

## THOMAS NEAL FARRIS

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### Education

Ph.D., Theoretical and Applied Mechanics, Northwestern University, 1986.  
M.S., Theoretical and Applied Mechanics, Northwestern University, 1984.  
B.S., Mechanical Engineering, Rice University, Cum Laude, 1982.

### Experience

**Professor and Head**, School of Aeronautics & Astronautics, Purdue University, 1998-; Professor, 1994-; Associate Professor, 1991-1994; Assistant Professor, 1986-1991. Teach and conduct research in aerospace structures and materials. Administer undergraduate and graduate education and research programs in School of Aeronautics & Astronautics. School consists of 28 faculty and 15 staff members who annually teach approximately 520 undergraduate and 270 graduate students and perform about \$8.5 million in externally funded research.

**Sabbatical Visitor**, Cambridge University Engineering Department, Fall, 1991. Hosted by Professor K.L. Johnson, plastic deformation and collapse of railway rail corners.

**Fellow**, Japan Society for the Promotion of Science, Summer, 1991. Hosted by Professor Y. Murakami of Kyushu University.

**Research Activities** Prof. Farris's research interests are in the area of aerospace structures and materials including tribology, manufacturing processes, and fatigue and fracture.

### Awards and Professional Activities

- National Science Foundation Presidential Young Investigator Award, 1990
- Japan Society for the Promotion of Science Fellowship, 1991
- ASME Burt L. Newkirk Award, 1992
- NAE Frontiers of Engineering Conference, 1996
- ASME/Boeing Structures and Materials Award for outstanding paper of SDM 1998
- *Journal of Strain Analysis* 2002 P E Publishing Award
- AIAA: Fellow(2009); Associate Editor, *Journal of Aircraft*, 1992-1997; General Chair, Structures, Structural Dynamics and Materials Conference, 2001
- ASME: Fellow(2001); Member of Executive Committee of Applied Mechanics Division, 2002-2007; Associate Editor, *Journal of Tribology*, 1994-2000
- IMECHE: Member of Editorial Board, *Journal of Strain Analysis*, 1998-
- Consultant to Army Science Board, 2005-
- W.A. Gustafson Outstanding Undergraduate Teacher Award, 2008

## **Administrative Accomplishments**

- Neil Armstrong Hall of Engineering dedicated October 27, 2007, selected for the 2008 American Institute of Architects, Indiana Chapter, Design Award of Merit. \$57 million state of the art facility for education and research, School alumni and friends contributed a significant portion of the private funds.
- Faculty
  - Faculty head count increased from 21 to 28 (with anticipation of increase to 29 in spring 2009) including one NAE member
  - A range of national and international recognition of faculty
  - Eleven are fellow of at least one major society
- Students
  - Undergraduate enrollment increased from less than 200 to ~520 students with 55% being out-of-state US residents
  - Graduate enrollment increased from ~130 to ~270 students
  - Student recognition by major society awards
  - Initiated distance education MS program
- Research
  - School external research expenditures approximately doubled in the last five years
  - Initiated two new disciplines at the graduate level to leverage multi-disciplinary opportunities and align graduate program with NRC Aerospace Specializations
- Development
  - Increased annual School development activity from ~\$1 million to ~\$3 million
  - Initiated Purdue Outstanding Aerospace Engineer (OAE) alumni recognition program, OAEs provided the bulk of the School's fund raising for Armstrong Hall and Professorships
  - Established Boeing Distinguished Lectureship
- Climate and Inclusiveness
  - Award BS degrees to more women than any of Purdue's aerospace peers
  - Increased number of female faculty from one to five
  - Cited by Dean during reappointment review for great respect for my work by colleagues and staff as well as the belief that I do an excellent job of communicating with all stakeholders
- The External Review Committee (commissioned by the Dean of Engineering) stated the following in their final report to the Dean in December 2006. "The School of Aeronautics and Astronautics at Purdue University is an outstanding academic department which merits its high national rankings. The quality and productiveness of its faculty, staff and student body is high. Further, there is an important and apparent sense of collegiality and cooperation that speaks well for the administration of the School and the nature of the unit's sense of community."

