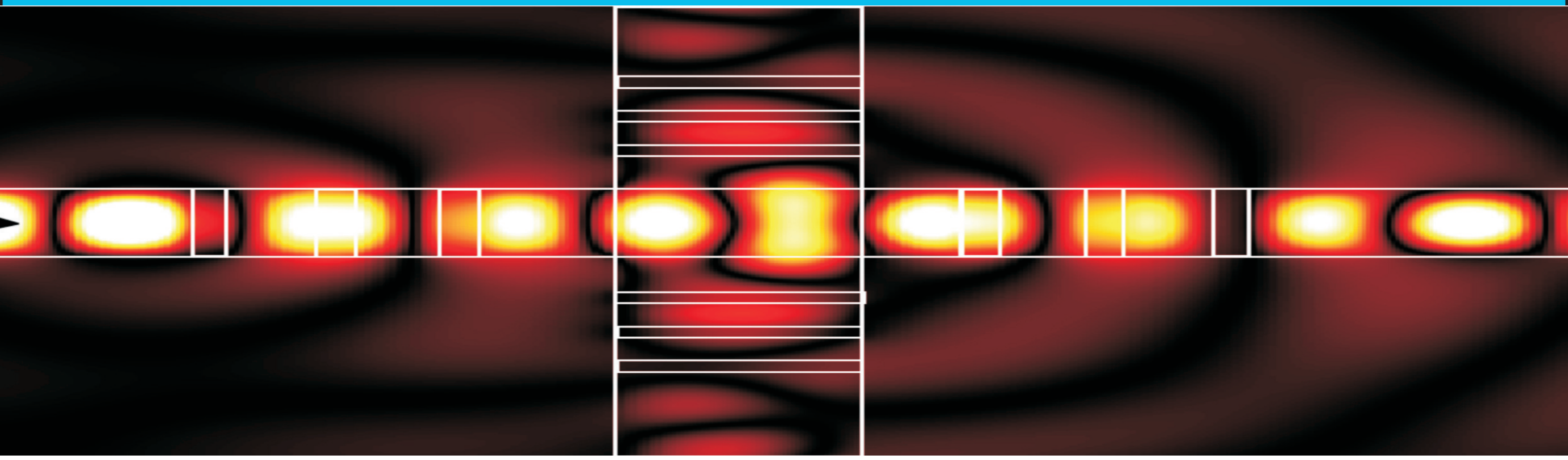
Your source of photonics software CAD tools



January 2007

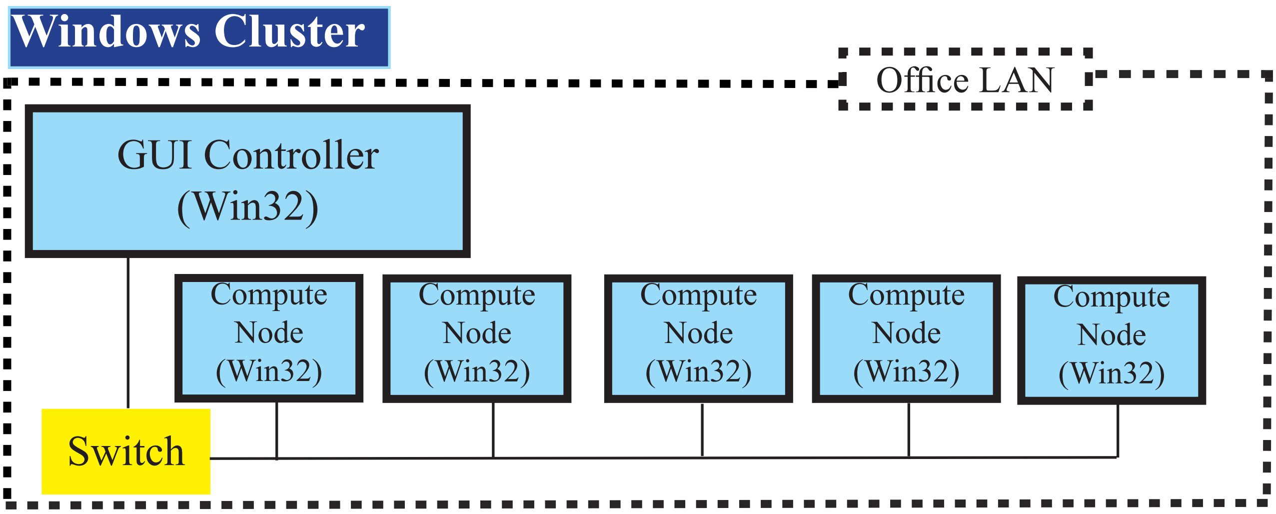
CrystalWave Version 4.0 was released since our last newsletter and represents a major new edition with a large number of important new features, including a named variable system (see below), anisotropy, non-linearity, magnetic permeability, sub-gridding (see below) and automatic parameter scanners. With this additional range of features, CrystalWave cements itself as the clear market leading tool for photonic crystal simulation. Other improvements include graded index structures and a very flexible tilted etching system. OmniSim Version 4.0 is also now released bringing you all the above technology to general purpose photonics applications.

