EDWARD STANLEY ANGEL

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Education

B.S., Engineering, California Institute of Technology, 1964
M.S., Electrical Engineering, University of Southern California, 1966
Ph.D., Electrical Engineering, University of Southern California, 1968

Work Record

2005-2009: Director, Art, Research, Technology, and Science Laboratory (ARTS Lab), University of New Mexico

2001-2007: Director, Arts Technology Center, College of Fine Arts, University of New Mexico, Professor of Computer Science, Electrical and Computer Engineering and Media Arts

1995-1996: Visiting Professor, Universidad de los Andes (Venezuela), Universidad Tecnologica Equinoccial (Ecuador)

1988-1989: Overseas Visitor, Department of Computing, Imperial College, London and Honorary Research Fellow, Department of Physics and Astronomy, University College, London

1985-1988: Chair, Department of Computer Science, Professor of Computer Science and Electrical and Computer Engineering, University of New Mexico

1982-1985: Associate Chairman for Computer Engineering, Department of Electrical and Computer Science, University of New Mexico

1980-2007: Professor, Electrical and Computer Engineering and Computer Science, University of New Mexico

1981-1982: Senior Fulbright Hays Lectureship, School of Automation, India Institute of Science, Bangalore, India

1978-1980: Associate Professor, Electrical Engineering and Computer Science
The University of New Mexico

1978: Associate Professor, Electrical Engineering, University of Rochester

1975-1978: Assistant Professor, Electrical Engineering and Obstetrics and Gynecology, University of Rochester

1973-1975: Assistant Professor, Electrical Engineering, University of Rochester

1971-1973: Assistant Professor, Electrical Engineering, University of Southern California

1970-1971: Acting Assistant Professor, Electrical Engineering and Computer Science, University of California Berkeley

1968-1970: Research Associate and Lecturer, University of
Southern California, Electrical Engineering and Medicine (Biomathematics)

Awards

Senior Fulbright Lectureship, Indian Institute of Science, Bangalore (1981)

First UNM Presidential Teaching Fellow (1993)

2006 Prize for Inter American Informatics (Institute for Advanced Studies of the Organization of American States)

Exemplary Service Award, UNM School of Engineering Alumni Leadership Board, 2019.

SIGGRAPH Distinguished Educator Award and SIGGRAPH Academy, 2022.

Research Areas

Computer Graphics

Scientific Visualization

Image and Signal Processing

Publications: Journals

1. ``Adaptive Finite-State Models of Manual Control Systems,'' E. S. Angel and G. A. Bekey, *IEEE Trans. on Man-Machine Systems*, Vol. MMS-9, 1968, pp. 15-20.

2. ``Dynamic Programming and Partial Differential Equations,'' *J. Math. Anal. Appl.*, Vol. 23, 1968, pp. 628-638.

3. ``Discrete Invariant Imbedding and Elliptic Boundary-Value Problems Over Irregular Regions,'' E. Angel, *J. Math. Anal. Appl.*, Vol. 23, 1968, pp. 471-484.

4. ``A Building Block Technique for Elliptic Boundary-Value Problems Over Irregular Regions,'' E. Angel, *J. Math. Anal. Appl.*, Vol. 26, 1969, pp. 75-81.

5. ``Inverse Boundary Value Problems Elliptic Equations,'' E. Angel, *J. Math. Anal. Appl.*, Vol. 30, 1970, pp. 86-89.

6. ``The Diagonal Decomposition Technique Applied to the Dynamic Programming Solution of Elliptic Partial Differential Equations,'' E. S. Angel and D. C. Collins, *J. Math. Anal. Appl.*, Vol. 33, 1971, pp. 467-481.

7. ``Invariant Imbedding Difference Equations and Elliptic Boundary-Value Problems,'' E. S. Angel, *J. Comp. Sys. Science*, Vol. 4, 1970, pp. 473-491.

