 file generation.**

GeoGrid-CSI is an interactive, graphically oriented software system which integrates all facilities required for the development and introduction of BFC models into the PHOENICS analysis environment. GeoGrid-CSI employs the latest in graphical user interface design concepts and interactive computer graphics which are seamlessly integrated with sophisticated geometric tool kits, a CAD interface, and grid generation facilities. The software also features a customized linkage to PHOENICS via the Virtual Reality (VR) interface.

The GeoGrid-CSI interface design is very intuitive as it employs a sophisticated menuing system which is context sensitive - it displays only those controls pertinent to the operation at hand. All user interaction is mouse driven and requires no mastery of a separate command language.

Sophisticated, yet easy to use, geometric tool kits permit the construction of arbitrary configurations. An assortment of visualization and construction aids further facilitate the development of the geometric model. GeoGrid-CSI also supports the direct import of CAD model

data via IGES into the modeling environment. A filtering facility based upon entity levels permits effortless identification of those surfaces which are to be imported. Selected surface entities are then automatically introduced into the database as though they had been created internally, and the geometric tool kits may then be used to correct deficiencies within the model and create the remainder of the computational domain. The CAD tool kit also supports the use of trimmed surfaces.

Surface and volume meshing tool kits within the software automatically key off the connectivity between geometric objects thereby facilitating the mesh generation effort. All local adjustments made to the mesh are propagated automatically throughout the domain to maintain well-connected and dimensionally consistent grid blocks. GeoGrid-CSI simplifies the construction of body conforming grids for complex configurations thereby increasing user productivity while

simultaneously expanding the versatility of the PHOENICS solver.

GeoGrid-CSI also provides for the interactive assignment of flow field boundary conditions directly upon the model itself via the mouse - it's a purely visual "point and click" operation which

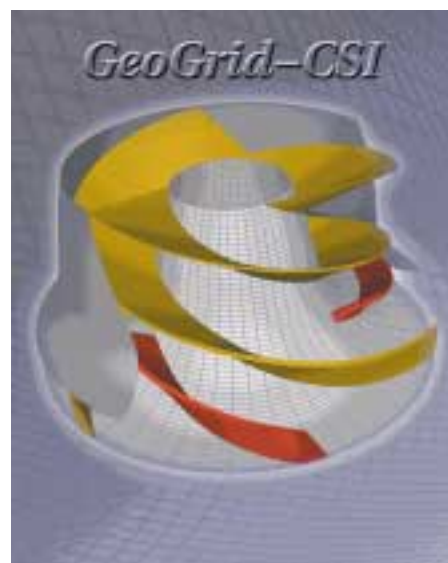
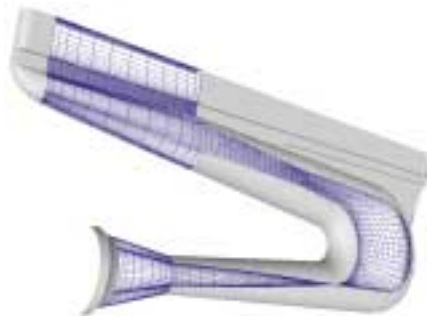
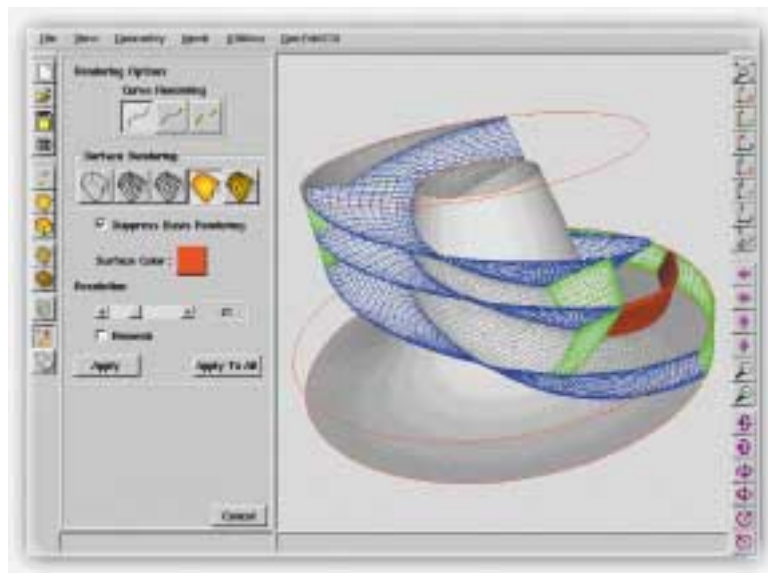
does not require knowledge of the specific grid indices or the coordinate system orientation; these details are transparently handled by the software.

The boundary condition types which may be specified correspond exactly with those used within PHOENICS, and both surface and volumetric boundary condition types may be prescribed. Customized rendering shows all prescribed boundary conditions graphically.

After all boundary conditions have been placed, a single operation

writes the multi-block mesh files in the proper format with the required layer of cells automatically attached at interfaces. GeoGrid-CSI also transparently generates the corresponding Q1 file which contains all required model commands describing boundary condition placement, and all block-block interface locations along with the relative orientations of the adjacent blocks; laborious hand editing of this data file is no longer required. The mesh and Q1 files can then be immediately imported directly into VR where resident facilities permit the assignment of the remaining attributes as required by PHOENICS for each of the boundary conditions displayed.

GeoGrid-CSI is now available for Windows 95/98/NT, Linux, and IRIX.