## **Service as External Evaluator and Advisory Boards**

- ABET visitor to 6 universities
- External Evaluator for University of British Columbia Mechanical Engineering Department
- External Evaluator for University at Buffalo Mechanical and Aerospace Engineering Department
- Rice University Mechanical Engineering and Materials Science Advisory Board

## **NRC Panels**

- NRC/NMAB Committee on SBIR Research to Support Aging Aircraft, 1999-2000
- Decadal Survey of Civil Aeronautics Panel C: Structures and Materials, 2006
- Planning Committee for NMAB Workshop on Materials State Awareness, 2007

## **Courses Taught**

1. A&AE 204 Aeromechanics II---Mechanics of Materials (3 credits, taught 17 times to an average of 51 students)
2. A&AE 352 Structural Analysis I (3 credits, taught 13 times to an average of 50 students)
3. A&AE 553 Elasticity in Aerospace Engineering (3 credits, taught 4 times to an average of 25 students)
4. A&AE 558 Finite Element Methods in Aerospace Structures (3 credits, taught 6 times to an average of 30 students)
5. A&AE 559 Mechanics of Friction and Wear (3 credits, taught 14 times to an average of 15 students)
6. A&AE 652 Theory of Plates and Shells (3 credits, taught 4 times to an average of 10 students)

## **Teaching Award**

### **2008 W.A. Gustafson Outstanding Undergraduate Teacher Award:**

Presented annually to an Outstanding Teacher in the Purdue University School of Aeronautics and Astronautics, selected by the juniors and seniors of the student body for excellence in teaching

## Course Evaluation Summary

The scores below are on a 5.0 base with 5 as the highest and 1 as the lowest

SEM	COURSE TITLE	COURSE #	ENROLL.	Course EVAL SCORE	Prof EVAL SCORE	AVG* SCHOOL Course SCORE	AVG* SCHOOL Prof SCORE
F01	Elasticity	553	18	4.2	4.3	4.3	4.5
S02	Aeromechanics II	204	39	4.1	4.6	4.2	4.5
F02	Structural Analysis I	352	82	3.9	4.2	3.9	4.2
S03	Mech of Friction and Wear	559	16	4.7	4.9	4.3	4.4
F03	Aeromechanics II	204	57	4.3	4.8	4.1	4.1
F04	Structural Analysis I	352	93	3.8	4.0	3.8	3.9
S05	Mech of Friction and Wear	559	16	4.7	4.9	4.2	4.3
F05	Aeromechanics II	204	38	4.2	4.4	4.0	4.0
F06	Aeromechanics II	204	62	4.1	4.7	3.9	4.0
S07	Mech of Friction and Wear	559	10	4.1	4.6	4.3	4.4
F07	Finite Elements	558	42	4.2	4.7	4.2	4.4
S08	Aeromechanics II	204	117	4.2	4.7	4.0	4.2

\*Average School Score refers to the average score in the School of Aeronautics & Astronautics for the *level of course* (i.e., 200s, 300s, 600s) during the *semester offered*.

## Graduate Thesis Supervision

### Ph.D. Theses

1. Kim Billy Blair, May 1992, Vice President for R&D, Xenith, LLC, Boston.
2. Minzhu Liu, August 1992, Ford Automatic Transmission, Livonia, MI.
3. Shi-Yew (Sy) Chen, December 1993, NIST, Gaithersburg, MD.
4. Scott Hucker, August 1994, GM Powertrain Div., Pontiac, MI.
5. Yen-Meng (Neil) Chen, December 1994 (IE), Ceramics Manufacturing, Republic of China..
6. Yongqing Ju, May 1997, Gillette, Boston, MA.
7. Lisa Hill, August 1997, Project Engineer, Northrop Grumman, El Segundo, CA.
8. Matt Szolwinski, August 1998, Section Manager, Military Engines, GE Transportation, Cincinnati, OH (**ASME Marshall Petersen Award, 2000**).
9. Shih-Hsiang Chang, December 1998, Assistant Professor, Far East College, Republic of China..
10. Pam McVeigh, August 1999, Manager, ISS Structural Integrity, Boeing, Houston, TX.
11. Ganapathy Harish, August 2000, Owner, IQCAIS, Madras, India (**Best Paper SDM**).
12. Long Jin, August 2001, Armillaire Technologies, Inc