8. ``Initial Value Transformation for Elliptic Boundary-Value Problems,''E. S. Angel and A. K. Jain, *J. Math. Anal. Appl.*, Vol. 35, 1971, pp. 496-502.

9. ``A One-Sweep Numerical Method for Vector-Matrix Difference Equations with Two-Point Boundary Conditions,'' E. S. Angel and R. Kalaba, *J. Opt. Theory Appl.*, Vol. 6, 1970, pp. 345-355.

10. ``Initial-Value Problems in Potential Theory,'' E. S. Angel, A. Jain and R. Kalaba, *J. Opt. Theory Appl.*, Vol. 11,1973.

11. ``Invariant Imbedding and the Reduction of Boundary-Value Problems of Thin Plate Theory to Cauchy Formulations,'' E.S. Angel, J. Distefano and A. Jain, Int. *J. Eng. Sci.*, Vol. 9, 1971, pp. 933-945.

12. ``Invariant Imbedding and Effects of Changes of Poisson's Ratio in Thin Plate Theory,'' *E. S. Angel and J. Distefano*, Int. J. Eng. Sci., Vol. 10, 1972, pp. 401-408.

13. ``Reduction of Dimensionality for the Potential Equation Using Dynamic Programming,'' E. S. Angel and R. Bellman, *Utilitas Mathematica*, Vol. 1, 1972, pp. 181-190.

14. ``Equivalence of a Cauchy System and a Class of Boundary-Value Problems in Thin Plate Theory,'' E. S. Angel and J. Distefano, *J. Engineering Math.*, Vol. 6, pp. 117-123.

15. ``Irregular Regions and Constrained Optimization,'' E. S. Angel, ASCE Journal of the Engineering Mechanics Division, Vol. 99, EM3, pp.501-595, 1973.

16. ``A Dimensionality Reducing Model for Distributed Filtering,'' E. S. Angel and A. Jain, *IEEE-AC-18*, February 1973, pp 59-62.

17. ``Image Restoration, Modelling and Reduction of Dimensionality,'' A. Jain and E. S. Angel, *IEEE-C-23*, May 1974, pp. 470-476.

18. ``Perturbation of Nonlinear Potential Problems,'' E. S. Angel, J*. Math. Anal. Appl*., Vol. 43, 1973, pp. 145-150.

19. ``Image Processing and Finite Difference Methods,'' E. S. Angel andA. K. Jain, Advances in Computer Methods for Partial Differential Equation, R. Vichnevetzky (ed.), *AICA,* 1975, pp. 183-186.

20. ``Computerized Ultrasound Biparietal,'' Diameter Measurement, E. Angel, C Hohler, S. Logghe, and D. Pessel, *Medinfo 77*, North Holland Publishing Co.

21. ``Computer Analysis of Fetal Breathing Movements Recorded by Real-Time Ultrasound Imaging,'' E. Angel, H. Fox, J. Inglis, S. Logghe, D. Pessel, M. Steinbrecher, *Ultrasound in Medicine*, Vol. 14, 1978, Plenum.

22. ``Restoration of Images Degraded by Spatially Varying Point Spread Functions by a Conjugate Gradient Technique,'' E. Angel and A. K. Jain, *Applied Optics*, Vol. 17, pp. 2186-2190, 1978.

23. ``Frame to Frame Restoration of Diffusion Images,'' E. Angel and A. K. Jain*, IEEE T -AC*, Vol. 23, pp. 850-855, 1978.

24. ``Digital Filtering and Fetal Heart Rate Variability,'' E. Angel H. Fox and E. Titlebaum, *Computers and Biomedical Research*, Vol. 12, pp. 167-180, 1979.

25. ``Maternal Ethanol Ingestion and the Occurrence of Human Fetal Breathing,'' H. Fox, M. Steinbrecher, E. Angel, J. Inglis and D. Pessel, *Am. J. Ob-Gyn, Vol*. 132, pp. 351-358, 1978.