*"Preprocessing Made Simple"  
Computational Sciences Inc*

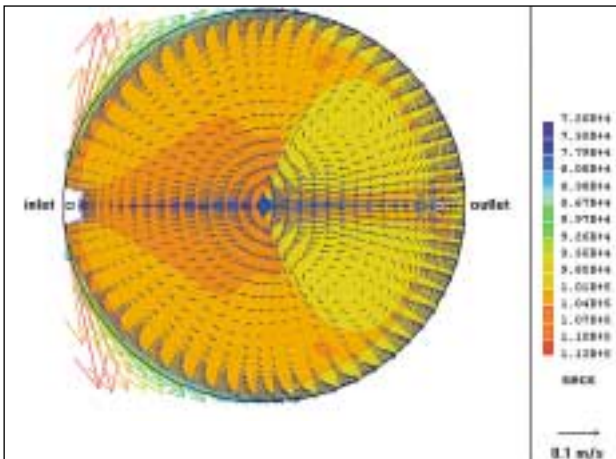
**For further information contact Lee Kania, email: [kania@csi-cfd.com](mailto:kania@csi-cfd.com) to request a product brochure and introductory CD. Visit CSI's web site at <http://www.csi-cfd.com> for additional information and free evaluation software.**

# Improving Drinking Water Quality

Flowsolve and Massey University suggest improvements to reservoir design using PHOENICS simulations

**Quality of the drinking water supply is a prime requirement for every water supplier.**

Water quality can be adversely affected by a poor flow pattern in a reservoir; for instance if there are any significant stagnant zones or short-circuiting pathways. CFD has the potential to provide valuable design insight into the hydraulics of reservoirs, but applications of CFD in this field are still relatively rare.



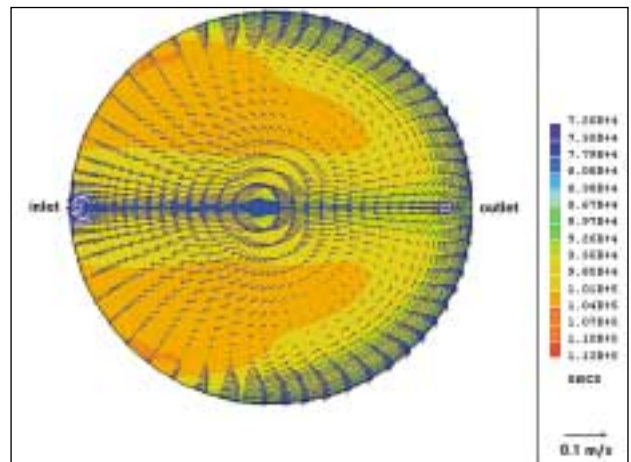
*Residence times & velocities at outlet height*

New Plymouth District Council have acted as pioneers in New Zealand by commissioning Massey University and Flowsolve Ltd to perform CFD studies of their new potable water storage reservoir at Inglewood, Taranaki.

The water inlet is from a bellmouth entry just above maximum water level. Water cascading down from this sets up a complex

three-dimensional flow pattern in the reservoir which is simulated by the model. Quality can be assessed from contour plots of mean residence time, together with a hydraulic residence-time distribution profile at the outlet, the latter being generated from a transient simulation of the motion of a virtual tracer.

The height of the outlet is determined by the requirement to maintain some water in the reservoir in the event of pipe rupture due to earthquake. Within this constraint, the exact location of the outlet could be changed, and a number of simulations were carried out to optimise the hydraulic performance of the reservoir. Valuable new insights were derived from the study.



*Residence times & velocities at surface*

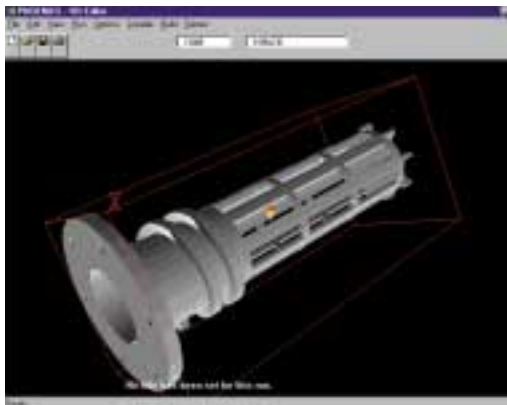
Andrew Shilton, Massey University, email: [a.n.shilton@massey.ac.nz](mailto:a.n.shilton@massey.ac.nz)  
Dr David R Glynn, Flowsolve Ltd, email: [cfid@flowsolve.com](mailto:cfid@flowsolve.com)

## Diet CADfix?

IGES-to-STL PHOENICS Wizard from FECS Ltd

**The ability of PHOENICS to read STL and DXF format files directly within its VR environment has been greatly enhanced by the appearance of CADfix from FECS Ltd.**

Now, a low-cost sub-set of the powerful CAD import and repair facilities within CADfix-Pro is available. Called CADfix-Lite, it permits the automatic conversion of IGES format files into the STL style most readily accepted by PHOENICS-VR.



*IGES file converted to STL format through CADfix-Lite*

Further details of the full CADfix-Pro product range can be found by searching the FECS web site: <http://www.fecs.co.uk> or contact CHAM's Sales Dept

email: [sales@cham.co.uk](mailto:sales@cham.co.uk) for a brochure.

PHOENICS customers need only pay £500 for the CADfix-Lite IGES-to-STL or IGES-to-DXF facility, which is 100% repaid when purchasing a licence of CADfix-Pro.

## YEAR 2000 COMPLIANCE STATEMENT

This is to certify that the PHOENICS software version 3.2 & 3.3 have been tested and neither their performance nor their functionality has been adversely affected by the Millennium date change.

Concentration, Heat and Momentum Limited guarantees that any PHOENICS version from 3.1 or later will be Year 2000 compliant, but any version earlier than 3.1 is not guaranteed to be compliant.

