Resume of Allen Tannenbaum

Personal Data

Name: Allen Robert Tannenbaum.
Date and Place of Birth: January 25th, 1953, New York City, New York.
Family Status: Married with 2 children.
Telephone Number: 612-625-6395.
Email: tannenba@ece.umn.edu.

Education

(i) Columbia University, B.A. in Mathematics, June 1973.
(ii) Harvard University, Ph.D. in Mathematics, June 1976.
Ph.D. advisor: Professor Heisuke Hironaka, Harvard University.
Thesis title: *Deformations of 1-Cycles and the Chow Scheme.*

Main Fields of Interest

Computational computer vision, image processing, medical imaging, computer graphics, control, mathematical systems theory, control of semiconductor fabrication processes, robotics, operator theory, functional analysis, algebraic geometry, differential geometry, invariant theory, and partial differential equations.

Present Position

Professor, Department of Electrical Engineering, University of Minnesota, Minneapolis, Minnesota, September 1988 - Present.

Recent Professional Activities

1. Co-Director of the Center for Control and Dynamical Systems (University of Minnesota), 1990-1995.

2. Technical consultant for Honeywell, 3M Corporation, GE Medical Systems, Picker, and Mayo Clinic.

3. Former associate editor of *Systems and Control Letters.* Associate editor of *International Journal of Robust and Nonlinear Control*, and *SIAM Journal of Control and Optimization.*

4. Reviewer for *Mathematical Reviews* and *Zentralblatt für Mathematik.*

5. Referee for numerous mathematics and engineering journals.

6. Have given numerous invited lectures at universities, conferences, and companies in Britain, Canada, China, France, Germany, Greece, Holland, Israel, Italy, Japan, Norway, Russia, Spain, Sweden, Switzerland, and the United States.

7. On organizing committee for Mathematical Control Conference in Israel in 1993.

8. Co-organizer (with Professors David Mumford, Peter Olver, and Dr. Guillermo Sapiro) of workshop on computer vision held at Geometry Center of University of Minnesota in 1995.

9. On organizing committee for US-China Control Conference held in 1995.

10. Co-organizer (with Prof. Tryphon Georgiou) of AFOSR Contractors' Meeting held in Minneapolis in 1995.

11. On the organizing committee of the 1996 SPIE Conference in San Diego.

12. Member of SIAM Reid Prize Committee.

13. Guest editor (with J. Morel and G. Sapiro) of special issue of *IEEE Trans. on Image Processing* on partial differential equation methods.

14. Have supervised 19 doctoral and 12 masters students.

15. On the Editorial Board of SIAM Book Series on Control and Dynamical Systems.

Awards and Honors

1. Phi beta kappa.

2. Graduated *summa cum laude* from Columbia University.

3. Kennedy Research Prize (Weizmann Institute).

4. NSF Research Initiation Award.

5. Fellow Award, Japanese Mathematical Society.

6. Plenary Speaker at International Conference on Partial Differential Equations and Distributed Control (1991).

7. Principal Lecturer for the CRM (University of Montreal) Summer School in Optimization and Control (1992).

8. Keynote Speaker at American Mathematical Society Annual Meeting (1994).

9. Plenary Speaker at American Mathematical Society Meeting (1997).

10. George Taylor Research Award (University of Minnesota).

11. Plenary Speaker for SIAM Conference on Control (1998).

12. Plenary Speaker for AFOSR Workshop on Optimal Design and Control (1997).

13. Takeda Best Paper Award for "New solution to the two block H^∞ problem for infinite dimensional stable plants" (with K. Hirata, Y. Yamamoto, T. Katayama), *Trans. of the Society of Instrument and Control Engineers* **32** (1996), pp. 1416–1424.

LIST OF PUBLICATIONS

Refereed Journal Publications

1. "Degenerations of curves in $\mathbf{P}^3$," *Proc. Am. Math. Soc.* **65** (1978), 6-10.

2. "Irreducible components of the Chow Scheme of space curves," *Math. Zeitschrift* **162** (1978), 287-294.

3. "On the geometric genera of projective curves," *Math. Annalen* **240** (1979), 213-221.

4. "Deformations of space curves," *Archiv der Mathematik* **34** (1980), 37-42.

5. "Families of algebraic curves with nodes," *Compositio Mathematica* **41** (1980), 107-126.

6. "Feedback stabilization of linear dynamical plants with uncertainty in the gain factor," *International Journal of Control* **32** (1980), 1-16.

7. "Castelnuovo curves and unobstructed deformations," *Math. Zeitschrift* **174** (1980), 141-147.

8. "Families of curves with nodes on K-3 surfaces," *Math. Annalen* **280** (1982), 239-253.

9. "On the stabilizer subgroup of a pair of matrices," *Linear Algebra and its Applications* (Special Issue on Linear Control Theory) **50** (1983), 527-544.

10. "Modified Nevanlinna-Pick interpolation and stabilization of linear plants with uncertainty in the gain factor," *International Journal of Control* **36** (1982), 331-336.

11. "On pole assignability over polynomial rings," *Systems and Control Letters* **2** (1982), 13-16.

12. "A note on linear systems on K-3 surfaces," *Proc. Am. Math. Soc.* **86** (1982), 6-9.