Fimmwave version 4.6 is also just out. This brings the named-variable technology first released in CrystalWave to FIMMWAVE. It also features a holey fibre editor and further significant improvements in the way Fimmprop structures can be defined, making it much faster than previously to define a wide range of devices.

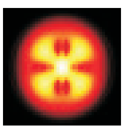
We have also now released our Cluster-FDTD engine for OmniSim and CrystalWave, available for both Linux and Windows clusters. See below for details.

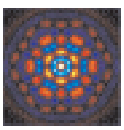
Clustered FDTD

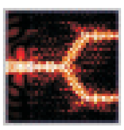
OmniSim and CrystalWave have long had one of the most efficient fast FDTD engines available commercially. This FDTD engine is now available in a cluster version. This will enable you to run your FDTD simulations efficiently over many PCs, both speeding up your simulations and allowing much bigger calculations. The solution scales almost without limit – you can cluster just 2 machines together or you can cluster 200 machines. Once set up, our cluster solution enables you to continue working on your Windows PC almost exactly as you would do with an un-clustered simulation – just select “Windows cluster” or “Linux cluster”, select the machines you want to include in your calculation and press the Calculate button – your structure is divided up into “tiles” and one tile sent off to each PC. When the simulation is finished all your results are available on your Windows controller PC in the usual manner; no learning one interface for local simulations and another for clustered ones.



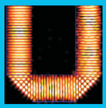
Photon Design Ltd
34 Leopold Street
Oxford, OX4 1TW
United Kingdom

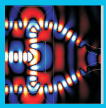


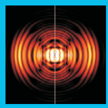




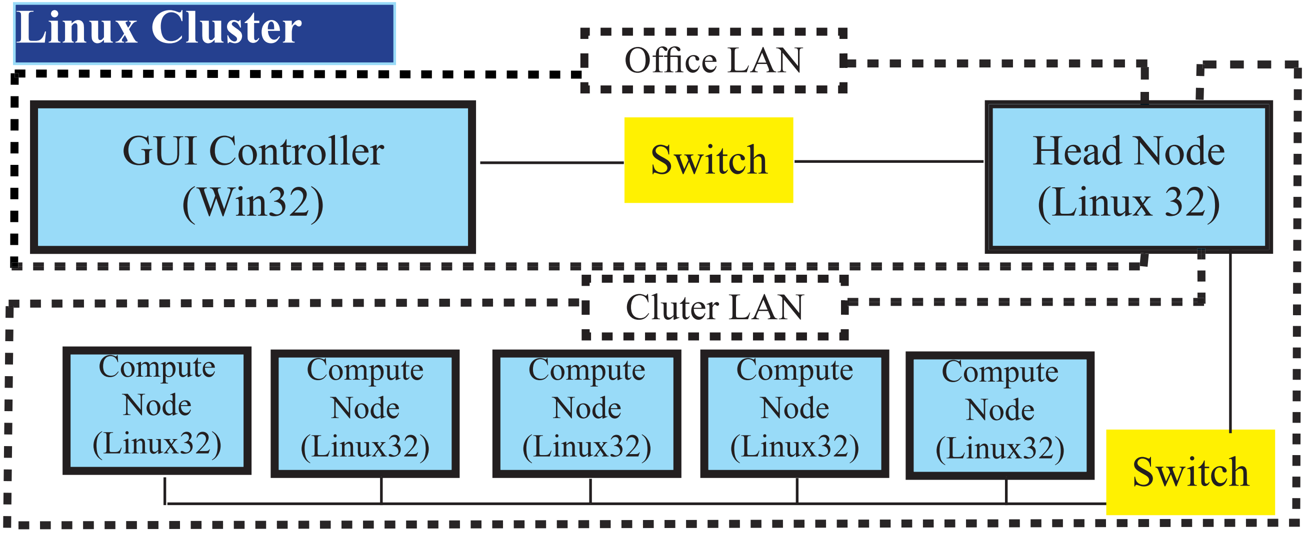
Tel: +44 1865 324990
Fax: +44 1865 324991
Email: info@photond.com
Web: http://www.photond.com