Any queries regarding Year 2000 compliance can be addressed to:

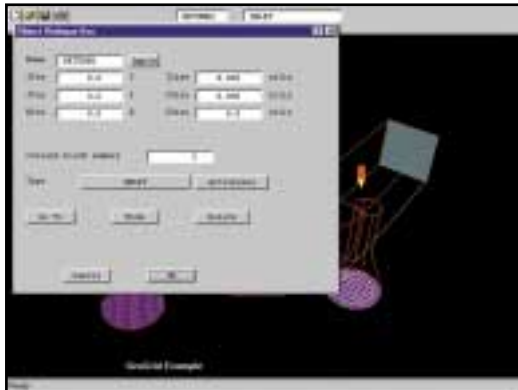
Dr Jeremy Z Wu, email: [jzw@cham.co.uk](mailto:jzw@cham.co.uk)

# What's New in PHOENICS-3.3?

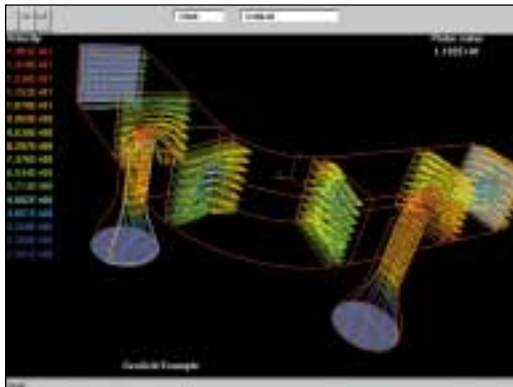
Dr John Ludwig reports on some of the improvements to the VR-Editor and VR-Viewer

This article comprises extracts from the Web Site entry entitled "What's New In PHOENICS-3.3-VR".

In PHOENICS 3.3, Body-Fitted-Co-ordinates (BFCs) are available within the VR environment. The VR-Editor can make the necessary boundary-condition settings, and the VR-Viewer can display the solutions.



VR-Editor - Boundary Condition Settings



VR-Viewer Display

## Mesh Generation

Although PHOENICS-VR does not itself possess any BFC mesh generation capability, BFC meshes generated outside PHOENICS-VR can be imported.

The possible methods of mesh generation are:

- External mesh generator, such as:-
  - GeoGrid from Computational Sciences Inc.
  - ICEM-CFD from ICEM CFD Engineering
  - FEMGV from FEMSYS Ltd.
- Grid Generation Menu in the PHOENICS Satellite General Menu.
- PIL Commands hand-edited into Q1.

The preferred method is via GeoGrid from CSI. This option is integrated within PHOENICS-VR.

All BFC library cases, and all user-generated BFC cases can now be loaded into PHOENICS-VR.

## Object Creation

Apart from the differences noted below, objects are created and manipulated, and have the same attributes as in Cartesian and Polar co-ordinates.

## Object Position and Size

The object position is given in terms of the I,J,K cell corner used as the origin of the object. The object size is given in terms of the number of cells occupied in each (grid) co-ordinate direction.

## Object Duplication

When an object is duplicated, a new object occupying the same number of cells as the original is created at the origin of the block containing the original.

## Object Arraying

When an object or group is arrayed, the Pitch specifies the number of cells between origins.

## Default Cliparts

Objects take on the shape of the cells they occupy.

Colours are attributed to objects on the basis of their type.

## Results Viewing

Apart from the differences noted below, the VR-Viewer operates as it does for Cartesian and Polar grids.

## Vector and Contour Slices

The Slice Direction X/Y/Z buttons now refer to the I, J and K grid co-ordinate directions, and not to the Cartesian space directions.

In a multi-block case, the contours and vectors are drawn for the block which contains the probe. If plots are required from more than one block at a time, the Create Slice button can be used to store the current slice. The probe can be moved to the next block, another slice created, and so on until the entire picture has been built up. The contour and vector display in the saved slices always follows that of the current slice.

## Streamlines

Streamlines can only be started at cell centres, because the probe only moves from cell-centre to cell-centre.

## The Virtual Reality Editor

The Reset Default Data button on the File menu has been replaced with Start New Case, which leads to a list of available Special Purpose Products.

The Edit button on the top menu bar now contains the items Domain attributes, Object attributes, Find object, and Editor parameters.

- Domain attributes leads to the Main menu.
- Object attributes leads to the Object dialog box of the currently-selected object.
- Find object brings up a list of objects, and makes the chosen object the current object.
- Editor parameters allows the snap size and geometry scaling factors to be set.



VR-Editor - Specifying Outlet conditions

Autoplot has been added to the Run menu. GeoGrid has been added to the Run menu.

The top menu bar now has a Help button, which leads directly to the PHOENICS on-line documentation.

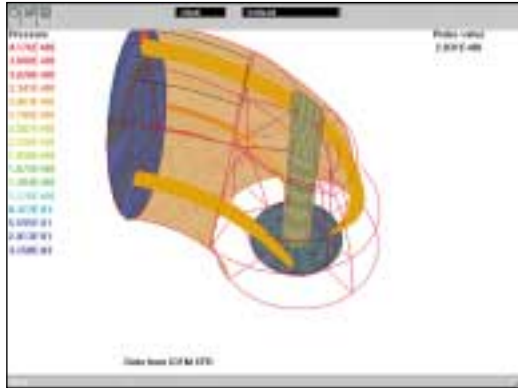
The object-visibility attribute is now saved to Q1. Once an object is hidden, it remains hidden until the user displays it again.

The Hide and show toggle now has a right-mouse-button function, which allows all objects of a given type to be displayed or hidden.

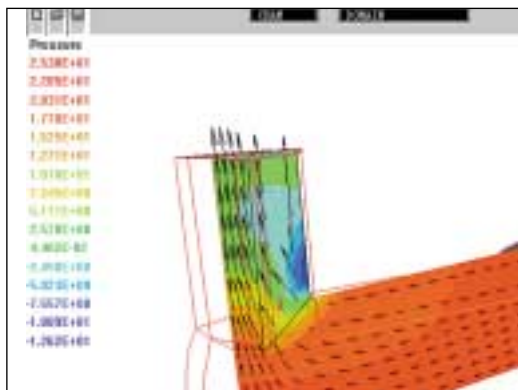
# What's New in PHOENICS-3.3?