13. "On the classicial characteristic linear series of plane curves with nodes and cuspidal points: two examples of Beniamino Segre," *Compositio Mathematica* **51** (1984), 169-183.

14. "Polynomial rings over arbitrary fields in two or more variables are not pole assignable," *Systems and Control Letters* **2** (1982), 222-226.

15. "Linear systems on curves," *Bulletin of the Canadian Math. Soc.* **27** (1984), 371-375.

16. "Pointwise stability and feedback control of linear systems with non-commensurate delays" (with E. W. Kamen and P. P. Khargonekar), *Acta Math.* **2** (1984), 159-184.

17. "On a certain class of real algebras which are projective-free," *Archiv der Mathematik* **42** (1984), 474-478.

18. "Stabilization of time-delay systems using finite-dimensional compensators" (with E. W. Kamen and P. P. Khargonekar), *IEEE Trans. on Aut. Control* **AC-30**, January 1985, 74-78.

19. "Noneuclidean metrics and the robust stabilization of systems with parameter uncertainty" (with P. P. Khargonekar), *IEEE Trans. on Aut. Control* **AC-30**, October 1985, 1005-1013.

20. "Robust control of linear time-invariant plants using periodic compensation" (with P. P. Khargonekar and K. Poolla), *IEEE Trans. on Aut. Control* **AC-30**, November 1985, 1088-1096.

21. "Stable Bezout factorizations and feedback control of time-delay systems," (with E. W. Kamen and P. P. Khargonekar), *International Journal of Control* **43** (1986), 837-857.

22. "On the multivariable gain margin problem," *Automatica* **22** (1986), 381-384.

23. "On the sensitivity minimization problem for linear time-varying periodic systems" (with A. Feintuch and P. P. Khargonekar), *SIAM Journal on Control and Optimization* **24** (1986), 1076-1085.

24. "Gain optimization for distributed systems" (with A. Feintuch), *Systems and Control Letters* **6** (1986), 295-301.

25. "Robotic manipulators and the geometry of real semi-algebraic sets" (with Y. Yomdin), *IEEE Journal of Robotics and Automation* **RA-3** (1987), 301-308.

26. "Weighted sensitivity minimization for delay systems" (with C. Foias and G. Zames), *IEEE Trans. on Automatic Control* **AC-31** August 1986, 763-766.

27. "On the H^∞-optimal sensitivity problem for systems with delays" (with C. Foias and G. Zames), *SIAM Journal on Control and Optimization* **25** (1987), 686-706.

28. "On decoupling the H^∞-optimal sensitivity problem for products of plants" (with C. Foias and G. Zames), *Systems and Control Letters* **7** (1986), 239-246.

29. "On the Nehari problem for a certain class of L^∞-functions appearing in control theory" (with C. Foias), *Journal of Functional Analysis* **74** (1987), 146-159.

30. "Sensitivity minimization for arbitrary SISO distributed plants" (with C. Foias and G. Zames), *Systems and Control Letters* **8** (1987), 189-195.

31. "On the uniqueness of a minimal norm representative of an operator in the commutant of the compressed shift" (with C. Foias), *Proceedings of the American Mathematical Society* **101** (1987), 687-692.

32. "On a local nonlinear commutant lifting theorem" (with J. Ball, C. Foias, J. W. Helton), *Indiana Univ. Journal of Mathematics* **36** (1987), 693-709.

33. "On the Nehari problem for a certain class of L^∞-functions appearing in control, II" (with C. Foias), *Journal of Functional Analysis* **81** (1988), 207-218.

34. "Weighted sensitivity minimization: general plants in H^∞ and rational weights" (with T. Lypchuk and M. Smith), *Linear Algebra and its Applications* **109** (1988), 71-90.

35. "Optimal sensitivity theory for multivariate distributed plants" (with C. Foias), *International Journal of Control* **47** (1988), 985-992.

36. "Generalized interpolation theory in control" (with B. Francis), *Mathematical Intelligencer* **10** (1988), 48-53.

37. "On skew Toeplitz operators, I" (with H. Bercovici and C. Foias), *Operator Theory: Advances and Applications* **29** (1988), 21-45.

38. "A Poincaré-Dulac approach to a nonlinear Beurling-Lax-Halmos theorem" (with J. Ball, C. Foias, and J. W. Helton), *Journal of Math. Analysis and Applications* **139** (1989), 496-514.

39. "Some explicit formulae for the singular values of certain Hankel operators with factorizable symbol" (with C. Foias and G. Zames), *SIAM J. Mathematical Analysis* **19** (1988), 1081-1091.

40. "On the four block problem, I," (with C. Foias), *Operator Theory: Advances and Applications* **32** (1988), 93-112.

41. "Iterated commutant lifting for systems with rational symbol" (with C. Foias), *Operator Theory: Advances and Applications* **41** (1989), 255-277.

42. "On the parametrization of the suboptimal solutions in generalized interpolation" (with C. Foias), *Linear Algebra and its Applications* **124** (1989), 145-164.

43. "On the four block problem, II: the singular system" (with C. Foias), *Integral Equations and Operator Theory* **11** (1988), 726-767.

