A Student’s Guide to Fourier Transforms

Fourier transform theory is of central importance in a vast range of applications in physical science, engineering and applied mathematics. Providing a concise introduction to the theory and practice of Fourier transforms, this book is invaluable to students of physics, electrical and electronic engineering and computer science.

After a brief description of the basic ideas and theorems, the power of the technique is illustrated through applications in optics, spectroscopy, electronics and telecommunications. The rarely discussed but important field of multi-dimensional Fourier theory is covered, including a description of Computerized Axial Tomography (CAT) scanning. The book concludes by discussing digital methods, with particular attention to the Fast Fourier Transform and its implementation.

This new edition has been revised to include new and interesting material, such as convolution with a sinusoid, coherence, the Michelson stellar interferometer and the van Cittert–Zernike theorem, Babinet’s principle and dipole arrays.

J. F. James is a graduate of the University of Wales and the University of Reading. He has held teaching positions at the University of Minnesota, The Queen’s University, Belfast and the University of Manchester, retiring as Senior Lecturer in 1996. He is a Fellow of the Royal Astronomical Society and a member of the Optical Society of America and the International Astronomical Union. His research interests include the invention, design and construction of astronomical instruments and their use in astronomy, cosmology and upper-atmosphere physics. Dr James has led eclipse expeditions to Central America, the central Sahara and the South Pacific Islands. He is the author of about 40 academic papers, co-author with R. S. Sternberg of The Design of Optical Spectrometers (Chapman & Hall, 1969) and author of Spectrograph Design Fundamentals (Cambridge University Press, 2007).