## Continued

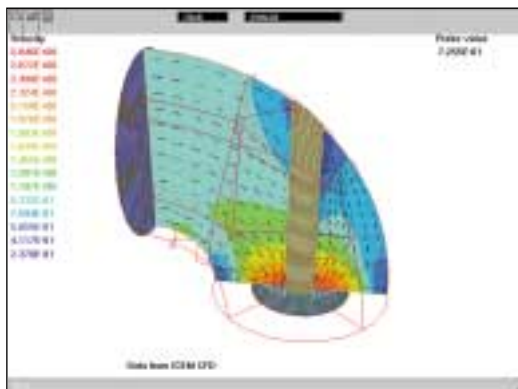
The Help entries accessed by clicking on the ? in the top-right of the window title bar, then clicking on the desired button or data entry field have been extended to the lower-level dialog boxes. In PHOENICS 3.2 only the top-level dialog boxes had help entries.



Streamlines within Intake Duct



Pressure contours in T-junction example



Velocity contours within Intake Duct

## Object Creation Dialog Box

There are now strict checks on duplicate object names. All object names are upper-cased before use. If a duplicate object name is entered, the user can choose to modify the existing object of that name, or enter another name.

The 'Cancel' button now fully undoes all actions taken in all dialog boxes below the main object dialog box.

The default objects for Inlet, Outlet and Fan have been changed to be transparent.

The default objects used in cylindrical-polar co-ordinates have been modified to use the same colours as Cartesian and Body-Fitted co-ordinates.

## Rotation Dialog Box

The three rotation angles, alpha, beta and theta are now real numbers with values

in the range -360 -> +360. Previously they were integers in the range 0 -> 359.

## PCB dialog Box

The default material is Epoxy, but all other materials are now allowed.

The non-isotropic conductivity feature can now be used to make a domain material 'thermal bridge' between two solid objects.

## Pressure-Relief Object Dialog Box

The pressure-relief object is forced to occupy a single cell, closest to the origin, and the pressure coefficient is defaulted to 1000. In Version 3.2, the user had to take great care that the object used was neither so small that it would be ignored, nor much bigger than the nearest cell. Also, the default coefficient was only set when the Attributes dialog box was visited.

## The Data-Input Menu

More detailed changes have been made 'below the surface' of the Main Menu. Many of these are the result of error-correction, or additional protection against conflicting settings or repeated changes of options.

## The Virtual-Reality Viewer

The view and object-visibility settings are now taken more accurately from the VR-Editor. Objects hidden in the VR-Editor remain hidden.

The stream-line algorithm has been improved, so that streamlines do not end unexpectedly, or in some cases never appear. The Delete streamlines and Delete slices buttons now allow a choice of Delete last or Delete all. A streamline or slice created inadvertently can thus be removed without losing the previous elements. The iso-surface is no longer drawn inside blockages for variables which have no meaningful value there (e.g. pressure inside a solid). The iso-surface value can be toggled between the probe value, and a user-specified value.

In a two-phase case, vector and streamline plotting can be switched between the phases. If temperature is stored, then Select Temperature will get the temperature of the current phase.

In multi-block BFC case, VR-Viewer displays results for the block containing the probe. As the probe is moved from block to block, so the display slice follows it. To build up a composite picture from several blocks, the slices in each block can be saved.

Dr John Ludwig, email: [jcl@cham.co.uk](mailto:jcl@cham.co.uk)

## OTHER IMPROVEMENTS IN PHOENICS-3.3

Of course, not all of the changes to PHOENICS-3.3 have taken place in the VR environment. Major improvements, also outlined on the web include:

- The PLANT Menu Utility - a feature originally introduced to enhance the PHOENICS Shareware product has been attached to the commercial version and upgraded to become an extremely powerful model-generation tool (see page 10).
- Input-file-library improvements - a new library system has been introduced.
- MUSES - the MUltiply-SharEd Space procedure.
- HOTBOX - more improvements in respect of VR, physical models and library examples.
- FLAIR - also upgraded to the latest VR environment.
- SAFIR - a new Special-Purpose Product (SPP) for blast furnaces.
- TUNDISH - revitalising the long-established TUNDISH model.
- VWT - the embryonic Virtual Wind Tunnel.
- RCS - the Remote Computing Service (see page 3 - Simuserve & ADELFI). The RCS is now up and running and, for the time being, FREE. Several systems can be accessed via the RCS, mostly running PHOENICS-3.2. At present, guinea pigs for PHOENICS-3.3 have to select the "ADELFI 1" system only.
- Radiation / Chemistry - improvements to the radiative-heat-transfer model and the multi-fluid model of turbulence.

Information on the above subject, and more, can be accessed via: <http://www.cham.co.uk/website/news/whatsnew.htm>

# PHOENICS Aids the Design of Auto-expansion Circuit Breakers

A Study by the University of Liverpool

The performance of a new generation of circuit breakers, the auto-expansion circuit breakers, is determined by many inter-related design parameters.

Traditional development method heavily relies upon full-power short-circuit tests, which are extremely costly and time-consuming.

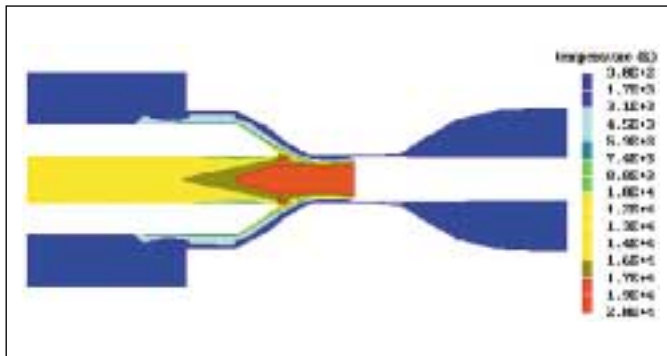


Fig. 1 SF6 arc (temperature field) in a model auto-expansion circuit breaker at high current (18.6kA).