Linux Cluster



The FDTD Cluster Engine is available for both Windows and Linux, with both Suse and Red Hat supported (probably it will work on others too). The Windows cluster is ideal for small ad-hoc clusters, perhaps just combining a few existing PCs together. The Linux architecture is designed for more professional purpose-built clusters where all access is typically through a head node.

Careful and innovative design of the Photon Design cluster architecture gives rise to market leading cluster performance – even for relatively small problems (where clustering is less efficient) on a 100MHz Ethernet you can usually achieve efficiencies of over 85% and for larger simulations (with >100MB of data on each computer), efficiencies over 95% can be achieved. High efficiencies will allow you to achieve the same calculation speeds while saving money with smaller clusters.

Automatic load balancing: if you have a mix of machines the Cluster Manager can calibrate the performance of each machine and automatically proportion the load on each to maximise performance. The FDTD Cluster Engine can easily and efficiently take advantage of dual or quad core machines.

CrystalWave – advanced photonic crystal design

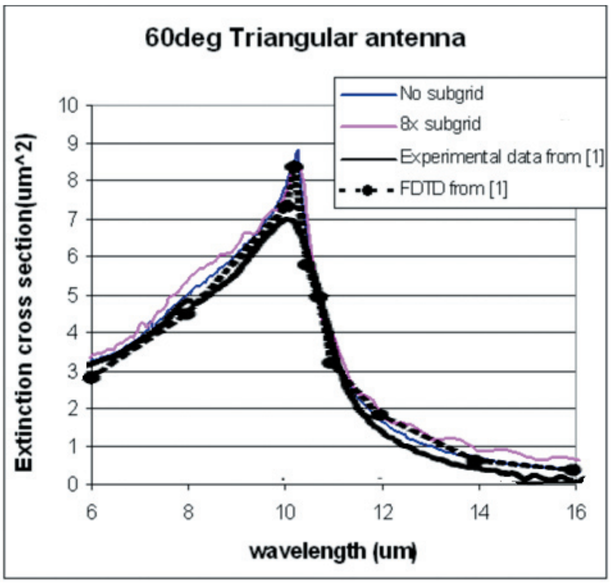
CrystalWave Version 4

Our market leading photonic crystal design suite CrystalWave recently got a major facelift. This latest release is probably the most major upgrade of CrystalWave since its launch. A huge amount of development has greatly extended the range of applications it can tackle. The list of powerful new features includes:

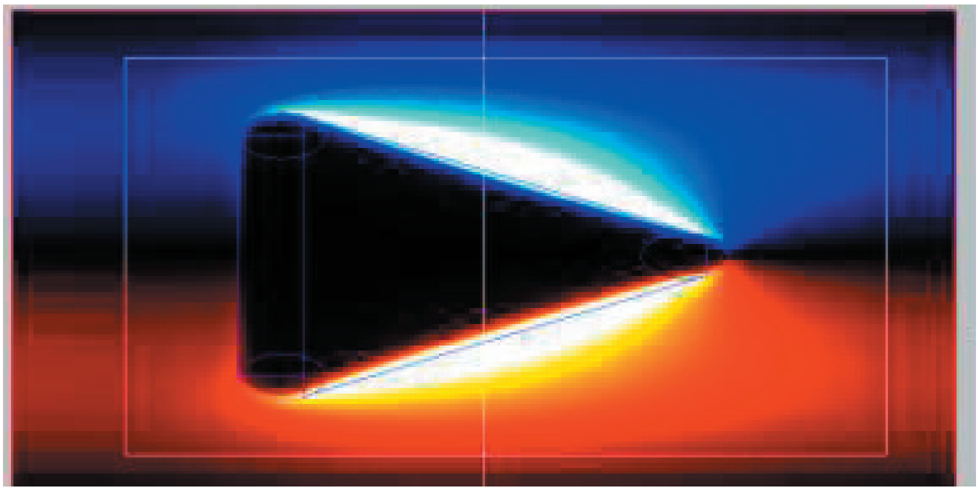
- anisotropy
- sub-gridding
- non-linear materials, both χ_2 and χ_3.
- magnetic permeability
- dispersive PMLs
- named variables
- parameter scanners for both FDTD and FD engine
- grading of materials
- tilted and rounded etching.
- improved FDTD engine.

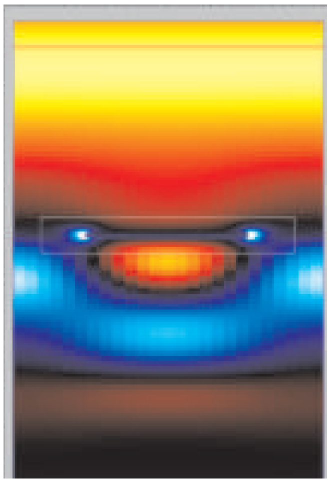
Photonic Crystal Laser Modelling

Coming soon to CrystalWave - a laser diode model integrated with CrystalWave's FDTD engine. Already we have some exciting scientific results from our new model. Contact us for availability.



Above: extinction cross section of a 60nm thick gold antenna computed with OmniSim with and without subgrid and compared with experimental and theoretical results from K. B. Crozier et al, J. Appl. Phys., Vol. 94, 2003. Using the 8x sub-grid achieves the same resolution in less than 1/30th the time in this example. (See also top of next page).

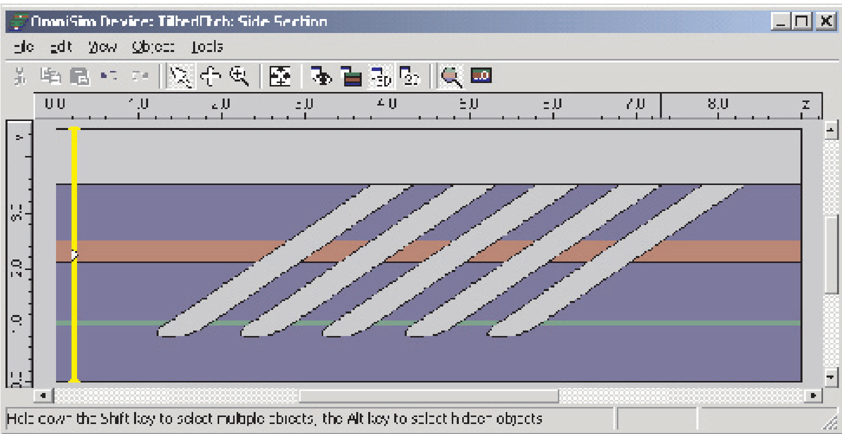




Above: modelling of the scattering of a 60nm thick gold antenna on a silica substrate. The left figure shows the Hy (out of plane) magnetic field as computed by FDTD. The right plot shows the Hy field in a cross section through the middle of the antenna. (See also bottom of previous page).