13. Yun Chen, August 2001, AutoDesk.
14. Pakalapati Rajeev, December 2001, Diamond Innovations, Technology Manager, Grinding Products and Coatings (**PE Publishing Award**).
15. Sridhar Kompella, August 2002 (IE), Diamond Innovations, Director, Mesh Technology.
16. Murthy N. Haradanahalli, August 2004, Assistant Professor, IIT Madras.
17. John F. Matlik, December 2004, Rolls-Royce Corporation (**Best Student Paper, SDM**).
18. Bence Bartha, May 2005, United Space Alliance (**Best Student Paper, ASTM**).
19. Guofeng Gao, August 2005, Research Engineer, Cooper Tire and Rubber.
20. Ihab Hanna, May 2006, GM Powertrain.
21. Shyama Kumari, May 2007, Pratt & Whitney.
22. Matthew C. Gean, August 2008, nanoPrecision Products, Inc.

### **M.S. Theses**

1. Robert Samuel, December 1988 (IE), Cummins Engine, Columbus, IN.
2. Shi-Yew (Sy) Chen, August 1989, obtained Ph.D. with TNF.
3. Yen-Meng (Neil) Chen, Dec 1990, obtained Ph.D. with Profs. Chandrasekar and Farris.
4. Scott Hucker, December 1990, obtained Ph.D. with TNF.
5. Lisa Hill, August 1992, obtained Ph.D with TNF.
6. James Mann, May 1994, CEO, M4 Sciences Corp, West Lafayette, IN.
7. Lisa Sack, May 1994, Rockwell, Houston, TX.
8. Steve Slijepcevic, May 1995, Allied Signal, South Bend, IN.
9. Bruce Varney, May 1995, Rolls-Royce, Indianapolis, IN.
10. Matt Szolwinski, August 1995, obtained Ph.D. with TNF.
11. Pamela McVeigh, December 1995, obtained Ph.D. with TNF.
12. Tony Dunlap, Dec 1995, Eng. Supervisor, Adv Mfg Eng., Daimler Chrysler Tech Center.
13. Ganapathy Harish, August 1996, obtained Ph.D. with TNF.
14. Pakalapati Rajeev, August 1997, obtained Ph.D. with TNF.
15. Jeffrey Bougher, May 1998, CFO, M4 Sciences, West Lafayette, IN.
16. William Reimann, August 1998, Black Diamond Sporting Goods Manufacturer.
17. Sridhar Kompella, August 1998, obtained Ph.D with Profs. Chandrasekar and Farris.
18. Srinivasan Ganesh, August 1999(IE), Manufacturing Engineer, Cummins, India.
19. Christopher Tieche, December 1999, Ph.D. at Northwestern.
20. Bence Bartha, May 2000, obtained Ph.D. with TNF.

21. Murthy N. Haradanahalli, December 2000, obtained Ph.D. with TNF.
22. John F. Matlik, May 2001, obtained Ph.D. with TNF.
23. Eddie Perez-Ruberte, August 2001, Honeywell.
24. Matt Gean, May 2004, obtained Ph.D. with TNF.
25. Shyama Kumari, August 2004, obtained Ph.D. with TNF.
26. George Mseis, May 2006, in Ph.D. program at UC Berkeley.

#### **Ph.D. Theses in Progress**

1. Srinivasan Sreeram, "Fretting Fatigue of Aluminum," passed prelim Spring 2007.
2. Narayan Sundaram, "Mechanics of Doubly-Connected Contacts," passed prelim Spring 2007.
3. Mark Boas, "Effect of Surface Treatment on Fretting Fatigue," began program Fall 2003, on leave at the Naval Research Lab.

#### **M.S. Theses in Progress**

1. Nathan Tate, "Fretting Fatigue Crack Propagation in Nickel-Based Superalloys, began program August 2007.
2. Lucas Robinson, "Fatigue of Gears," began program January 2008.

#### **External Examiner**

- Daniele Dini, PhD entitled "Studies in Fretting Fatigue with Particular Application to Almost Compete Contacts," University of Oxford, July 2004.
- Young Suk Kim, PhD entitled "A Draw-Bend Friction Test Applied to Measurement and Modeling of Anisotropic Friction on Sheet Metal," McMaster University, November 2008.

