

John C. Russ
Curriculum Vitae

Present position: Adjunct Professor (retired), Materials Science and Engineering Dept, North Carolina State University, Raleigh, NC.
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Background: BS & MS degrees in Engineering and Solid State Physics from California Institute of Technology, PhD in Engineering from California Coast University (also AB in History from Pennsylvania). Employment: Bethlehem Steel Co. Research Labs (alloy development) 1963-68; Japan Electron Optics Laboratories (Director of Applications Laboratories), 1968-1970; Senior Vice President, Edax International (manufacturer of X-ray analytical equipment) 1970-1979; Director of Research, Rank Taylor Hobson (manufacturer of precision instrumentation) 1995-1997; Research Affiliate, Danish Technological Institute (gov't. sponsored research institute) 1996-2005; North Carolina State University 1979-present, retired but active as an author, workshop instructor, consultant and expert witness.

Research programs have involved private, commercial and government agency sponsors. The topics of these research efforts include:

- 3-D X-ray and neutron tomography of microstructure, with resolution better than 10 μm , and elemental specificity. This involved construction of instrumentation, development of computer simulation and reconstruction algorithms and display software, intended initially to study the complex topology of sintered heterogeneous microstructures in ceramics and explosives, and three-dimensionally woven fiber composites. Stereological measurement and characterization of the structures, and visualization of the imagery, was also involved. This activity supported both M.S. and Ph.D. students.
- Metrology of microelectronics devices, including extensive modeling of the physics of electron beam-specimen surface interaction and the effect of electronic states on scanning tunneling microscope measurements of semiconductors. Intercomparison of SEM results with electrical resistance measurements, confocal scanning light microscopy, and other methods, was performed for photoresist and silicon, including contact holes and liftoff geometry, with simulation to deal with internal charge distribution in insulators and semiconductors. This activity supported M.S. students.
- Studies of surface roughness in machined and worn materials, and of fracture surfaces in brittle materials (metals and ceramics) performed using light and scanning electron microscopy, interference microscopy, and atomic force microscopy. Surface parameters such as fractal dimension correlate with the surface history, fracture toughness, etc. Studies include modeling of anisotropic fractal surfaces, study of the MTF of the various measuring microscopes and the influence on results, and comparison of various mathematical characterizations. This effort included portions of the research projects of both M.S. and Ph.D. students; study of AFM and other characterization of polymer coatings involved a Ph.D. student at the Danish Technological Institute. Russ is the author of the text "Fractal Surfaces" (Plenum, 1994). After retirement from active teaching at NCSU, he became the Director of Research for Rank Taylor Hobson, the (British) firm that manufactures surface metrology instrumentation for roughness and form characterization.
- The use of "multimedia" (computer graphics, digital video, simulations, etc.) was adapted for teaching undergraduate introductory courses in materials science. Russ created modules covering the most difficult concepts for students to comprehend from traditional (blackboard and verbal lectures) presentations, in a joint effort with other universities as part of the NSF-funded SUCCEED coalition, resulting in the publication and distribution of multimedia materials including digital movies, notebooks for math packages, animations and simulations, interactive data sets, and other novel materials for use in lectures and for self-paced individual use by students. This activity supported numerous undergraduate and graduate students.

While John Russ' background is in physics and materials science, he has been involved in many interdisciplinary studies in the life sciences, textiles, food science, geology, and archaeology. This has resulted in jointly authored papers, sitting on student's committees in other departments, and some familiarity with the terminology and particular problems which arise in these fields. Russ is a member of the faculty of the Biomedical Engineering graduate program, and teaches workshops frequently on his specialty topic of image analysis and measurement.

Teaching: Russ has taught both graduate level and undergraduate courses. He introduced MAT 511, computer-assisted image analysis, which attracted students from many departments across campus. He taught MAT 201 (Introduction to Materials Science) for many years, and was nominated for the University's Teacher of the Year award. He also introduced a new Junior-level course (MAT 310) on computer applications in materials science, and entirely revised the department's introductory sophomore courses to include extensive multimedia materials. He has been involved in University efforts to deliver traditional courses via the internet for distance learning.