OmniSim Version 4

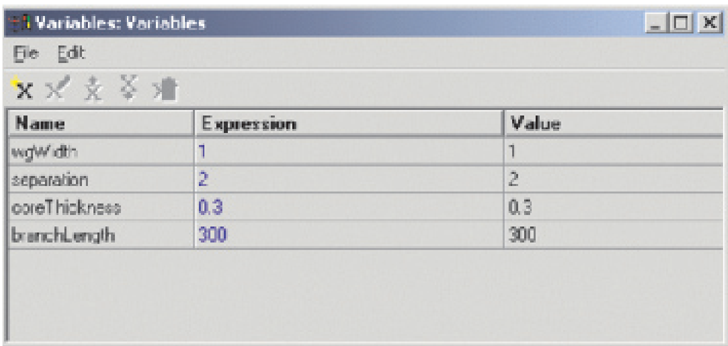
Most of the new features introduced in CrystalWave Version 4 (see above) are available for more general applications. The figure below illustrates graded and rounded etching in OmniSim.



Left. The latest version of our mask designer features some powerful effects. The figure illustrates a tilted etch defined easily in OmniSim; this example is a surface emitting grating created using a 45 degree etch. Notice also the rounded bottoms to the holes – again easily achieved in OmniSim.

Named Variables

The release of Version 4.0 of OmniSim and CrystalWave and Version 4.6 of FIMMWAVE now feature Photon Design's new Named Variable feature. This enormously improves the design process. Now you can define your structure in terms of a named variable and then set all the named variables centrally. For example in FIMMPROP you might have a Y-junction where the input waveguide and both output waveguides should be the same width. Instead of entering a number in each waveguide, you enter the string "wgWidth" and then in a Variables project node define the value for wgWidth. Then, if you change the value, all 3 waveguides will change together.



Name	Expression	Value
wgWidth	1	1
separation	2	2
coreThickness	0.3	0.3
branchLength	300	300

Above: a Variables Node defining the parameters for a Y-junction

Furthermore, as well as defining a parameter via a Named Variable, you can enter an arithmetic expression instead. Expressions can include trigonometric functions, exp(), ln(), min(), max() as well as functions for returning a spline fit to a set of data points.

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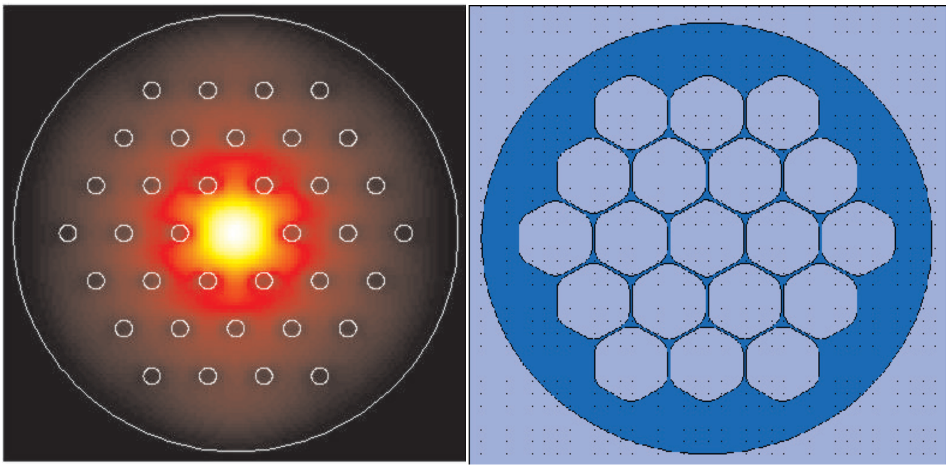
FIMMWAVE

The latest version of FIMMWAVE includes our new Named Variable system (see above). We have also substantially improved the new layout system initially introduced in version 4.5. Now it is more intuitive to use than ever and more flexible.

Photonic Crystal Fibre Editor

FIMMWAVE now includes a new graphical user interface for defining photonic crystal fibre easily. This will enable new users to easily simulate photonic crystal fibre without needing to understand scripting. It will quickly and conveniently define a wide variety of structures.