#### **Visitors**

- Prof. T. Sakagami, Osaka University, Spring and Summer, 1997.
- Prof. I.G. Goryacheva, Russian Academy of Sciences, Fall 1998, Fall 1999, Fall 2000, Fall 2001.
- Dr. M. Okane, Toyama University, 1999-2000 Academic Year.
- Jon Madariaga, PhD Candidate, University of Mondragon, 2007

#### **Patents**

1. S. Chandrasekar, W.D. Compton, T.N. Farris, and K.P. Trumble, K. P., "Methods of Forming Nano-Crystalline Structures and Product Formed Thereof," U.S. Patent 6,706,324B2, issued March 16, 2004, Licensed.

2. S. Chandrasekar, W.D. Compton, T.N. Farris and K.P. Trumble, "Method of Forming Nano-Crystalline Structures and Product Formed Thereof," U. S. Patent, 7,294,165B2, issued November 13, 2007, Licensed.
3. S. Chandrasekar, W.D. Compton, T.N. Farris and K.P. Trumble, "Method of Forming Nano-Crystalline Structures," European Patent No. 1347852 issued August 15, 2007, Licensed.

## Published Work

### a. Books

1. *Small Business Innovation Research to Support Aging Aircraft: Priority Technical Areas and Process Improvements*, NRC Committee, National Academy Press, 2001.

### b. Journal Articles

1. Farris, T.N. and Keer, L.M., "Williams' Blister Test Analyzed as an Interface Crack Problem," *International Journal of Fracture*, **27**, 2, pp 91-103 (1985).
2. Keer, L.M., Farris, T.N., and Lee, J.C., "Knoop and Vickers Indentation in Ceramics Analyzed as a Three-Dimensional Fracture," *Journal of the American Ceramic Society*, **69**, 5, pp 392-396 (1986).
3. Keer, L.M. and Farris, T.N., "Effects of Finite Thickness and Tangential Loading on Development of Zones of Microslip in Fretting," *ASLE Transactions*, **30**, 2, pp 203-210 (1987).
4. Lee, J.C., Farris, T.N., and Keer, L.M., "Stress Intensity Factors for Cracks of Arbitrary Shape Near an Interfacial Boundary," *Engineering Fracture Mechanics*, **27**, 1, pp 27-41 (1987).
5. Farris, T.N., Keer, L.M., and Steele, R.K., "The Effect of Service Loading on Shell Growth in Rails," *Journal of the Mechanics and Physics of Solids*, **35**, 6, pp 677-700 (1987).
6. Hanson, M.T., Keer, L.M., and Farris, T.N., "Energy Dissipation in Non-Hertzian Fretting Contact," *STLE Tribology Transactions*, **32**, 2, pp 147-154 (1989).
7. Farris, T.N. and Doyle, J.F., "Wave Propagation in a Split Timoshenko Beam," *Journal of Sound and Vibration*, **130**, 1, pp 137-147 (1989).
8. Sun, C.T. and Farris, T.N., "On the Completeness of The Westergaard Stress Functions," *International Journal of Fracture*, **40**, 1, pp 73-77 (1989).
9. Farris, T.N. and Chandrasekar, S., "On the Characterization and Control of Surface Finishing Damage in Ceramics," *Journal of Mechanical Working Technology*, **20**, pp 69-78 (1989).
10. Samuel, R., Chandrasekar, S., Farris, T.N., and Licht, R.H., "The Effect of Residual Stresses on the Fracture of Ground Ceramics," *Journal of the American Ceramic Society*, **72**, 10, pp 1960-1966 (1989).
11. Farris, T.N., Keer, L.M., and Steele, R.K., "Life Prediction for Unstable Shell Growth in Rails," *ASME Journal of Engineering for Industry*, **112**, 2, pp 175-180 (1990).