For an auto-expansion breaker, the designer cannot even predict the qualitative trend of the effects of changing one design parameter. The main difficulty lies with the behaviour of the arc, which is formed between the two contacts of the breaker.

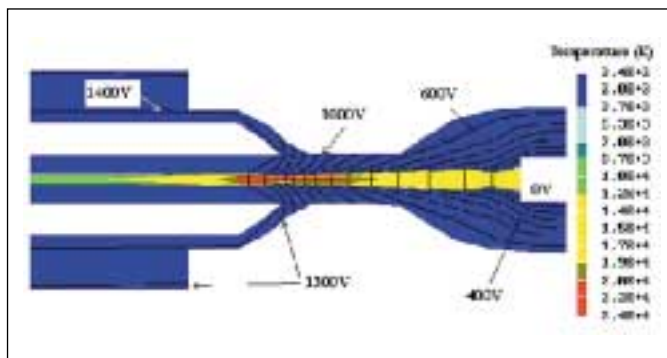


Fig. 2 Temperature field and equi-potential contours at low current (2.5kA). The arc voltage is 1420V.

Advancement of our understanding of the basic physical

processes in arcs in gas flow and the rapid development of computer technology have made computer simulation of the operation of an auto-expansion circuit breaker a reality.

The general-purpose CFD package, PHOENICS, has been proven to be effective for incorporating arc physics into the gas conservation equations. Radiation transport, radiation induced wall ablation, turbulence enhanced momentum and energy transport, the electromagnetic forces, the presence of shocks, and the moving parts of the breaker are fully taken into account. The PC based PHOENICS gives detailed mapping of temperature and velocity fields as well as the electric and magnetic fields. The effects of changing design parameters can be simulated in detail,

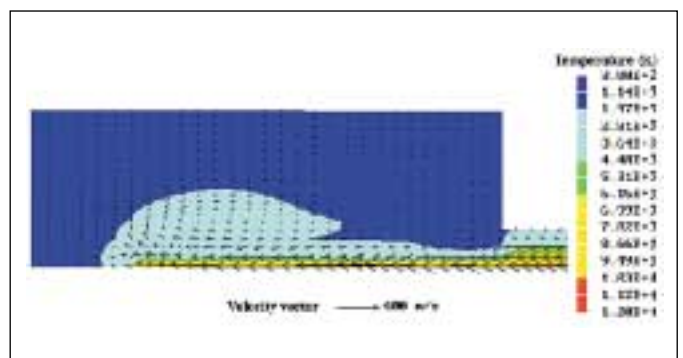


Fig. 3 Flow and temperature field inside the storage volume of the breaker at 20kA.

thus greatly reducing the development cost and time.

The development of PC based PHOENICS as a design tool for SF6 circuit breakers has been an on-going co-operation since 1992 between Liverpool University and VA Tech Reyrolle. At Liverpool, the work has been financially supported by Reyrolle and is under the direction of Professor Michael Fang.

Arc research has for many years been supported by EPSRC. The PC based PHOENICS has been used at Reyrolle design office and the computer simulated results were verified by test results.

Dr J D Yan, Dept of Electrical Engineering & Electronics  
University of Liverpool, UK

Email: [yaneee@liverpool.ac.uk](mailto:yaneee@liverpool.ac.uk)

## PHOENICS AWARD

The 1999 PHOENICS prize for the best CFD project of the year at the University of Hertfordshire, has been awarded to Mr Gavin Hall.

Gavin joined the University in October 1995 to study a degree course in Aerospace Engineering. During the third year of his course, he undertook an industrial placement at British Aerospace Airbus in Broughton, near Chester.

During his placement he learnt a considerable amount about the design and manufacture of aircraft wings. This experience became invaluable during his final year as he took on the responsibility of Wing Design in the Aerospace Engineering Group Design Project to design a 1000 seat aircraft

He chose a final year major project, supervised by Dr Ken Hart, to investigate the flow behaviour of oil in the sump of a turboprop aircraft gearbox. This work is the first attempt to look at the way in which oil flows are drawn through the sump towards the scavenge pump inlets. This will help to optimise the design of the sump geometry and positioning of

magnetic chip detectors to improve pilot awareness of any ferritic particles being shed by a deteriorating gearbox.

Further investigations are planned to investigate the more realistic gearbox environment, in particular, the influence of local, high speed rotating components and the presence of air/oil mixtures fed by high velocity oil splash.

Gavin was awarded a First Class Honours degree in Aerospace Engineering at the University of Hertfordshire graduation ceremony in November 1999, and will take up employment with Rolls Royce plc in Derby in the near future.

Further information can be obtained from:-

Dr Arne E Holdo, Reader in Fluid Dynamics, CFD Group, Faculty of Engineering & Information Science, University of Hertfordshire, Hatfield, HERTS AL10 9AB. Email: [a.e.holdo@herts.ac.uk](mailto:a.e.holdo@herts.ac.uk)

