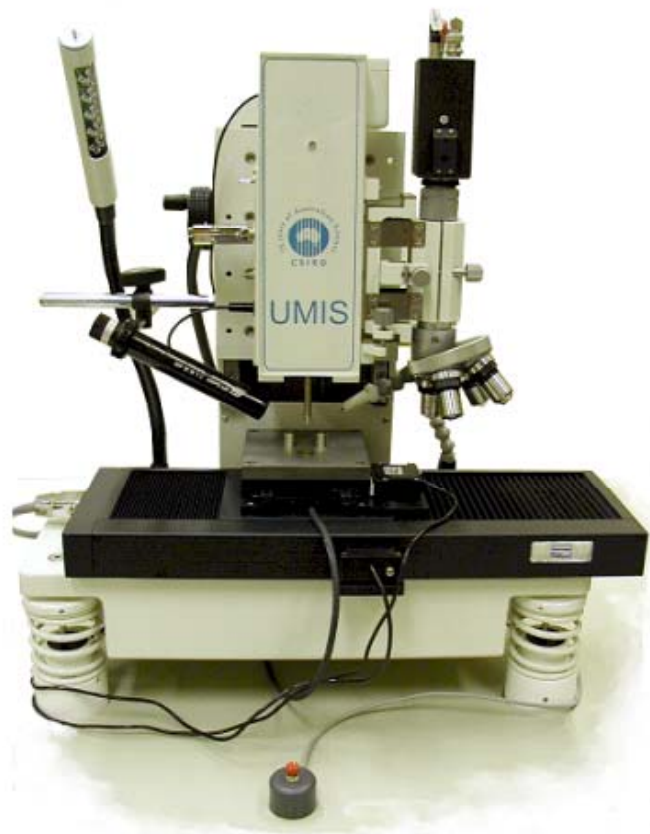


# UMIS

ULTRA MICRO INDENTATION SYSTEM



## Upgrades

*Fischer-Cripps Laboratories Pty. Limited*

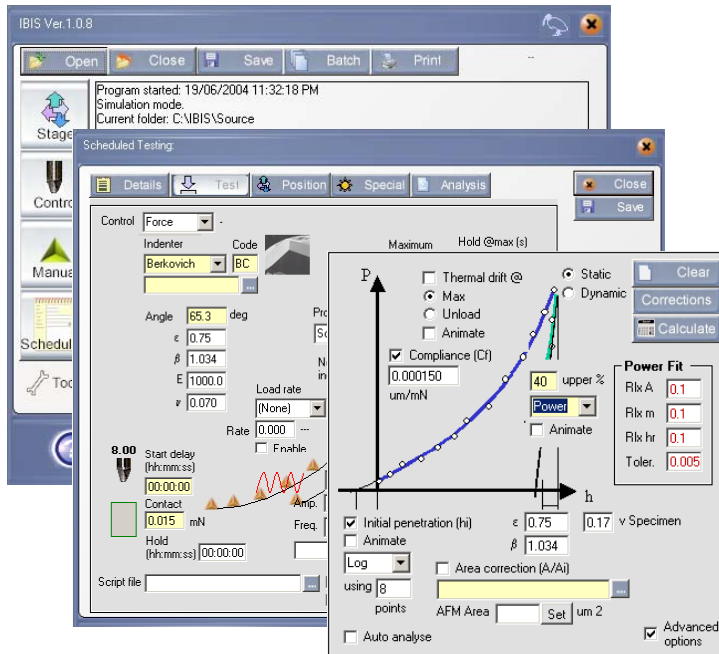
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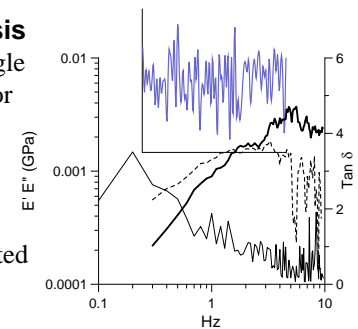
[www.ibisonline.com.au](http://www.ibisonline.com.au)

# Software Upgrade for UMIS®



**Analysis** module provides full access to correction and analysis parameters. Includes creep, initial penetration, compliance and area function corrections. Powerful non-linear solver calculates power law fitting to unloading data. Calculates elastic modulus, hardness, energy consumed and recovered. Traditional Oliver and Pharr method and effective indenter shape included.