44. "Weighted sensitivity optimization for nonlinear systems" (with C. Foias), *SIAM Journal on Control and Optimization* **27** (1989), 842-860.

45. "Some remarks on optimal interpolation" (with C. Foias), *Systems and Control Letters* **11** (1988), 259-264.

46. "Skew Toeplitz approach to the H^∞-control of multivariate distributed systems" (with H. Özbay), *SIAM J. Control and Optimization* **28** (1990), 653-670.

47. "A strong Parrot theorem" (with C. Foias), *Proceedings of the American Mathematical Society* **106** (1989), 777-784.

48. "Control of slowly time-varying linear systems" (with E. Kamen and P. Khargonekar), *IEEE Transactions Automatic Control* **AC-34** (1989), 1283-1286.

49. "Four block problem : stable weights and rational weightings" (with P. Khargonekar and H. Özbay), *International Journal of Control* **50** (1989), 1013-1023.

50. "On the structure of suboptimal H^∞ controllers in the sensitivity minimization for distributed stable plants" (with H. Özbay), *Automatica* **27** (1991), 293-305.

51. "A spectral commutant lifting theorem" (with H. Bercovici and C. Foias), *Transactions of the AMS* **325** (1991), 741-763.

52. "On certain minimal entropy extensions appearing in dilation theory" (with C. Foias and A. Frazho), *Linear Algebra and Its Applications* **137** (1990), 213-238.

53. "On spectral tangential Nevanlinna-Pick interpolation" (with H. Bercovici and C. Foias), *Journal of Math. Analysis and Applications* **155** (1991), 156-176.

54. "The invariant subspaces of a uniform Jordan operator" (with H. Bercovici), *Journal Math. Analysis and Applications* **156** (1991), 220-230.

55. "Frequency domain analysis and robust control design for an ideal flexible beam" (with K. Lenz, H. Özbay, J. Turi, B. Morton), *Automatica* **27** (1991), 947-961.

56. "Mixed sensitivity optimization for unstable infinite dimensional systems" (with H. Özbay and M. Smith), *Linear Algebra and Its Applications* **178** (1993), 43-83.

57. "On the evolution of curves via a function of curvature, I: the classical case" (with B. Kimia and S. Zucker), *Journal of Math. Analysis and Applications* **163** (1992), 438-458.

58. "Structured interpolation theory" (with H. Bercovici and C. Foias), *Operator Theory: Advances and Applications* **47** (1990), 195-220.

59. "On the optimal solutions in spectral commutant lifting theory" (with H. Bercovici and C. Foias), *Journal of Functional Analysis* **101** (1991), 38-49.

60. "On a causal linear optimization theorem" (with C. Foias and C. Gu), *Journal of Math. Analysis and Applications* **182** (1994), pp. 555–565.

61. "Abstract model and controller design for an unstable aircraft," (with D. Enns and H. Özbay), *AIAA Journal on Guidance, Control, and Dynamics* **15** (1992), 498-508.

62. "Some mathematical problems in computer vision" (with A. Bruckstein), *Acta Math. Appl.* **30** (1993).

63. "Causality in commutant lifting theory" (with C. Foias), *Journal of Functonal Analysis* **118** (1993), 407–441.

64. "A lifting technique for linear periodic systems with applications to sampled-data control" (with B. Bamieh, B. Francis, J. B. Pearson), *Systems and Control Letters* **17** (1991), 79-88.

65. "On combined H^∞–H^2 suboptimal interpolants" (with C. Foias and A. Frazho), *Linear Algebra and Its Applications* **203-204** (1994), pp. 443–469.

66. "On affine plane curve evolution" (with G. Sapiro), *Journal of Functional Analysis* **119** (1994), pp. 79–120.

67. "Intertwining dilations, intertwining extensions, and causality" (with C. Foias and C. Gu), *Acta Sci. Math. (Szeged)* **56** (1993), pp. 101–123.

68. "Nonlinear H^∞ optimization: a causal power series approach," *SIAM J. Control and Optimization* **33** (1995), pp. 185–207.

69. "Nonlinearity in H^∞ theory, causality in commutant lifting theory, and extension of intertwining operators" (with C. Foias and C. Gu), *Integral Equations and Operator Theory* **23** (1995), 89-100.

70. "Shapes, shocks, and deformations, I: the components of shape and the reaction-diffusion space" (with B. Kimia and S. Zucker), *International Journal of Computer Vision* **15** (1995), 189-224.

71. "Affine invariant scale-space (with G. Sapiro), *International Journal of Computer Vision* **11** (1993), 25-44.

72. "On invariant curve evolution and image analysis" (with G. Sapiro), *Indiana Univ. Journal of Mathematics* **42** (1993), 985-1009.

73. "A relative Toeplitz-Hausdorff theorem" (with H. Bercovici and C. Foias), *Operator Theory: Advances and Applications* **71** (1994), pp. 29–34.

74. "Continuity of the spectrum on closed similarity orbits" (with H. Bercovici and C. Foias), *Integral Equations and Operator Theory* **18** (1994), 242–246.

75. "On area and length preserving geometric invariant curve evolutions" (with G. Sapiro), *IEEE Trans. on Pattern Analysis and Machine Inteligence* **17** (1995), pp. 67–72.