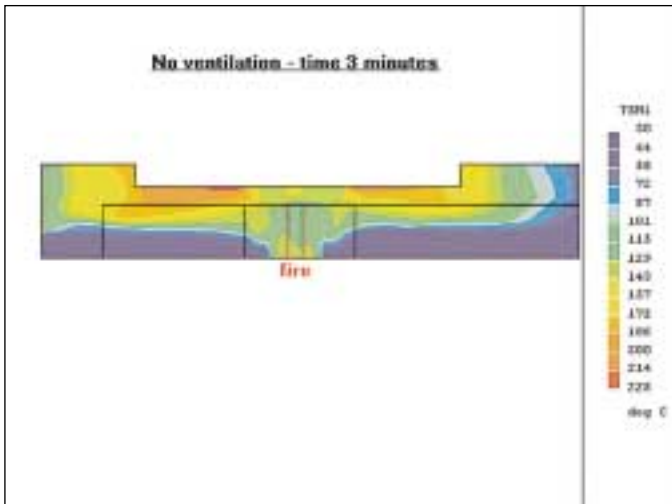


# Assisting Underground Railway Safety

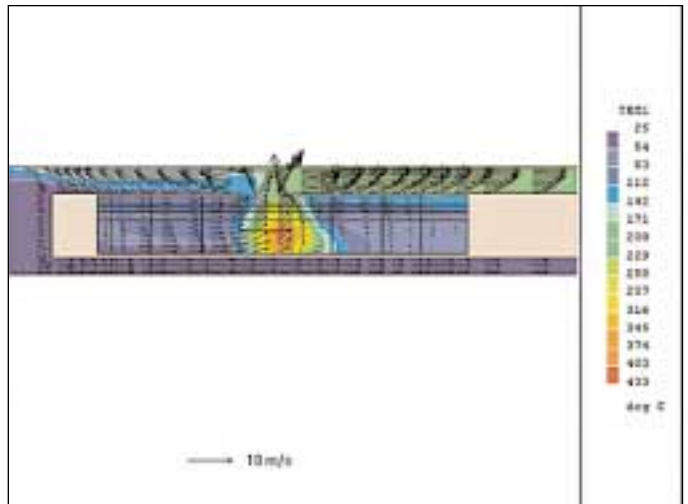
Flowsolve and D'Appolonia report on a fire-safety study using PHOENICS

Following the disastrous fire at Kings Cross Underground station several years ago, and the more recent fire in the Channel Tunnel, transport authorities are acutely aware of the need for providing means for evacuation and escape for passengers in the event of a fire in an underground train or station.

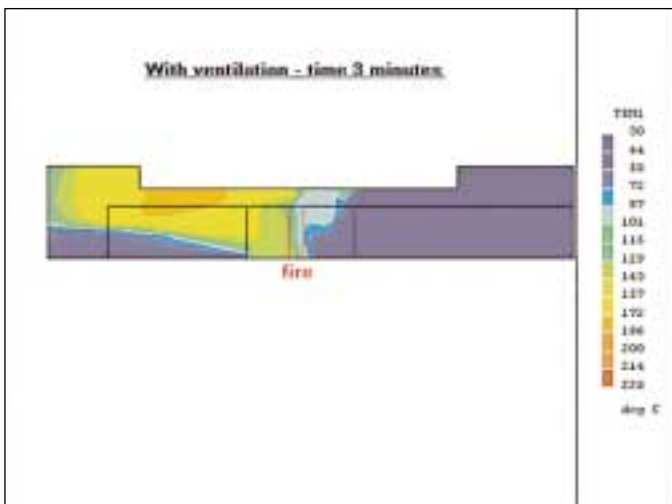
based consultants Flowsolve Ltd assisted D'Appolonia SpA of Genova in the simulation of a number of train-fire scenarios in tunnels and stations on the system, to confirm the adequacy of these new ventilation arrangements. The study was managed by STA, Societa Transporti Automobilistici SpA, on behalf of the Municipality of Rome, VII Department.



Temperatures on section along platform (vertical scale x3)



Temperatures on centre plane of burning carriage



Temperatures on section along platform (vertical scale x3)

The Rome underground railway system is upgrading the ventilation arrangements on one of its lines in the interests of passenger safety in the event of fire. On detection of a fire, emergency fan procedures are activated to increase the ventilating air blown along the relevant tunnels, with the aim of providing fresh air to passenger escape routes. PHOENICS-

Scenarios considered included simulations of fires originating on trains in sub-surface and in deep-bored tunnels and stations. Each fire was simulated as a heat source, increasing to several megawatts and subsequently decaying, located within the burning carriage. The model simulated the development of the fire plume within the carriage, the egress of hot air and smoke out of the doors and, subsequently, the escape of the hot air through the roof when the latter collapses. The collapse of the roof causes the fire plume to extend into the upper part of the tunnel. In some cases this substantially modified the local ventilation pattern, with the cold fresh air being forced below the hot plume, creating a pressure disturbance which propagated at a speed comparable with the speed of the forced ventilation air.

The various scenarios considered featured different smoke extraction arrangements, the efficiency of which could be determined as an outcome of the model simulations. A particular feature of the predictions was that for the deep-bored station roof-level smoke extraction was very efficient in removing the drifting hot air and smoke before this could cause problems for escape.

Dr David R Glynn, Flowsolve Ltd, email: [cfd@flowsolve.com](mailto:cfd@flowsolve.com)



**flowsolve Ltd**

Tel: +44-181-944-0940, Fax: +44-181-944-1218,

Email: [cfd@flowsolve.com](mailto:cfd@flowsolve.com), Web <http://www.flowsolve.com>

# "PLANT" becomes menu-driven

by Dr Sergei Zhubrin

**PHOENICS 3.3 includes a new user-friendly front end for the "PLANT" problem definition facility, a menu-driven PHOENICS Expression Language (PEL).**

This will enable users to incorporate complex physical models quickly and reliably, as well as defining property relationships, boundary conditions, arbitrary sources formulations etc., all from within a front end menu.

With the previous PLANT option, when creating new functions, PHOENICS users have had to resort to Q1 settings made in PEL. To do so effectively the user may need to learn the PEL syntax and number of rules how to implement the settings. Menu-driven PEL avoids all of that and makes it really easy for engineers to write the intended expression with logical and relational conditions.

Users will be guided through specific menus (see figures below) by context help advice and warnings, ensuring that the expression is that which the engineer intended.

This will enable users to model complex chemistry, turbulence interactions, or to specify specific non-linear boundary conditions, sources and sinks using the number of menu-selected functions of the solved and stored variables purely through the menu operations.