26. ``Evaluation of Fetal Monitoring by Telemetry,'' E. Angel, et al., *Am. J. Ob. Gyn*., 1979.

27. ``Dynamic Programming for Noncausal Problems,'' E. Angel, *IEEE T-AC*, 1981.

28. ``The Karhunen Loeve Transform in Computerized Tomography,'' L. Chang and E. Angel, Mathematical Biosciences, 1986.

29. ``From Dynamic Programming to Fast Transforms,'' E. Angel*, J. Math. Anal. Appl.,* 119,1986.

30. ``Speeding Up Bresenham's Algorithm,'' E.S. Angel and D.M. Morrison, *IEEE Computer Graphics and Applications*, 11(6), pp. 16-17, Nov 1991.

31. ``Design of Operator Interfaces for Hazardous Waste Removal Systems,'' E. Angel, F. Thompson, A. Ferrara and J. VanDyke, *Radioactive Waste Management and Environmental Restoration* 18(1-2), pp. 1-12, 1994.

32. ``Supercomputing Surface Intersections Using Parallel Subdivision,'' L.C. Chang, W. Bein and E. Angel, *Supercomputer 40*(VII-6),pp 10-18.

33. ``Surface Intersections Using Parallelism,'' L.C. Chang, W.W. Bein and E.S. Angel, *Computer Aided Geometric Design* 11, 39-69, 1994.

34. ``Multidimensional Dynamic Programming on Massively Parallel Computers'', E. Angel and P. Leong, *Computers Math. Appl.*, 27(9-10), pp 67-75, 1994.

35. ``Teaching a Three-Dimensional Computer Graphics Class Using OpenGL,'' E. Angel, *Computer Graphics*, 31(3), 1997.

36. ``OpenGL on the Mac (Part 1),'' E. Angel, *MacTech*, 14(12), pp 26-33, Dec 1998,

37. ``OpenGL on the Mac (Part 2),'' E. Angel, *MacTech*, 15(1), pp 12-19, Jan 1999,

38. ``The Deferred Accumulation Buffer,'' P.S. McCormick, C. Hansen and E. Angel, Journal of Graphics Tools 4(3) pp 35-46, 1999.

39. ``ARTS Lab and Game Development,'' E. Angel, T.P. Caudell, and E. Whitmore, *Journal of Game Development*, Vol2, Feb 2007, pp 18-21.

40. "Teaching a Shader-Based Introduction to Computer Graphics," E. Angel and D. Shreiner, *IEEE Computer Graphics and Applications*, 31(2), March/April 2011, pp. 9-13.

41. "The Case for Teaching Computer Graphics with WebGL: A 25-Year Perspective," E. Angel, *IEEE Computer Graphics and Applications*, 37(2) March/April 2017, pp 106-112.

Publications: Conference Proceedings

1. ``Asynchronous Finite State Models of Manual Control Systems,'' E. S. Angel and G. A. Bekey, *Second Annual NASA-University Conference on Manual Control* (1966), NASA SP-128.

2. ``Adaptive Finite-State Models of the Human Operator,'' E. S. Angel, *Third Annual NASA-University Conference on Manual Control* (1967), NASA SP-144.

3. ``Dynamic Programming and Partial Differential Equations,'' E. S. Angel*, First Hawaii International Conference on System Science*, 1968.

4. ``On Invariant Imbedding and Optimal Distributed Control,'' E.S. Angel and A. Jain, *Fourth Hawaii International Conference on Systems Science*, 1971, pp. 177-179.

5. ``A Nearest Neighbors Approach to Multidimensional Filtering,'' E. Angel and A. K. Jain, Proc. 1972 *IEEE Conference Decision and Control*, pp. 84-88.

6. ``Filtering of Multidimensional Diffusion Processes,'' E. Angel and A. K. Jain, *Sixth Asilomar Conference on Circuits and Systems*, November 1972, pp. 484-488.