76. "Stability margin optimization via interpolation and conformal mappings" (with J. Cockburn and Y. Sidar), *IEEE Trans. Aut. Control* **40** (1995), pp. 1066–1070.

77. "On a lifting theorem for the structured singular value" (with H. Bercovici, C. Foias, and P. Khargonekar), *Journal of Math. Analysis and Applications* **187** (1994), pp. 617–627.

78. "Classification and uniqueness of invariant geometric flows" (with P. Olver and G. Sapiro), *Comptes Rendus Acad. Sci. (Paris)* **319** (1994), pp. 339–344.

79. "Multivariable stability margin optimization: a spectral tangential interpolation approach" (with Juan Cockburn), *Int. J. Control* **63** (1996), pp. 557-590.

80. "The structured singular value for linear input/output systems," (with H. Bercovici and C. Foias), *SIAM J. Control and Optimization* **34** (1996), pp. 1392–1404.

81. "Invariant geometric evolutions of surfaces and volumetric smoothing" (with P. Olver and G. Sapiro), *SIAM J. Applied Math.* **57** (1997), pp. 176-194.

82. "Optical flow: a curve evolution approach" (with A. Kumar and G. Balas), *IEEE Trans. Image Processing* **5** (1996), pp. 598–611.

83. "Conformal curvature flows: from phase transitions to active contours" (with S. Kichenesamy, A. Kumar, P. Olver, and A. Yezzi), *Archive for Rational Mechanics and Analysis* **134** (1996), pp. 275–301.

84. "The equivalence among the solutions of the H^∞ optimal sensitivity computation problem" (with K. Hirata and Y. Yamamoto), *Trans. of the Society of Instrument and Control Engineers* **31** (1995), pp. 1954–1961.

85. "Three snippets of curve evolution theory in computer vision," *Mathematical and Computer Modelling Journal* **24** (1996), pp. 103–119.

86. "On skew Toeplitz operators, II" (with H. Bercovici and C. Foias), *Operator Theory: Advances and Applications* **103** (1997).

87. "Behavioral analysis of anisotropic diffusion in image processing" (with Y. You, M. Kaveh, W. Xu), *IEEE Trans. Image Processing* **5** (1996), pp. 1539–1553.

88. "Affine geometry, curve flows and invariant numerical approximations" (with E. Calabi and P. Olver), *Advances in Mathematics* **124** (1996), pp. 154–196.

89. "New solution to the two block H^∞ problem for infinite dimensional stable plants" (with K. Hirata, Y. Yamamoto, T. Katayama), *Trans. of the Society of Instrument and Control Engineers* **32** (1996), pp. 1416–1424.

90. "Affine invariant edge maps and active contours" (with P. Olver and G. Sapiro), to appear in *Journal of Mathematical Imaging and Vision.*

91. "Geometric active contours for segmentation of medical imagery," (with S. Kichenesamy, A. Kumar, P. Olver, and A. Yezzi), *IEEE Trans. Medical Imaging* **16** (1997), pp. 199–209.

92. "Differential and numerically invariant signature curves applied to object recognition" (with E. Calabi, P. Olver, C. Shakiban), *International Journal of Computer Vision* **26** (1998), pp. 107-135.

93. "Some remarks on Hamiltonians and the infinite-dimensional one block H^∞ problem" (with K. Hirata and Y. Yamamoto), *Systems and Control Letters* **29** (1996), pp. 111-117.

94. "Area and length minimizing flows for segmentation" (with Y. Lauziere, K. Siddiqi, and S. Zucker), *IEEE Trans. Image Processing* **7** (1998), pp. 433-444.

95. "Introduction to special issue of *IEEE Trans. Image Processing* on partial differential equation methods in image processing" (with V. Caselles, J. M. Morel, and G. Sapiro), *IEEE Trans. Image Processing* **7** (1998), pp. 269-274.

96. "Shapes, shocks, and wiggles" (with K. Siddiqi, B. Kimia, and S. Zucker), to appear in *Journal of Imaging and Vision Computation.*

97. "Curve evolution models for real-time identification with application to plasma etching" (with J. Berg and A. Yezzi), *IEEE Trans. Aut. Control* **44** (1999), pp. 99-104.

98. "Skew Toeplitz solution to the H^∞ problem for infinite dimensional unstable plants" (with K. Hirata, Y. Yamamoto, and T. Katayama), to appear in *Trans. of the Society of Instrument and Control Engineers.*

99. "On the affine invariant heat equation for nonconvex curves" (with S. Angenent and G. Sapiro), *Journal of the American Mathematical Society* **11** (1998), pp. 601-634.

100. "The shape triangle: parts, protrusions, and bends" (with B. Kimia, K. Siddiqi, and S. Zucker), to appear in *Vision Research.*

101. "On a state space solution to the singular value problem of Toeplitz operators and the computation of the gap" (with K. Hirata and Y. Yamamoto), to appear in *Systems and Control Letters.*

102. "Knowledge-based segmentation of SAR data with learned priors" (with S. Haker and G. Sapiro), to appear in *IEEE Trans. Image Processing.*

103. "Laplace-Beltrami operator and brain surface flattening" (with S. Angenent, S. Haker, and R. Kikinis), to appear in *IEEE Trans. on Medical Imaging.*

104. "On the computation of switching surfaces in optimal control: A Groebner basis approach" (with U. Walther and T. Georgiou), submitted for publication to *IEEE Trans. Aut. Control.*

Books

105. *Invariance and Systems Theory: Algebraic and Geometric Aspects, Lecture Notes in Mathematics* **845**, Springer-Verlag, New York, 1981.