**Dynamic Analysis** module allows single frequency testing or the new multiple-frequency Fourier transform analysis. Storage and loss moduli are calculated along with phase angle and complex viscosity.



## FEATURES

- Completely flexible test specifications including standard tests to ISO 14577.
- Analysis of data from Berkovich, spherical, and cube corner indenters plus others.
- Predictive calculations based upon user inputs of estimated modulus and hardness.
- Force rate, strain rate control.
- Batch testing for automated unattended operation.
- Multiple-frequency Fourier-transform dynamic testing - limited to 0.1 to 10 Hz (2 decades) in UMIS.
- Finite element modeling interface to Strand7®.
- Creep with iterative solving for up to 4-element Maxwell-Voigt model.

## REQUIREMENTS

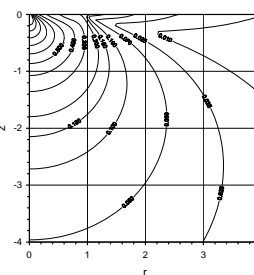
- UMIS fitted with PCI ADC interface
- WinXP operating system

IBIS Nanoindentation software is a complete replacement for WinUMIS. With the associated hardware upgrade for older machines, IBIS can be used with any model UMIS.

**Control** module allows user-defined test schedules or standard tests. Batch processing of tests, creep, scratch and dynamic (oscillatory) motion. Force, depth and strain rate control.

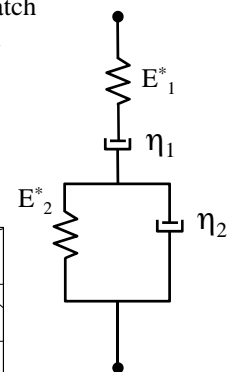
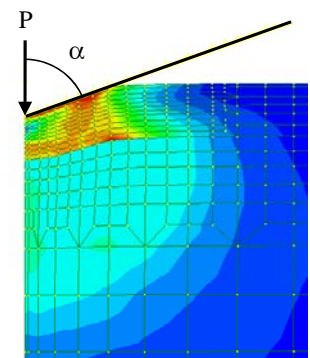
**Creep** module uses the non-linear least squares solver to calculate phenomenological 2, 3 and 4 element standard models.

**Contact Mechanics** module calculates elastic indentation stress fields, stress trajectories and surface displacements for spherical, conical, cylindrical punch indenters and point load for bulk specimen geometry.



**Finite Element** module interfaces directly with Strand7® to calculate stresses and deflections for axis-symmetric (cone or sphere), elastic-plastic indentation contact. Includes friction coefficient, strain-hardening and residual stress for a single layer coating as optional boundary conditions.

**REQUIRES THE FINITE ELEMENT UPGRADE.**



# Hardware Upgrade for UMIS®

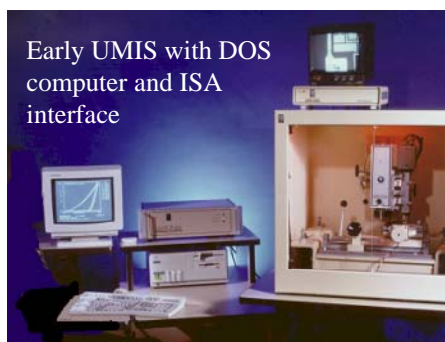
**Introduction:** If you own a UMIS® more than about 10 years old, it will be controlled by older style ISA interface cards (i.e. the "black" style of expansion slots). The software running your UMIS® interfaces directly with these cards (no device driver is required). For this reason, you are not able to directly upgrade the operation of your UMIS® to a computer running Windows® XP. There is a solution. Instead of buying a new instrument costing over a hundred thousand dollars, retain your investment in the quality instrument you already have and simply upgrade the computer. The IBIS Hardware Upgrade Kit contains a PCI type of interface card along with all the necessary cables to allow you to control your UMIS® from a computer running Windows® XP.

**IBIS Hardware Upgrade:** The upgrade kit consists of an IOtech® brand interface card, driver software, and cable adaptor. Cables from your existing UMIS® electronics controller plug into the cable adaptor which in turn plugs into the IOtech® interface card installed in your computer. **You need to supply a suitable computer running Windows XP.** By installing the hardware upgrade, you are able to take advantage of the new possibilities of IBIS Nanoindentation software which is included as part of the Hardware Upgrade Kit at no extra charge.