7. ``Simulation Control of Stochastic Epidemics Using Interactive Graphics,'' E. S. Angel and A. Schumitzky, Proc. *IEEE Conference on Systems, Man and Cybernetics,* 1973, pp. 278-279.

8. ``Image Restoration and Automated Cytology,'' E. S. Angel, Proc. *Eighth Hawaii International Conference on Systems Science*, 1975, pp. 181-182.

9. ``Iterative Algorithm for Restoration of Space Variant PSF Degraded Images,'' E. Angel and A. K. Jain, *Proc. 1975 Optical Society Meeting*, Boston Mass., Fall 1975.

10. ``Computers in Obstetrics,'' E. Angel, H. Fox, C. Hohler, S. Logghe, D. Pessel, E. Titlebaum, *Thirteenth IEEE Computer Society International Conference (COMCOM),* Fall 1976.

11. ``A Look at Human Fetal Breathing Using Real-Time Ultrasound Techniques and Computer Analysis,'' E. Angel, H. Fox, C. Hohler, and D. Pessel, *European Congress of Perinatal Medicine, Uppsala, Sweden*, June 1976.

12. ``Computer Analysis of Fetal Breathing Movements,'' E. Angel, H. Fox, S. Logghe, D. Pessel, *Proc. 30th AEMB,*, 1977.

13. ``Spectral Methods in the Analysis of Fetal Heart Rate Variability,'' E. Angel, H. Fox and E. Titlebaum, *Proc. 30th AEMB*, 1977

14. .``Image Restoration and Image Models,'' E. Angel, *Fall National SIAM Meeting*, 1977.

15. ``Computer Acquisition and Analysis of Real Time Ultrasound Data,'' S. B. Logghe, E. Angel, H. E. Fox and D. Pessel, *32nd ACEMB*, 1979.

16. ``Digital Halftones and Image Coding,'' E. Angel, *International Symposium on Information Theory*, 1981.

17. ``Filtering of Halftone Images,'' E. Angel and L. D. Daigle, *24th Midwest Symposium on Circuits and Systems*, 1981.

18. ``Recovering an Image from Its Halftone,'' E. Angel and L. D. Daigle, *IFAC Symposium on Theory and Application of Digital Control*, 1982.

19. ``Image Processing, An Overview,'' E. Angel, *Electro IV*, Chihuahua, Chi., Mexico, 1982.

20. ``A High Speed Maximum Entropy Encoder for Images,'' E. Angel and L. D. Daigle, *ICASSP*, 1983.

21. ``A Maximum Entropy Encoder for Speech,'' E. Angel, L. D. Daigle and M. A. Rodriguez, *ICASSP*, 1983.

22. ``A Fast Conditional Entropy Encoder,'' E. Angel and L. D. Daigle, *International Coding Symposium,* 1983.

23. ``Robot Vision: A Current Perspective,'' E. S. Angel and J. M. Brayer, *Proc. Phoenix Conference on Computers and Communications,* 1985.

24. ``User Interface Tools for Telerobotic Systems for Handling Hazardous Waste,'' E. Angel, F. Thompson, A. Ferrara and J. VanDyke*, Proc. AI91*, pp 412-420, Sep, 1991.

25. ``Multidimensional Dynamic Programming on Massively Parallel Computers'', E. Angel and P. Leong, Fifth International Workshop - *Bellman Continuum*, Jan, 1993.

26. ``Isosurface Extraction Using Particle Systems,'' P. Crossno and E. Angel*, IEEE Visualization*, Nov 1997.

27. ``Visual Debugging of Visualization Software: A Case Study for Particle Systems,'' P. Crossno and E. Angel, *IEEE Visualization*, Oct 1999.

28. ``Spiraling Edge: Fast Surface Reconstruction from Partially Organized Sample Points,'' P. Crossno and E. Angel, *IEEE Visualization*, Oct 1999.