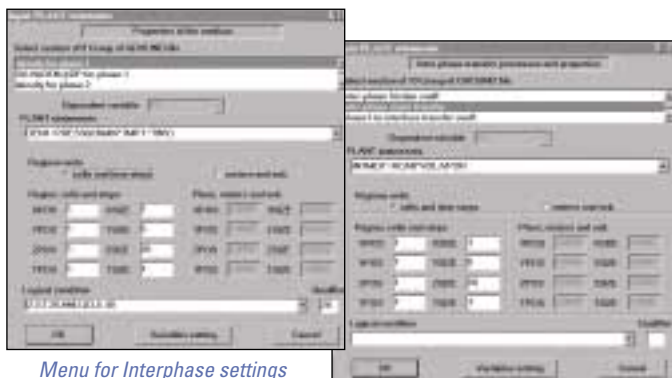
The following pictures show the main PLANT menu which lists the functions available and displays the PLANT settings of current Q1 file.



Main PLANT menu

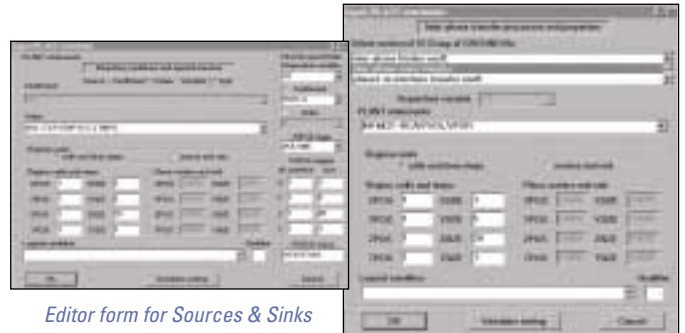
The example of regional, conditional settings for the calculations of variable HSUB at the end of Z-slab is shown next.

Dr Sergei Zhubrin, email: [svz@cham.co.uk](mailto:svz@cham.co.uk)



Menu for Interphase settings

Property Editor Form



Editor form for Sources & Sinks

Conditional Settings

## International PHOENICS User Conference

Luxembourg, 17-20 May, 2000

**The programme for the International PHOENICS Users Conference has now been finalised, though, since the programme is flexible, space can be made for last minute contributors.**

The event will include papers from PHOENICS Users throughout the world. Representation will be made by users from as far afield as Australia, India, USA, Canada and South America, plus a large European contingent.

The programme runs from Wednesday to Saturday inclusive, for those wishing to take advantage of lower cost flights with a Saturday night stayover.

The venue is the luxurious modern Inter-Continental Hotel in Luxembourg. The 4-day schedule involves the presentation of



Poolside View

technical papers in seven sessions with the afternoon of Day 4 reserved for an Open Forum Session. Alongside the conference itself, there will be exhibits, workshops and demonstrations from CHAM personnel and complementary third party software and hardware vendors. As

well as the latest developments in PHOENICS, CHAM will be demonstrating its parallel configuration, and remote computing via Simuserve.

Participants travelling from the UK will be able to join a 53-seater CHAM coach to/from Luxembourg, but reserve your place ASAP as space will be limited. The coach will leave on the afternoon of 16th May and return late evening on 20th. There will be a mid-week Conference Dinner at a location in the interesting "Grund" section deep in Old Luxembourg. Partners and friends are invited to this social gathering.

Presenters are encouraged to send the final script of their papers to the Conference Organiser, Mrs S K Stevens as soon as possible; email: [sks894460@aol.com](mailto:sks894460@aol.com). Use the same address to receive details of the finalised programme, travel/hotel information, and booking forms.

# CFD Modelling of an Air Autogenous Mill

Dr Nicolas Agnew reports on recent work undertaken by Gilmore Engineers, Brisbane

**Gilmore Engineers has recently been involved in a fluid dynamics analysis of an air autogenous mill (AAM) used for mineral assaying, gold recovery, and mineral sands processing. The work was conducted through the Queensland based Technology Diffusion Centre.**

Gilmore Engineers is a mechanical engineering consultancy based in Brisbane, Queensland, Australia, specialising in Research and Development of New Products, Failure Analysis, Technical Project Management and Product Commercialisation ([www.uq.net.au/gileng/](http://www.uq.net.au/gileng/))

Martin Rayner, a former computer engineer and inventor, designed the air-based grinding machine after becoming frustrated crushing ore at his Warwick gold mine in rural Australia with limited water and electricity supplies.

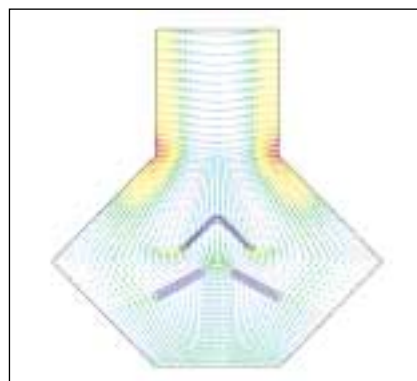


*Air Autogenous Mill*

The patented air autogenous mill has a long development history, and has been assessed both by the Commonwealth Scientific and Industrial Research Organisation (CSIRO) and recently at the Julius Kruttschnitt Mineral Research Centre, Brisbane Australia. The device utilises autogenous breakage through inter-particle collisions to optimally shape rock and sand particles. Traditional impact methods including hammer mills tend to shatter and misform the particles. Without any additional classification, the 100 kg/h prototype AAM has demonstrated the capability of reducing 25mm feed material to a powder of mostly less than 75µm sized particles.

Although the key to the operation of the mill had always been assumed to be the air flow characteristics inside the machine, this had never been characterised or quantified for a complete understanding of the process. Such an understanding was regarded as crucial before any further commercial up-scaling of the AAM prototype was undertaken.