## FEATURES

- Extends the usable life of your UMIS® for many years.
- Easy to install, instructions provided.
- Take advantage of IBIS software features.
- Expert on-going support.

Any UMIS can be fitted with the hardware upgrade kit.



Upgrade to a PCI interface and revive your nanoindenter for a fraction of the cost of a new instrument.



**\*Note:** The IBIS hardware upgrade replaces the functions of the standard UMIS "PIO" and "ADC" cards. The Coreco Bandit card supplied with some model UMIS instruments is not Windows 2000/XP compatible and cannot be fitted or used with this upgrade. An alternative video card is available.

**Requirements:** Windows XP with one available full height PCI slot for ADC operations and one available PCI slot for existing National Instruments motion control card if fitted. A third PCI slot is required if a PCI image card is to be fitted. A fourth PCI slot is required if the AFM option is installed.

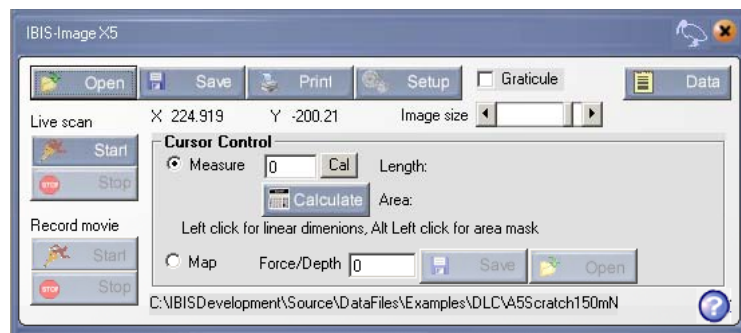
# Video Software Upgrade for UMIS®

**Introduction:** Upgrading to a PCI bus type of computer allows you to take advantage of new capabilities of a modern computer interface. If your UMIS is fitted with a video microscope, then chances are the camera from your microscope is connected directly to a separate high resolution black and white monitor. Now, with the IBIS Hardware Upgrade Kit fitted, you can also fit a standard PCI style video capture card and have your indentations and sample surfaces displayed on your computer monitor for easy capture to disk and inclusion in your own documents.

**IBIS-Image Upgrade:** The Image Upgrade Kit consists of an industry-leading PCI video card which will accept the output from your existing UMIS video camera. The IBIS-Image software allows you to capture and save your images to disk as well as a real-time display of video output on your computer screen.

## IBIS-Image SOFTWARE FEATURES

- Works with IBIS Nanoindentation software to provide imaging of your sample surface.
- Captures images to disk file.
- Captures live video (movies) to disk file.
- Measurement function allows you to conveniently measure crack lengths and impression areas.
- Point and click positioning of indentations directly on video image when used with IBIS Nanoindentation software.
- Optional image analysis features for calculation of areas of residual impressions from optical or AFM images.



**Notes:** The Coreco Bandit card supplied with some model UMIS instruments is not Windows 2000/XP compatible and cannot be used with this upgrade.

**Requirements:** Windows XP with one available full height PCI slot

## Camera Hardware Upgrade for UMIS®

This upgrade for older UMIS's replaces the original CCD camera with a modern unit (choice of monochrome or colour at time of order) and includes a PCI image card and IBIS Video Software.

Camera will mount onto existing 4-turret microscope. Signal can be tee'd into existing feed to existing separate monochrome monitor.

Camera: Monochrome: 1/2" CCD, 625 TV lines - 795Hx596V(PAL) H resolution 600 lines.

Colour: 480 lines 752Hx582V 1/3" CCD Video card: PCI full height, NTSC or PAL. Monochrome CCIR (625 lines) and EIA RA-170 (525 lines).

Windows 98/2000/XP and full-height PCI slot required.

Colour



Monochrome



An alternative to the turret-mounted camera is the SPI microscope long-range high resolution video miniature microscope. Variable zoom (manually adjustable) provides imaging from a wide field at low magnification to a narrow field at high magnification. Maximum magnification is in the order of  $\times 400$ . The microscope is supplied with a magnetic mount and arm to allow flexible positioning.