106. *Feedback Control Theory* (with John Doyle and Bruce Francis), MacMillan Company, New York, 1991. (This book has been translated into Chinese and Japanese.)

107. *Robust Control of Distributed Parameter Systems* (with Ciprian Foias and Hitay Özbay), *Lecture Notes in Control and Information Sciences* **209**, Springer-Verlag, New York, 1995.

108. *Feedback Control, Uncertainty, and Complexity*, edited by Bruce Francis and Allen Tannenbaum, *Lecture Notes in Control and Information Sciences* **202**, Springer-Verlag, New York, 1995.

109. *Deformation Theory*, lectures by Michael Artin, notes by C. S. Seshadri and A. Tannenbaum, *Tata Institute Lecture Notes,* Bombay, India, 1976.

Book Chapters

110. "The Brauer group and unirationality: an example of Artin-Mumford," Lecture Notes in Mathematics **844**, Springer-Verlag, New York (1981), 103-128.

111. "On weak pole placement of linear systems depending on parameters" (with P. P. Khargonekar), *Lecture Notes in Control and Information Sciences* **58**, Springer-Verlag, New York (1984), 829-839.

112. "A local theory of linear systems with noncommensurate time delays" (with E. W. Kamen and P. P. Khargonekar), *Lecture Notes in Control and Information Sciences* **58**, Springer-Verlag, New York (1984), 521-541.

113. "Optimal interpolation in H^∞: a new approach" (with C. Foias and G. Zames), *Modelling, Robustness, and Sensitivity Reduction in Control Systems* (edited by Ruth Curtain), NATO ASI Series, Springer-Verlag, New York, 1987, 381-399.

114. "Nonlinear interpolation in H^∞" (with J. Ball, C. Foias, J. W. Helton), *Modelling, Robustness, and Sensitivity Reduction in Control Systems* (edited by Ruth Curtain), NATO ASI Series, Springer-Verlag, New York, 1987, 31-47.

115. "From curve detection to shape description" (with A. Dobbins, L. Iverson, B. Kimia, and S. Zucker), in *Computer Vision: Systems, Theory, and Applications*, edited by A. Basu and X. Li, World Scientific, Singapore, 1993, pages 25-39.

116. "Operator theoretic methods in the control of distributed and nonlinear systems" (with C. Foias), in *Signal Processing: Control Theory and Applications,* IMA Series on Applied Mathematics **23**, Springer-Verlag, 1990, 51-78.

117. "On the singular values of the four block operator and certain generalized interpolation problems" (with C. Foias), *Analysis and Partial Differential Equations,* edited by Cora Sadosky, Marcel Dekker, New York, 483-493, 1990.

118. "Nonlinear H^∞ theory" (with C. Foias), *Robust Control of Nonlinear Systems and Nonlinear Control*, edited by M. Kaashoek, J. van Schuppen, A. Ran, Birkhauser, Boston, 1990, pages 267-276.

119. "Standard problem for distributed systems" (with C. Foias), *Robust Control of Nonlinear Systems and Nonlinear Control*, edited by M. Kaashoek, J. van Schuppen, A. Ran, Birkhauser, Boston, 1990, pages 599-608.

120. "On the synthesis of H^∞ optimal controllers for infinite dimensional plants" (with H. Özbay), *New Trends and Applications in Distributed Parameter Control Systems,* edited by G. Chen, E. B. Lee, W. Littman, L. Markus, Marcel Dekker, New York, 1990, pages 271-301.

121. "Invariant theory and families of systems," *Mathematical System Theory: the Influence of R. E. Kalman*, edited by A. C. Antoulas, Springer-Verlag, New York, 1991, pages 327-345.

122. "Spectral variants of the Nevanlinna-Pick interpolation problem" (with H. Bercovici and C. Foias), *Signal Processing, Scattering and Operator Theory, and Numerical Methods*, edited by M. Kaashoek, J. van Schuppen, A. Ran, Birkhauser, Boston, 1990, pages 599-608.

123. "Towards a computational theory of shape: an overview" (with B. Kimia and S. Zucker), *Lecture Notes in Computer Science* **427** (1990), pp. 402-407.

124. "Generalized interpolation theory and its application to robust control design," *Digital and Numeric Techniques and Their Applications in Control Systems,* edited by C. T. Leondes, Academic Press, 1993, pages 163-217.

125. "Entropy scale-space" (with B. Kimia and S. Zucker), in *Visual Form*, edited by C. Arcelli, pages 333-344, Plenum Press, New York, 1992.

126. "On optimal control methods in computer vision and image processing" (with B. Kimia and S. Zucker), in *Geometry Driven Diffusion in Computer Vision,* edited by Bart Romeny, Kluwer, Holland, 1994.