29. ``An Object-Oriented Particle System for Simulation and Visualization,'' J. Zhang, E. Angel, P. Alsing, and D. Munich, *XXVII Conferencia Latinamericana de Informatica (CLEI 2001*), September, 2001.

30. ``Marching Flow,'' E. Angel, P. Crossno, and D. Munich, *XXI International Conference of the Chilean Computer Science Society (SCCC)*, November, 2001.

31. ``Visualizing Ocean Currents with Color and Dithering,'' P. Crossno, E. Angel and D. Munich, *Symposium on Parallel and Large-Data Visualization and Graphics (PVG 2001)*, October, 2001

32. ``The FFT on a GPU,'' K. Moreland and E. Angel, *Proceedings of Eurographics/SIGGRAPH Workshop on Graphics Hardware 2003*, pp 112-119.

33. ``Creating Dome Animations with the Digital Pueblo Project,'' E. Angel, H. Walker Baumgarner-Kirby, and D. Beining, SIGGRAPH 2003 (Technical Sketches).

34. "A Fast High Accuracy Volume Renderer for Unstructured Data," K. Moreland and E.Angel. *Proceedings of Volume Visualization, 2004* IEEE Symposium on Volume Visualization.

35. "Teaching Computer Graphics without Raster-level Algorithms," E. Angel, S. Cunningham, P. Shirley and K. Sung, *Proceedings of the 39th SIGCSE Technical Symposium on Computer Science Education*, SIGCSE 2006

36. "ARTS Lab and Game Technology," E. Angel, T. Caudell and E. Whitmore, *Microsoft Academic Days*, 2007.

37. "Progress in Rendering and Modeling for Digital Planetariums," M. Magnor, P. Sen, J. Kniss, E.Angel and S. Wenger, Eurographics, 2010.

38. "Preparing STEM Teachers to offer New Mexico Computer Science for All," I. Lee, M. P. Dombrowski, E. Angel, *SIGCSE,* 2017.

39. "CGEMS: Computer Graphics Educational Material," A. T. Duchowski, E. Angel, B. Gooch and D. Luebke, *SIGGRAPH 2017*.

40. "There and Back Again: Computer Graphics Education with a View to the Future," E. Angel and D. Shreiner, *SIGGRAPH 2022*.

Books, Book Chapters and Published Notes

1. Dynamic Programming and Partial Differential Equations, E. Angel and R. Bellman, Academic Press, 1972 (also translated into Russian by A. Letov).

2. ``Cauchy Problems for Ordinary Differential, Differences and Integral Equations,'' Invariant Imbedding, Lecture Notes in Operations Research and Mathematical Systems, Springer-Verlag, 1972, pp. 19-33.

3. ``Invariant Imbedding and Partial Differential Equations,'' E. S. Angel and A. Jain, Invariant Imbedding, Lecture Notes in Operations Research and Mathematical Systems, Springer-Verlag, 1972, pp. 34-45.

4. ``Fetal Breathing and Ultrasound,'' H. Fox, D. Pessel and E. Angel in Ultrasonography in Obstetrics and Gynecology, R. Saunders (ed.), Appleton-Century Croft (2nd ed.), 1980.

5. Computer Graphics, A Comprehensive Introduction, E. Angel, Integrated Computer Systems Publishing Co., 1983.

6. Hands-on Graphics Programming Using GKS/VDI Tools, E. Angel, Integrated Computer Systems Publishing Co.,1986.

7. Computer Graphics, E. Angel, Addison-Wesley, 1990).

8. ``Introduction to Computer Graphics and Visualization,'' E. Angel and C. Hansen, Supercomputing '91 and '92.

9. ``Computer Graphics,'' E. Angel, Handbook of Computer Engineering, McGraw-Hill, 1992.