Gilmore Engineers initially undertook an experimental study of the AAM involving digitisation of the geometry, and pitot static pressure measurements at various fan speeds. This data was used to generate a CFD model with realistic boundary conditions. The CFD code PHOENICS (v3.1) was used on a four processor Silicon Graphics minicomputer located at the Queensland Manufacturing Institute. Parallel CFD benchmarking of the mill is intended to be undertaken on a 64 processor Silicon Graphics supercomputer located at The University of Queensland, in the near future.



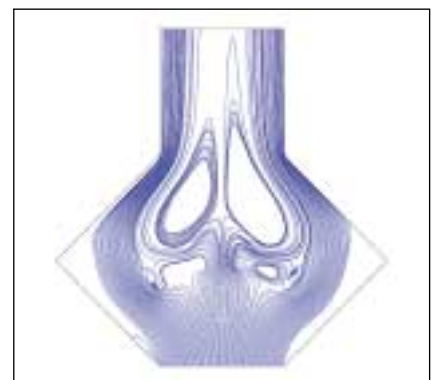
*Velocities within autogenous zone*

In most cases CFD runs of at least 15 hours were required for models to converge.

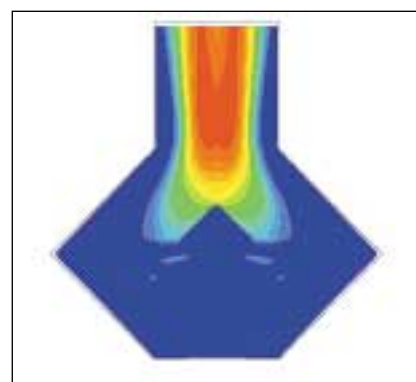
The CFD modelling results demonstrated areas of recirculation, high air velocity and turbulence that were most likely responsible for the efficient autogenous breakage mechanism within the mill.

Particle tracking was also implemented to characterise the classification action of the device and the likely trajectories of sand particles of varying sizes, densities and degree of shape irregularity.

The CFD study has created a better understanding of the air-flow, and produced the possibility of up-scaling and classification of particles consistent with experimental results.



*Streamlines within autogenous zone*



*Turbulent kinetic energy within autogenous zone*

The next stage of the project, also involving CFD, will be a feasibility study of a much larger up-scaled prototype of the mill. Further CFD will be essential for any future optimisation and design.

For further information please contact:

Dr Nicholas Agnew  
email:  
[gileng@uq.net.au](mailto:gileng@uq.net.au)

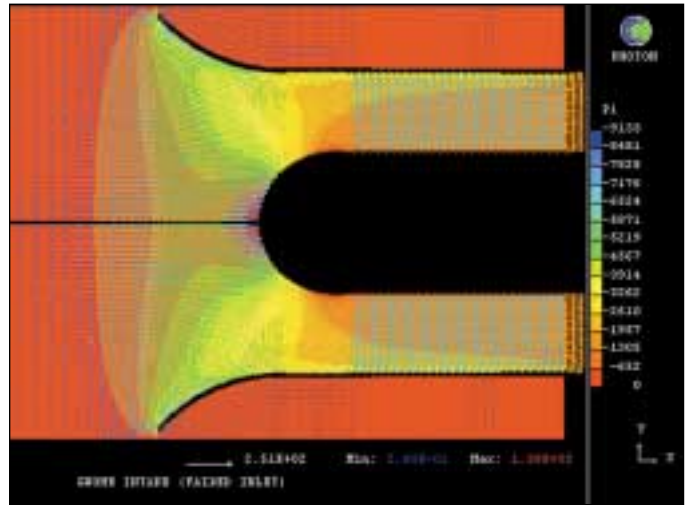
# S&C Thermofluids models Gnome

S&C Thermofluids uses a Rolls-Royce "Gnome" gas turbine engine on behalf of DERA, for experimental measurements of the exhaust flows.

In order to measure mass flow through the engine, a new intake was required which would produce a smooth inlet profile and a parallel section ahead of the compressor face where the velocities and static pressure would be uniform.



Intake of Gnome Gas Turbine



Gnome Intake (Faired Inlet)

PHOENICS was used to examine different intake shapes and to assess the uniformity of the flow and the overall pressure drop caused by the intake. The intake has now been constructed and successfully run on the engine at full power.

Dr Tony Smith, S&C Thermofluids

Email: [tony.smith@thermofluids.co.uk](mailto:tony.smith@thermofluids.co.uk)

## Notices & Events January 2000

### CHAM

Mr Peter Spalding, UK  
Tel: (+44) 181 947 7651

February	24	PHOENICS-3.3 'Refresher' Course
April	27	As above
May	17 to 20	International PHOENICS Conference
June	15	PHOENICS-3.3 'Refresher' Course
July	27	As above

Further dates will be announced for 1-day 'Refresher' courses, and 4-day 'Full' training programmes.



### ACADS-BSG

Mr Murray Mason, Australia  
Tel: (+61) 398 85 65 86

Two major events for the air conditioning industry will take place in Melbourne in 2000 at the Melbourne Exhibition Centre:

**AIRAH** (Australian Institute of Refrigeration Air Conditioning Heating & Ventilation) National Conference - 29th to 30th March.

**ARBS 2000** a world class Air Conditioning Refrigeration and Building Services Industry Exhibition - 30th March & 1st April.

At AIRAH, ACADS-BSG will be hosting the Thursday morning session on CFD Applications with PHOENICS well represented. Of the 5 papers being presented 3 are by PHOENICS licensees from Lincolne Scott, Connell Wagner, Engineered Fire & Safety.

ARBS 2000 is being held in Australia's most modern exhibition centre with 3000m<sup>2</sup> exhibition space, with over 400 exhibitors. **ACADS-BSG will be on Stand 16** demonstrating the full range of software that they distribute and support including PHOENICS, the program that is increasingly being used by the building services industry to model air conditioning and fire applications.

Contact Murray Mason, ACADS-BSG, Email: [acadbsg@ozemail.com.au](mailto:acadbsg@ozemail.com.au)