127. "Exploring the shape manifold: the role of conservation laws" (with B. Kimia and S. Zucker), in Ying-Lie, O., Toet, A., Foster, D., Heijmans, H., and Meer, P. (eds), *Shape in Picture*, Springer-Verlag, 1994, 601 - 620.

128. "Differential invariant signatures and flows in computer vision: a symmetry group approach" (with P. Olver and G. Sapiro), in *Geometry Driven Diffusion in Computer Vision,* edited by Bart Romeny, Kluwer, Holland, 1994.

129. "On the structured singular value for operators on Hilbert space," (with H. Bercovici and C. Foias), *Lecture Notes in Control and Information Sciences* **202** (1995), 11–23.

130. "On the shape triangle" (with B. Kimia and S. Zucker), in C. Arcelli, L. Cordella, and G. Sanniti di Baja (eds), *Aspects of Visual Form Processing*, 1994, World Scientific, Singapore, 307 - 323.

131. "Frequency domain methods for the H^∞ optimization of distributed systems," in *Analysis and Optimization of Systems: State and Frequency Domain Approaches for Infinite Dimensional Systems,* edited

by Ruth Curtain, Lecture Notes in Control and Information Sciences **185**, Springer-Verlag, New York, 1992.

132. "New techniques for the control of linear infinite dimensional systems" (with E. W. Kamen and P. Khargonekar), in *Frequency Domain and State Space Methods for Linear Systems* edited by C. Byrnes and A. Lindquist, North Holland, Amsterdam (1986), pages 355-367.

133. "Periodic controllers for robust control of linear time-invariant plants," (with P. P. Khargonekar and K. Poolla), in *Modelling,Identification and Robust Control* edited by C. Byrnes and A. Lindquist, North Holland, Amsterdam (1986), pages 137-147.

134. "Invariant numerical approximations to differential invariant signatures" (with E. Calabi and P. Olver), to appear.

135. "On the nonlinear standard H^∞ problem" (with C. Foias and C. Gu), in *Communications, Computation, Control, and Signal Processing*, edited by A. Paulraj and V. Roychowdhury, Kluwer, Holland, 1997.

136. "Differential invariants and curvature flows in active vision" (with A. Yezzi), in *Operators, Systems, and Linear Algebra* edited by U. Helmke and D. Praetzel-Wolters, Birkhauser-Verlag, 1997.

137. "Gradients, curvature, and visual tracking" (with A. Yezzi), in *Computational Methods for Optimal Design and Control* edited by J. Borggaard, J. Burns, E. Cliff, and S. Schreck, Birkhauser-Verlag, 1998.

138. "Multivariable gain margins and spectral interpolation," in *Open Problems in Mathematical Systems and Control Theory*, edited by V. Blondel, E. Sontag, M. Vidyasagar, and J. Willems, Springer, New York, 1998.

139. "Mean curvature flows, edge detection, and medical image segmentation" (with S. Angenent, S. Haker, A. Yezzi), to appear as a book chapter.

140. "Visual tracking, active vision, and gradient flows" (with A. Yezzi), in *The Confluence of Vision and Control*, edited by G. Hager and D. Kriegman, *Lecture Notes in Control and Information Sciences* **237**, Springer-Verlag, New York, 1998.

141. "Switching surfaces and Groebner bases" (with T. Georgiou), in *Learning, Complexity, and Control*, edited by Y. Yamamoto and S. Hara, *Lecture Notes in Control and Information Sciences* **240**, Springer-Verlag, New York, 1998.

142. "On area preserving maps of minimal distortion" (with S. Angenent, S. Haker, and R. Kikinis), to appear as a book chapter.

Conference Papers

143. "Robust stabilization of systems with uncertain parameters" (with P. P. Khargonekar), *Proceedings of 23rd IEEE Conference on Decision and Control,* Las Vegas, Nevada, December 1984, and MTNS, Stockholm, Sweden, June 1985.

144. "Sensitivity minimization of delay systems" (with C. Foias and G. Zames), *Proceedings of 24th IEEE Conference on Decision and Control*, Fort Lauderdale, Florida, December 1985, 244-249.

145. "Weighted sensitivity minimization for periodic systems" (with A. Feintuch and P. P. Khargonekar), *Proceedings of 24th IEEE Conference on Decision and Control*, Fort Lauderdale, Florida, December 1985, 686-688.

146. "H^∞-optimization theory for distributed systems" (with C. Foias and G. Zames), *Proceedings of 25th IEEE Conference on Decision and Control*, Athens, Greece, December 1986.

147. "Spectral Nevanlinna-Pick interpolation theory," *Proceedings of 26th IEEE Conference on Decision and Control*, Los Angeles, December 1987, 1635-1638.

148. "On the spectra and invertibility of a certain class of operators in control" (with C. Foias), *Proceedings of 26th IEEE Conference on Decision and Control*, Los Angeles, December 1987, 1338-1342.

149. "A solution to the standard H^∞ problem for multivariable distributed systems" (with H. Özbay), *Proceedings of 28th IEEE Conference on Decision and Control*, Tampa, Florida, December 1989, 1444-1446.

150. "On approximately optimal H^∞ controllers for distributed systems" (with H. Özbay), *Proceedings of 28th IEEE Conference on Decision and Control*, Tampa, Florida, December 1989, 1454-1460.