The variable zoom feature allows the microscope to be used in a variety of ways. As a direct in-situ device it allows you to obtain a sideways view of the indenter and specimen surface. Alternately, it can be mounted on-axis in a similar way to the standard UMIS microscope. Another use is simply as a camera to provide a wide-angle view of the sample stage to assist in using your UMIS with remote software such as PCAnywhere.

Standard UMIS microscope lenses can be mounted on the end of the camera for additional magnification if desired.

# Finite Element Upgrade for UMIS®

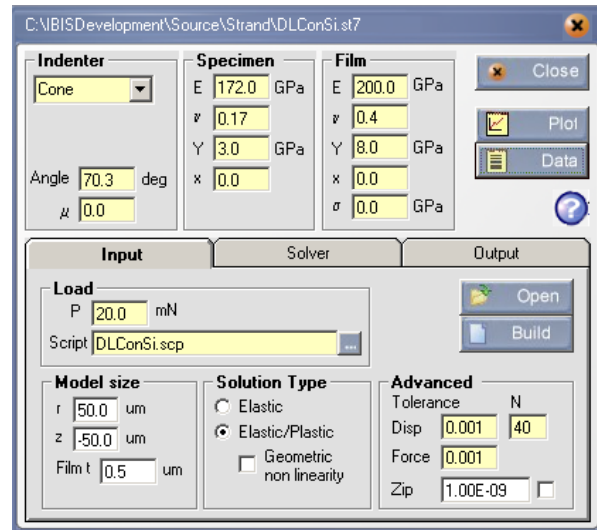
**Introduction:** One of the most important and valuable tools available to the materials scientist is the availability of numerical solutions to contact problems through the finite element method. Traditionally, such techniques have been the domain of the specialist, but thanks to modern Windows® API functionality, advanced finite element modelling can be performed by the non-specialist using a pre-defined applications-specific interface such as that provided by the IBIS software. IBIS allows you to input the indentation parameters (indenter load and geometry, elastic and plastic properties of the specimen, etc). IBIS then automatically communicates with Strand7® finite element analysis system and creates a mesh with the necessary boundary conditions for full elastic-plastic indentation loading.

## FEATURES

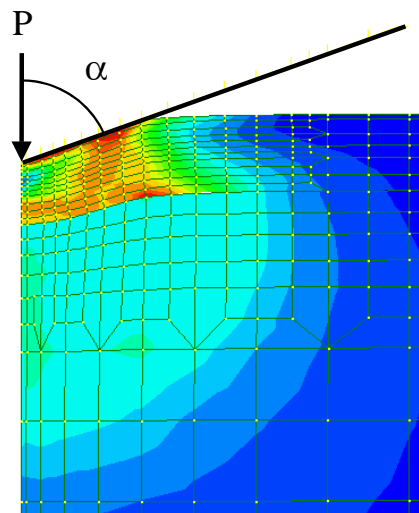
- Easy user interface to modeling optimized for indentation analysis.
- Elastic-plastic material properties with strain hardening.
- Optional coating geometry.
- Interfacial friction.
- Residual stress.
- Conical or spherical indenter geometries.
- Variety of output formats.
- No prior knowledge of finite element analysis required.
- Potential for many other advanced analyses.

**\*Note:** The IBIS Finite Element Interface requires a separate installation of Strand7®. Strand7® can be supplied as part of this upgrade. The IBIS Finite Element Interface attracts a one-off support fee in addition to the purchase of Strand7®.

**Requirements:** Windows 95/98/2000/XP



User input of indentation parameters.



IBIS assembles the mesh and calls the Strand7® solver without user intervention. After the solver has completed, IBIS produces a load-displacement curve which can be directly compared with experimental results, or, depending on other software installed, produce publication-quality contour maps of stresses within the specimen.

# AFM DS45-40 Upgrade for UMIS®

**Introduction:** One of the main advantages of nanoindentation is the instrumented record of the load-displacement curve from which various mechanical properties can be determined. However, for sub-micron scale testing, it is of interest to examine the actual residual impression in the specimen surface for deformation patterns, piling-up, corner cracks, and a direct measurement of the contact area. Usually, optical microscopy is limited for this type of work and the depth of field available is very inconvenient. The DME brand Dualscope attachment provides an easy method of imaging the residual impression. Using this objective, the residual impression, or the prospective indentation site, can be imaged using a state of the art sense-mode atomic force microscope.

