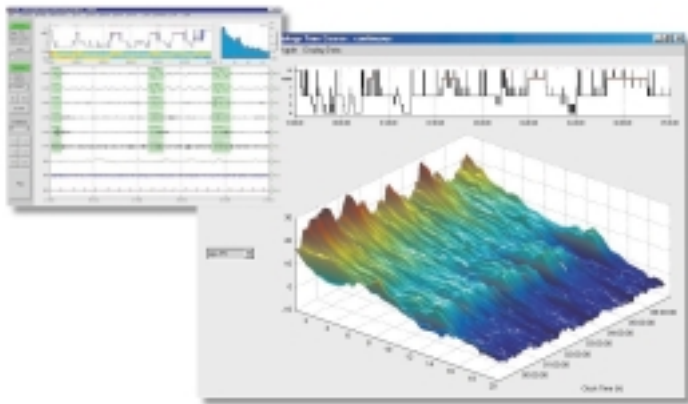


# BIOTECH, MEDICAL, AND PHARMACEUTICALS

Scientists and engineers in these rapidly changing areas are expected to meet intensifying demands for reliable data, accurate diagnostic tools, and effective therapies. To confront these challenges they must process and interpret massive amounts of data from biomedical instruments and design complex medical devices and diagnostic approaches. Increasingly, they are using MATLAB, Simulink, and other MathWorks products to develop and deploy their work.

Here are some examples.



## Analyzing Data for Sleep Research

The French company PhiTools has developed software that enables physiologists to perform scientific, pharmacological, and clinical investigations of sleep. Built using MATLAB and the Signal Processing Toolbox, the ERA and Profiler products provide easy access to state-of-the-art techniques for signal processing and analysis. They also incorporate recent developments in sleep research and chronobiology to process and analyze polysomnography (PSG) and electroencephalography (EEG) data, with improved rejection of artifacts. Researchers in hospitals, pharmaceutical firms, and health science centers use the tools in projects such as comparing normal sleepers with insomniacs and exploring the effects of aging. Since ERA and Profiler are GUI-based, the researcher does not need to know the MATLAB language, but a MATLAB-conversant researcher can customize and extend the ERA-Profiler software.

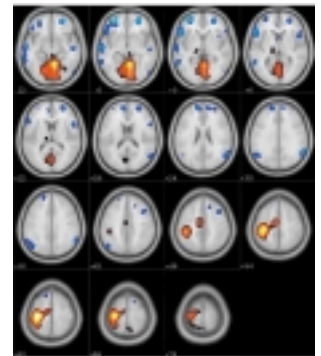
[www.phitools.com](http://www.phitools.com)

## Signal Processing in the Development of Hearing Devices

The Australian medical devices company, Cochlear Ltd., is the market leader in cochlear implants, with over 60% market share. Their products consist of implants placed in the cochlea (the inner ear) and a microphone/signal processor/transmitter external to the body that captures and processes sound and transmits through the skin to the cochlear implant, which excites the auditory system. Cochlear uses MATLAB and toolboxes for designing, evaluating, and verifying the signal processing, giving improved product performance and quality. [www.cochlear.com](http://www.cochlear.com)

## Using Statistical Analysis and Modeling to Interpret Brain Response

Developed in MATLAB by members of the Wellcome Department of Cognitive Neurology at the Institute of Neurology in London and now supported by a worldwide consortium of neuroimaging researchers, SPM is a software package for constructing and accessing spatially extended statistical processes. Researchers use it to develop and test hypotheses about brain responses from multi-domain neuroimaging data sources, such as SPECT, PET, and functional MRI systems. Introduced to the then-emerging functional imaging community in 1991, SPM has promoted collaboration and a common analysis scheme across laboratories. Over 1,000 users in the neuroimaging field use SPM, and it has received over 1,500 citations in the biomedical research literature. [www.fil.ion.ucl.ac.uk/spm](http://www.fil.ion.ucl.ac.uk/spm)

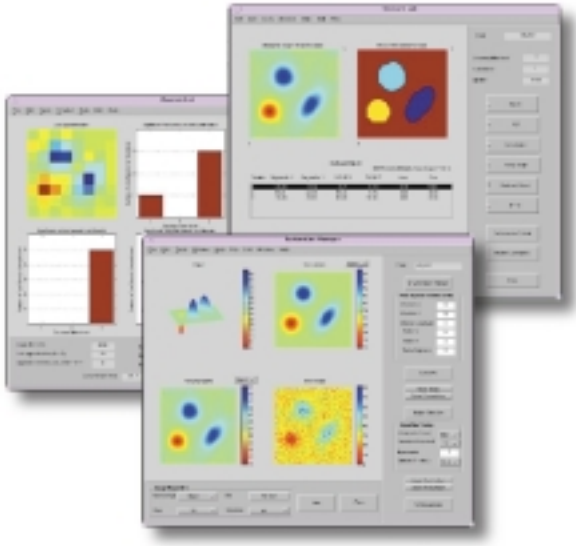


# MATLAB

## In the World

SPOTLIGHTING INNOVATIVE  
APPLICATIONS OF THE MATHWORKS TOOLS  
ACROSS THE SCIENCES AND INDUSTRY

BY JIM TUNG AND ROSEMARY OXFENFORD



### Reducing Quantum Noise in Organ, Bone, and Tissue Scintigrams

Dr. Ghada Jammal of the Technical University of Darmstadt in Germany has developed a filtering tool that substantially reduces quantum noise in scintigrams (nuclear medicine images produced by gamma cameras). While diagnostic techniques such as ultrasound or X-ray characterize only the anatomy, scintigrams reveal organ function as well as structure. However, the images are considerably degraded by Poisson noise, impeding image analysis and interpretation. Using MATLAB and the Wavelet, Statistics, Image Processing, and Signal Processing Toolboxes, Dr. Jammal developed algorithms that decompose the image into its signal and noise components and then restore it once the noise has been eliminated. She also built a GUI that enables doctors to use the tool without having to learn MATLAB. The filtering tool, DeQuant, can be used in all applications where Poisson or quantum noise is present, including astronomy, communications, and networks. [www.nesi.e-technik.tu-darmstadt.de/ghada](http://www.nesi.e-technik.tu-darmstadt.de/ghada)

### Extracting Forensic Information from DNA Datasets

Forensic DNA databases are indispensable law-enforcement tools, helping police match DNA from a crime scene to a DNA database of known offenders. Translating the millions of forensic samples into useful information, however, is a labor-intensive task. The Pittsburgh, Pennsylvania-based bioinformatics company, Cybergenetics, used MATLAB to develop TrueAllele, software that automates this data review. TrueAllele automatically analyzes and scores DNA fragments from capillary- and gel-based DNA sequencers. Data analysis and filtering algorithms, as well as a graphical interface, were developed and implemented in MATLAB. The UK's Forensic Science Service has chosen TrueAllele to build the UK National DNA Database. [www.cybgen.com](http://www.cybgen.com)

### Processing Images of the Small Intestine

The Israeli biomedical company, Given Imaging®, has developed a noninvasive diagnostic tool that permits visual imaging of the entire small intestine. The tool consists of a tiny video camera in a swallowable capsule. The camera transmits digital pictures from the gastrointestinal tract to a receiver fitted on the patient's body. Given Imaging® used MATLAB and the Image and Signal Processing Toolboxes to develop algorithms that decode the information transmitted over the receiver and then process and improve the resulting pictures. Once processed, the images can be exported to reports or sent via e-mail to an attending physician anywhere in the world. [www.givenimaging.com](http://www.givenimaging.com)



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