151. "The four block problem for distributed systems" (with C. Foias), *Proceedings of 27th IEEE Conference on Decision and Control*, Austin, Texas, December 1988, 993-998.

152. "Spectral radius interpolation and robust control" (with H. Bercovici and C. Foias), *Proceedings of 28th IEEE Conference on Decision and Control*, Tampa, Florida, December 1989, 916-918.

153. "Remarks on H^∞-optimization of multivariate distributed systems," *Proceedings of 27th IEEE Conference on Decision and Control*, Austin, Texas, December 1988, 985-987.

154. "Conservation laws and the evolution of shape" (with B. Kimia and S. Zucker), *Human/Machine Vision Workshop, SPIE Meetings*, Falmouth, MA, 1991.

155. "Robust control design for a flexible beam using a distributed parameter H^∞ method" (with K. Lenz, B. Morton, H. Özbay), *Proceedings of 28th IEEE Conference on Decision and Control*, Tampa, Florida, December 1989, 2673-2678.

156. "On the nonlinear mixed sensitivity problem" (with D. Enns, C. Foias, T. Georgiou, M. Jackson, B. Schipper), *Proceedings of 28th IEEE Conference on Decision and Control*, Tampa, Florida, December 1989, 986-990.

157. "Controller design for unstable distributed plants" (with H. Özbay and M. C. Smith), *Proceedings of ACC,* 1990, 1583-1588.

158. "Interpolation theory in robust control" (with H. Bercovici and C. Foias), *Proceedings of IFAC*, 1990.

159. "Structured Nevanlinna-Pick and robust design" (with H. Bercovici and C. Foias), *Proceedings of 29th IEEE Conference on Decision and Control*, Honolulu, Hawai, December 1990, 2874-2878.

160. "Spectral tangential interpolation and gain margin problems" (with H. Bercovici and C. Foias), *Proceedings of ACC*, 1990, 2385-2388.

161. "On the two block problem for unstable distributed systems" (with H. Özbay and M. Smith), *Proceedings of 29th IEEE Conference on Decision and Control*, Honolulu, Hawaii, December 1990, 1163-1167.

162. "Computational methods for the H^∞ control of distributed systems," *Proceedings of 30th IEEE Conference on Decision and Control*, Brighton, England, December 1991.

163. "H^∞ optimal controllers for a distributed model of an aircraft" (with D. Enns and H. Özbay), *Proceedings of 30th IEEE Conference on Decision and Control*, Brighton, England, December 1991.

164. "On the optimal two block H^∞ compensators for distributed unstable plants" (with H. Özbay), *Proceedings of ACC*, 1992.

165. "A constructive solution to the gain-phase margin problem" (with Juan Cockburn and Yariv Sidar), *Proceedings of 31st IEEE Conference on Decision and Control*, Arizona, 1992.

166. "A conservation-minded approach to shape" (with B. Kimia and S. Zucker), *Proceedings of IEEE Conference on Intelligent Control*, Philadelphia, 1991.

167. "On area and length preserving geometric diffusions" (with G. Sapiro), *Proceedings of ECCV94*, 1994.

168. "Synthesis methods for robust nonlinear control" (with D. Bugajski and D. Enns), *Proceedings of ACC*, 1993.

169. "Preliminary mu-synthesis design for the ATB-1000" (with D. Bugajski and Dale Enns), *Proceedings of Tenth Army Conference on Applied Mathematics and Computing*, West Point, New York, 1992.

170. "Formulating invariant heat-type curve flows" (with G. Sapiro), *Proceedings of the SPIE Geometric Methods of Computer Vision Conference*, San Diego, 1993.

171. "Robust optimization of distributed parameter systems," *Proceedings of SPIE Conference on Mathematics and Control in Smart Structures*, pages 97-108, San Diego, 1995.

172. "Non-linear shape approximation via the entropy scale space" (with B. Kimia and S. Zucker), *Proceedings of the SPIE Geometric Methods of Computer Vision Conference*, San Diego, 1993.

173. "A lifting technique for the robust stability analysis of systems with structured time-varying perturbations" (with H. Bercovici, C. Foias, and P. Khargonekar), *Proceedings of the Conference on Information Sciences and Systems,* Johns Hopkins University, March 1993.

174. "Affine invariant flows and image smoothing" (with G. Sapiro), *Proceedings of the Conference on Information Sciences and Systems,* Johns Hopkins University, March 1993.

175. "On structured tangential interpolation in robust control" (with H. Bercovici, J. Cockburn, and C. Foias), in *Proceedings of 32nd IEEE Conference on Decision and Control*, December 1993.

176. "Pseudorational functions and H^∞ theory" (with Y. Yamamoto), *Proceedings of ACC*, 1994.

177. "Experiments on geometric image enhancement" (with M. Kaveh, G. Sapiro, Y. L. You), *First IEEE International Conference on Image Processing*, Austin, 1994.

178. "Results in anisotropic diffusion" (with Y. L. You, M. Kaveh, W. Xu), *First IEEE International Conference on Image Processing*, Austin, 1994.