10. Interactive Computer Graphics, A Top-Down Approach with OpenGL, E. Angel, Addison-Wesley, 1997.

11. Programming with OpenGL, An Introduction, E. Angel and K. Danielson, SIGGRAPPH 97 Course Notes.

12. An Interactive Introduction to OpenGL, D. Shreiner, M. Woo, and E. Angel, SIGGRAPH 99 Course Notes.

13. Interactive Computer Graphics, A Top-Down Approach with OpenGL (Second Edition), E. Angel, Addison-Wesley, 2000.

14. An Interactive Introduction to OpenGL, D. Shreiner,E. Angel, and V. Shreiner, SIGGRAPH 2000, 2001, 2002, 2003, 2004, 2005, 2006, 2007 Course Notes.

15. OpenGL: A Primer, E. Angel, Addison-Wesley, 2001.

16. Interactive Computer Graphics, A Top-Down Approach with OpenGL (Third Edition), E. Angel, Addison-Wesley, 2003.

17. "Fourier Processing in the Graphics Pipeline," E. Angel and K. Moreland, inIntegrated Image and Graphics Technologies, D. Zhang, M. Kamel and G. Baciu (ed), Kluwer Academic Publishers, 2004.

18. OpenGL: A Primer, Second Edition, E. Angel, Addison-Wesley, 2004.

19. Interactive Computer Graphics, A Top-Down Approach with OpenGL,Fourth Edition), E. Angel, Addison-Wesley, 2005.

20. OpenGL: A Primer, Third Edition, E. Angel, Addison-Wesley, 2008.

21. OpenGL: What's Coming Down the Pipeline, D. Shreiner, B. Licea-Kane, E. Hart and E. Angel, SIGGRAPH 2008 Course Notes.

22. Introduction to OpenGL and OpenGL ES Programming, D. Shreiner and E. Angel, SIGGRAPH Asia 2008 Course Notes.

23. Interactive Computer Graphics, A Top-Down Approach with OpenGL(Fifth Edition),E. Angel, Addison-Wesley, 2009.

24. Introduction to Shader-Based OpenGL Programming, E. Angel and D. Shreiner, SIGGRAPH 2009 Course Notes.

25. Introduction to Modern OpenGL Programming, E. Angel and D. Shreiner, SIGGRAPH 2011, SIGGRAPH Asia 2011, 2014, 2017, 2019, SIGGRAPH 2012-2018, Course Notes.

26. "Teaching Computer Graphics Starting with a Shader-Based OpenGL," Edward Angel, in OpenGL Insights, P. Cozzi and C. Ricchio (ed), CRC Press, 2012.

27. Interactive Computer Graphics, A Top-Down Approach with WebGL (Seventh Edition), E. Angel and D. Shreiner, Addison-Wesley, 2015.

28. "Teaching ian Introductory Computer Graphics Course with WebGL," Edward Angel and Dave Shreiner,in WebGL Insights, P. Cozzio (ed), CRC Press, 2015.

29. Interactive Computer Graphics, A Top-Down Approach with WebGL (Eighth Edition), E. Angel and D. Shreiner, Pearson Education, 2020.

30. WebGL in Practice, E. Angel and D. Shreiner, SIGGRAPH Course Notes, 2021.

31. An Interactive Introduction to WebGL, E. Angel and D. Shreiner, SIGGRAPH Course Notes, 2022.

Reviews

``Imbedding Methods in Applied Mathematics,'' by Casti and R. Kalaba, Journal of the Franklin Institute, Vol. 299, No. 3, pp. 221, 1973.

``Perception of Displayed information,'' by L. Biberman. Optical Engineering, 1975.

``Image Restoration,'' by R. Hunt and H. Andrews, Journal Optical Society of America, Vol. 68, pp. 273-274, 1978.

``Digital Image Processing,'' by R. Gonzalez and P. Wintz, Journal Optical Society of America, Vol. 68k, pp. 1457-1458, 1978.