**DME Dualscope AFM objective:** The Dualscope objective is a combined optical and AFM attachment. A  $\times 15$  lens allows you to view right through the device onto the AFM cantilever and specimen surface. The easy-to-use wizard-driven software means that you do not have to be an AFM expert to use this device. The objective fits on in place of a standard optical objective in the microscope assembly.

## FEATURES

- Wizard-driven adjustment
- Easy tip replacement using pre-mounted tips
- Sense mode operation
- Optical view directly down the axis of the objective
- Powerful image analysis functions

## REQUIREMENTS

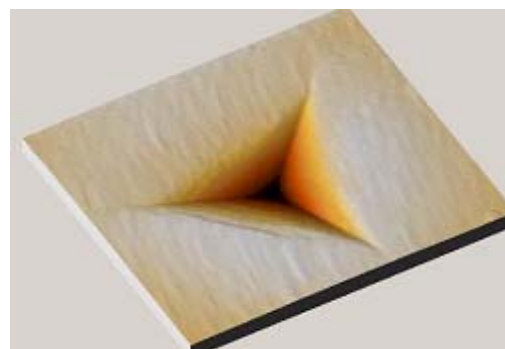
- UMIS fitted with standard 4 turret microscope
- Win95,98,2000/XP operating system

## SPECIFICATIONS

- 40 x 40  $\mu\text{m}$  scan size;
- $<1$  nm X,Y,Z resolution;
- 2.7  $\mu\text{m}$  z range;
- $>1.5$  mm approach.



AFM Objective fitted to optical microscope



8 x 8  $\mu\text{m}$  scan on  $\text{Si}_3\text{N}_4$  coating on silicon indented with a Berkovich indenter.

# Technical Support for UMIS®

## Information

Nanoindentation has been around for about 15 years but there is a scarcity of introductory material on the market. These books bring you all the information you need to become an expert in the field.

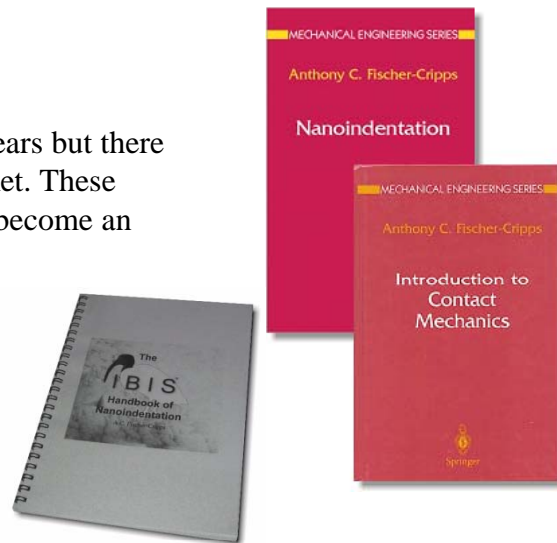
**Nanoindentation** (2nd Edition)

ISBN 0 387 22045 3

**Introduction to Contact Mechanics**

ISBN 0 387 98914 5

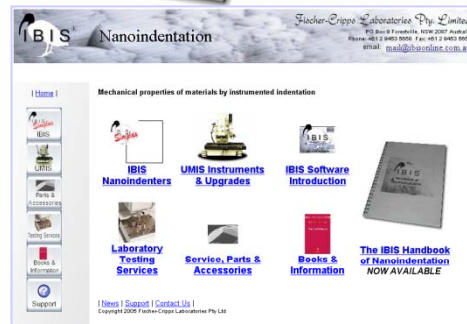
**IBIS Handbook of Nanoindentation**



## Web site

with downloadable free program updates, indenter area functions, support information.

[www.ibisonline.com.au](http://www.ibisonline.com.au)



## Repairs and adjustments

UMIS is a very robust machine and can withstand significant abuse from inexperienced operators. Occasionally, however, a repair or adjustment might become necessary. Fischer-Cripps Laboratories carries a full range of spare parts and has the expertise to bring your UMIS back to as new condition. Where a part is not available, it can be manufactured.



### Typical electrical adjustments

- Internal offsets to instrumentation amplifiers
- LVDT drive signal equality
- Servo loop offset

### Typical mechanical adjustments

- Head assembly adjustment (preload, safety gap, LVDT position)
- Microscope adjustment
- Stage tuning and adjustment

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