179. "Skew Toeplitz theory and pseudorational transfer functions" (with Y. Yamamoto), *Proceedings of IEEE Conference on Decision and Control*, 1994.

180. "Gradient flows and geometric active contours" (with S. Kichenesamy, A. Kumar, P. Olver, and A. Yezzi), *Proceedings of ICCV*, 1995.

181. "Affine invariant gradient flows" (with P. Olver and G. Sapiro), *Proceedings of International Conference on Partial Differential Equations Computer Vision and Image Processing*, Paris, 1996.

182. "Surface flows for 3D segmentation" (with A. Yezzi), *Proceedings of MTNS*, 1996.

183. "Gradient flow based snake models" (with S. Kichenasamy, A. Kumar, P.Olver, A. Yezzi), *Proceedings of IEEE Conference on Decision and Control*, December 1995.

184. "L^1 minimization approach for the computation of optical flow" (with A. Kumar and G. Balas), *Proceedings of International Conference on Image Processing*, 1995.

185. "Affine gradients, edge detection, and contour finding" (with P. Olver and G. Sapiro), *Proceedings of CVPR*, June 1996.

186. "New solution to the two block H^∞ problem for infinite dimensional stable plants" (with K. Hirata and Y. Yamamoto), *Proceedings of the European Control Conference*, September 1995.

187. "A gradient surface approach to 3D segmentation" (with S. Kichenesamy, P. Olver, and A. Yezzi), *Proceedings of IS&T 49th Annual Conference*, May 1996.

188. "Surface evolution, conformal metrics, 3D contour finding, and 3D segmentation" (with S. Kichenesamy, P. Olver, and A. Yezzi), *MTNS*, June 1996.

189. "Robust estimation for visual motion" (with A. Kumar and G. Balas), *Proceedings of SPIE*, San Diego, California, 1996.

190. "State space formulae for the gap computation" (with K. Hirata and Y. Yamamoto), *Proceedings of IEEE Conference on Decision and Control*, 1996.

191. "Phase transitions and the estimation and control of semiconductor manufacturing processes" (with J. Berg and A. Yezzi), *Proceedings of IEEE Conference on Decision and Control*, 1996.

192. "Shapes, shocks, and wiggles" (with B. Kimia, K. Siddiqi, and S. Zucker), *International Workshop on Visual Form*, June 1997.

193. "Toward real-time estimation of surface motion: isotropy, anisotropy, and self-calibration" (with J. Berg and A. Yezzi), to appear in *Proceedings of IEEE Conference on Decision and Control*, December 1997.

194. "Stereo disparity and L^1 minimization" (with S. Haker, A. Kumar, C. Vogel, and S. Zucker), *Proceedings of IEEE Conference on Decision and Control*, December 1997.

195. "Hyperbolic smoothing of shapes" (with K. Siddiqi, and S. Zucker), *Proceedings of ICCV*, January 1998.

196. "Real-time control of semiconductor etching processes: experimental results" (with J. Berg and T. Higman), *Proceedings of SPIE*, 1997.

197. "Causal power series and the nonlinear standard H^∞ problem" (with C. Foias and C. Gu), *Proceedings of IEEE Conference on Decision and Control*, December 1997.

198. "Knowledge based segmentation of SAR images" (with S. Haker and G. Sapiro), *Proceedings of International Conference on Image Processing*, 1998.

199. "On the psychophysics of the shape triangle" (with B. Kimia, K. Siddiqi, and S. Zucker), submitted to the *Vision/Attention Conference*, Providence, RI, 1999.

200. "On the computation of the gap metric" (with K. Hirata and Y. Yamamoto), *Proceedings of MTNS*, 1998.

201. "Categorical features in shape perception" (with B. Kimia, K. Siddiqi, and S. Zucker), to appear in *ARVO Conference*, 1999.

202. "Conformal surface parametrization for texture mappings" (with S. Angenent, S. Haker, M. Halle, R. Kikinis), Technical Report, Department of ECE, University of Minnesota, December 1998.

203. "On the psychophysics of the shape triangle" (with B. Kimia, K. Siddiqi, and S. Zucker), submitted to the *Vision/Attention Conference*, Providence, RI, 1999.

204. "A Hamiltonian approach to the eikonal equation" (with K. Siddiqi and S. Zucker), submitted to *Proceedings of CVPR'99*.

205. "Conformal geometry and visualization of colon MR images" (with S. Angenent, S. Haker, and R. Kikinis), to appear in *Proceedings of ISCAS'99*.

206. "Computational algebraic geometry and switching surfaces in optimal control" (with T. Georgiou and U. Walther), submitted to *Proceedings of 1999 IEEE Conference on Decision and Control.*

207. "The Hamilton-Jacobi skeleton" (with K. Siddiqi and S. Zucker), submitted to *Proceedings of ICCV'99*.

208. "On the evolution of the skeleton" (with J. August and S. Zucker), submitted to *Proceedings of ICCV'99*.

Book Reviews

209. Book review of *H^∞-Optimal Control and Related Minimax Design Problems*, by T. Başar and P. Bernhard, *SIAM Review* (1994).

210. Book review of *Theory of Limit Cycles,* by Ye Yan-Qian, *Bulletin of the American Mathematical Society* **17** (1987), 178-180.