``Principles of Dynamic Programming,'' by R. Larson and J. Casti IEEE Circuits and Systems Magazine, Vol. 1, pp. 31, 1979.

``Digital Signal Processing and Control and Estimation Theory,'' by A Willsky, IEEE Circuits & Systems Magazine, Vol. 2, pp. 24-25, 1980.

``Two-Dimensional Digital Signal Processing I, Linear Filters,'' H. S. Huang (ed.), IEEE Circuits and Systems Magazine, 1981.

Technical Reports

``Invariant Imbedding and Three-Dimensional Potential Problems,'' E Angel, University of Southern California, USCEE-325 (1969).

``Numerical Inversion of the Laplace Transform and Multidimensional Heat Equations,'' E. Angel, USCEE-70-5, 1970.

``Matrix Initial Value Methods for the Biharmonic Equation,'' E. Angel, USCEE-70-29, 1970.

``Advanced Ultrasonic Imaging for Clinical Diagnosis,'' D. Ballard, R. Waag and E. Angel, Computer Science Engineering Research Review, 1977-78, University of Rochester.

Professional Societies and Activities

SIGGRAPH, SIGGRAPH Academy
ACM
IEEE
Sigma Xi

Etta Kappa Nu
Computer Society, Computer Society Education Committee, 1978-79
Associate Editor, Journal of Mathematical Analysis and Application
Flicks on 66 Film Festival, Board of Directors, (NM)
Governor's Council on Film and Media Industries, Executive Committee (NM)
Mayor's Advisory Board on Film, Media and Theater (Albuquerque)
Santa Fe Complex, Chair, Board of Directors
New Mexico Supercomputing Challenge, Vice President, Board of Directors
Creative Startups, Executive Committee, Board of Directors, Santa Fe
Charleston Digital Media Initiative, Board of Directors, South Carolina
City of Santa Fe, Telecommunications Advisory Committee, Chair
Santa Fe Alliance for Science
UNM School of Engineering, Campaign for UNM SOE, Steering Committee

Courses Taught

Undergraduate: Circuits, Systems, Linear Control Theory, Numerical Methods, Logic Design, Logic Laboratory, Computer Programming, Computer Graphics, Discrete Mathematics, Data Structures and Algorithms.

Graduate: Linear Systems, Image Processing, Digital Signal Processing, Optimization, Optimal Control Theory, Biomathematics, Pattern Recognition, Logic Design, Computer Graphics, Scientific Visualization, Computer Networks.

Intensive Short Courses

Computer Graphics, Image Processing and Networks short courses taught through ISTEC (Ibero-american Science Technology Engineering Consortium) in Argentina, Brazil, Colombia, Ecuador, Mexico, Peru, Venezuela

Organized and taught OpenGL/WebGL tutorials at SIGGRAPH and SIGGRAPH ASIA 1997-2022 and at IEEE Visualization.

Organized and taught full day tutorial ``Introduction to Computer Graphics and Visualization,'' SuperComputing '91 and '92.

Course author of two computer graphics courses and senior instructor for Learning Tree International-Integrated Computer Systems, Inc. Courses taught in the U.S., Canada, U.K, Sweden, Netherlands, Israel.

Digital Image Processing, Taught at Institute of Optics (University of Rochester), NASA – Langley and worldwide through Learning Tree International, Inc

Coursera MOOC, Computer Graphics with WebGL, 2014

Consulting

Consultant - Sandia National Laboratories
Visiting Scientist - Los Alamos National Laboratory

Grants (post 2000)

PI, NSF Partnership for Innovation, Digital Pueblo Project, UNM, $600,000, 2002-2004.

PI, ARTS Lab, UNM, State of New Mexico $3,000,000, 2004-2008.

Co-PI, NSF Partnership for Innovation, Consortium for Fulldome Development, $600,000, 2009-2011.

Co-PI, New Mexico CS for All, NSF, Santa Fe Institute and UNM, 2012-2014.