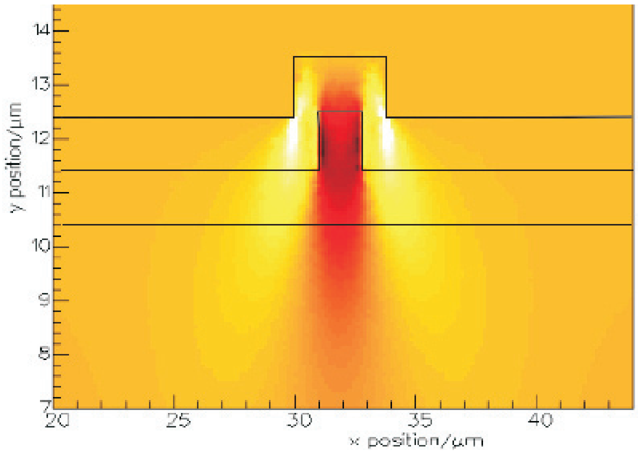
Above left: holey fibre simulated with FIMMWAVE 's FEM mode solver; right: design of a honeycomb fibre structure using new Holey Fibre Editor.

Stress Solver

FIMMWAVE now features an optional Stress Solver module. This will be an important tool for those customers who need to understand the effect of stress and birefringence induced commonly by thermal expansion mismatch between different materials. Stress induced birefringence can have a dramatic effect on the polarisation sensitivity of devices. This is particularly true for components fabricated in materials such as silicon or silica where high processing temperatures can lead to high stress.

The Stress Solver is fully integrated with FIMMWAVE, so that once you have computed your stress fields you can readily compute the eigenmodes of the stressed waveguide. The Solver is based on a 2D FEM algorithm with an automatic mesh generation, so even fine features in your waveguide will be correctly accounted for.

Applications include SOI waveguides as well as multicore and Panda fibres containing differentially expanding stress elements.



Above: stress fields in a SOI (silicon-on-insulator) ridge waveguide resulting from differential cooling from a manufacturing temperature of ~1000 Celcius to room temperature. The figure shows the stress in the y-direction.

Photon Design Customer Publications

Here are some recent FIMMWAVE publications.

K. Yamada, H. Fukuda, T. Tsuchizawa, T. Watanabe, T. Shoji, and S. Itabashi, "All-Optical Efficient Wavelength Conversion Using Silicon Photonic Wire Waveguide", IEEE Photonics Technology Letters, Vol.18, No. 9, pp.1046-1048, May 2006.

L Li, A. Schulzgen, Chen, and V.L. Temyako, "Phase locking and in-phase supermode selection in monolithic multicore fiber lasers", Optics Letters V.31, No.17, P2577-2579, Sep 2006.

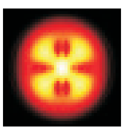
If you do publish anything which references our software, please do let us know. We can help to publicise your work and if we understand how our software is being used then we can make it even better.

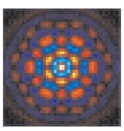
Meet Photon Design

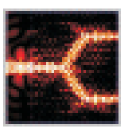
We are again exhibiting at a wide range of exhibitions. In the coming year we will be exhibiting at the exhibits shown below. Do come and visit us at one of these if you can - in this Internet age we enjoy meeting real people more than ever!

OFC	27-29 March 2007	Anaheim Convention Center,Anaheim, California, USA
ECIO	25-27 April 2007	Technical University of Denmark (DTU), Copenhagen, Denmark
CLEO	08-10 May 2007	Baltimore Convention Center,Baltimore, Maryland, USA
Photonics North	05-06 June 2007	Quebec City Convention Center, Quebec, Canada
InterOpto	11-13 July 2007	Makuhari Messe, Japan (with Opto Design - our Japan agent)
ECOC	17-19 September 2007	International Congress Center (ICC),Berlin, Germany

Photon Design Ltd
34 Leopold Street
Oxford, OX4 1TW
United Kingdom







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