Other relevant activities: Founding Editor of the Journal of Computer Assisted Microscopy. This journal, published from 1989-1997 by Plenum Press, was concerned with three areas of research: the use of computers to control and optimize microscope performance, the simulation of microscope operation, and the processing and analysis of microscope images, covering all types of microscopes (light, electron, ion, acoustic, tunneling, etc.) and a wide variety of disciplines (materials, life sciences, geology, medicine, food science, etc.). Russ is also a member of the editorial board of the Journal of Microscopy Research and Technique, and a member of the board of directors of the Society for Quantitative Morphology (SQM). He is a member of the Microscopy Society of America (MSA); Microbeam Analysis Society (MAS); Society of Photo-Optical Instrumentation Engineering (SPIE); International Society for Stereology (ISS); Fellow of the Royal Microscopical Society (RMS). On November 16, 2006, the New York Microscopical Society awarded John Russ the Ernst Abbe Memorial Award for his contributions to the field of microscopy as a developer of computer-assisted microscopy and image analysis.

Author of several textbooks and reference books in the field of image analysis including:

The Image Processing Handbook (CRC Press, 1992; 2nd ed. 1994, 3rd ed. 1998, 4th ed. 2002, 5th ed. 2006) which presents comprehensive coverage of methods for image processing and measurement.

Introduction to Image Processing and Analysis (CRC Press, 2007), a textbook for students learning how to program algorithms for image processing and measurement, including source code and worked problems in C.

Fractal Surfaces (Plenum Press, 1994) which summarizes current knowledge and research on how such surfaces are produced, measured and mathematically described.

The Image Analysis Tool Kit and **Fovea Pro** (Reindeer Graphics, Inc., 1996-2007), CD-ROMs containing tutorials and programs for scientific image analysis.

Computer Assisted Microscopy (Plenum Press, 1990) which deals with the computer-based techniques for two- and three-dimensional image processing, reconstruction and measurement.

Practical Stereology (Plenum Press, 1988; 2nd ed., 2001) which comprehensively treats issues of sampling, automated measurement and microstructural interpretation.

Forensic Uses of Digital Imaging (CRC Press, 2001) which deals with processing and interpretation issues important for images used in courtroom settings.

Image Analysis of Food Microstructure (CRC Press, 2004) which provides step-by-step procedures and examples for measurement of structurally important parameters in natural and processed foods.

Russ is the author or editor of 11 other books, including **Fundamentals of Energy Dispersive X-ray Analysis** (Butterworth, 1984), and several volumes in the annual series **Advances in X-ray Analysis** (Plenum). In addition, he has published more than 300 papers, primarily in the fields of X-ray analysis, microscopy, and image analysis (full list available upon request).

In the undergraduate teaching field, Russ is the author of three CD-ROM disks **Visualizations in Materials Science** (1994) and **Materials Science, a Multimedia Approach** (Mac, 1995; Windows, 1996). He is also the author of a set of notebooks that use the math package Theorist to solve about 200 problems in Materials Science and Engineering (published by PWS Kent, Boston) which have been adopted for teaching undergraduate courses at various universities, worldwide. Russ has also written popular articles and books on image processing and digital photography. Currently an on-line resource with his image processing notes and interactive tutorials is available through Florida State University at <http://molecular.magnet.fsu.edu/primer/digitalimaging/russ/index.html>.

For twenty five years, Russ has organized and principally taught a highly successful short course and workshop in image analysis at North Carolina State University, which deals with the topics of image acquisition, processing, measurement, stereology, and interpretation from a variety of types of microscopes. This course has also been taught for ten years at the Danish Technological Institute, near Copenhagen, for seven years at the University of Missouri, Columbia, for five years as the principal customer training for Media Cybernetics, Inc (supplier of image analysis software), and at the McCrone Associates College of Microscopy (a major analytical service lab near Chicago). He has also taught similar courses for the American Society for Materials (light microscopy of materials), S.P.I.E. (image metrology), and the State University of New York at New Paltz (scanning electron microscopy), and has organized and taught custom designed courses for such industrial clients as Goodyear, Exxon, UOP, United Technologies, General Electric, 3M, Upjohn, Eli Lilly, Shell Development, Glaxo Wellcome, IBM, Monsanto, Rohm and Haas, Zygo, Mead Paper, Kodak, Parke Davis, Proctor and Gamble, Philip Morris, the U. S. Defense Department Mound Laboratories and Los Alamos National Laboratories, and many others. He frequently consults for a wide variety of industrial clients requiring special expertise, has programmed customized image analysis systems for dedicated needs including industrial quality control and pharmaceutical testing, and has provided testimony as an expert witness in civil and criminal trials.