12. Doyle, J.F. and Farris, T.N., "A Spectrally Formulated Finite Element for Flexural Wave Propagation in Beams," *International Journal of Analytical and Experimental Modal Analysis*, **5**, 2, pp 99-107 (1990).
13. Chandrasekar, S., Farris, T.N., and Bhushan, B., "Grinding Temperatures for Magnetic Ceramics and Steel," *ASME Journal of Tribology*, **112**, 3, pp 535-541 (1990).
14. Farris, T.N., and Chandrasekar, S., "High Speed Sliding Indentation of Ceramics: Thermal Effects," *Journal of Materials Science*, **25**, 9, pp 4047-4053 (1990).
15. Doyle, J.F. and Farris, T.N., "A Spectrally Formulated Element for Wave Propagation in 3-D Frames," *International Journal of Analytical and Experimental Modal Analysis*, **5**, 4, pp 223-237 (1990).
16. Chen, S.Y., Farris, T.N., and Chandrasekar, S., "Sliding Microindentation Fracture of Brittle Materials," *STLE Tribology Transactions*, **34**, 2, pp 161-168 (1991).
17. Chandrasekar, S., Farris, T.N., Shaw, M.C., and Bhushan, B., "Surface Finishing Processes for Magnetic Recording Head Ceramics," *ASME Advances in Information Storage Systems*, **1**, pp 353-373 (1991).
18. Farris, T.N. and Doyle, J.F., "A GLOBAL/LOCAL Approach to Lengthwise Cracked Beams: Static Analysis," *International Journal of Fracture*, **50**, pp 131-141 (1991).
19. Farris, T.N., "Mechanics of Fretting Fatigue Tests of Contacting Dissimilar Elastic Bodies," *STLE Tribology Transactions*, **35**, 2, pp 346-352 (1992).
20. Hebbar, R., Chandrasekar, S. and Farris, T.N., "Ceramic Grinding Temperatures," *Journal of the American Ceramic Society*, **75**, 10, pp 2742-48 (1992).
21. Farris, T.N., and Doyle, J.F., "A GLOBAL/LOCAL Approach to Lengthwise Cracked Beams: Dynamic Analysis," *International Journal of Fracture*, **60**, 2, pp 147-156 (1993).
22. Chauhan, R., Ahn, Y., Chandrasekar, S., and Farris, T.N., "Role of Indentation Fracture in Free Abrasive Machining of Ceramics," *Wear*, **162-164**, Part A, pp 246-257 (1993).
23. Hucker, S.A. and Farris, T.N., "Modified Crack Closure Method Using Boundary Elements," *Engineering Fracture Mechanics*, **46**, 5, pp 763-772 (1993).
24. Liu, M. and Farris, T.N., "Three Dimensional Infinite Boundary Elements for Contact Problems," *International Journal for Numerical Methods in Engineering*, **36**, 19, pp 3381-3398 (1993).
25. Farris, T.N. and Liu, M., "Boundary Element Crack Closure Calculation of Three Dimensional Stress Intensity Factors," *International Journal of Fracture*, **60**, 1, pp 33-47 (1993).
26. Su, S.G. and Farris, T.N., "Generalized Characteristic Method of Elastodynamics," *International Journal of Solids and Structures*, **31**, 1, pp 109-126 (1994).
27. Chen, S.Y. and Farris, T.N., "Boundary Element Crack Closure Calculation of Axisymmetric Stress Intensity Factors," *Computers and Structures*, **50**, 4, pp 491-497 (1994).
28. Farris, T.N. and Chandrasekar, S., "Wear Mechanisms in Ceramic Machining," *Applied Mechanics Reviews*, **47**, #6, Part 2, S204-208, (1994).



29. Liu, M. and Farris, T.N., "Effect of Three Dimensional Near Surface Defects on Rolling and Sliding Contact Fatigue," *ASME Journal of Tribology*, **116**, #4, pp 841-849, (1994).
30. Mann, J.B., Farris, T.N., and Chandrasekar, S., "Effects of Friction on Contact of Transverse Ground Surfaces," *ASME Journal of Tribology*, **116**, #3, pp 430-438, (1994).
31. Kurtz, R.D., Farris, T.N., and Sun, C.T., "The Numerical Solution of Cauchy Singular Integral Equations with Application to Fracture," *International Journal of Fracture*, **66**, #2, pp 139-154 (1994).
32. Chen, S.Y., Farris, T.N., and Chandrasekar, S., "Contact Mechanics of Hertzian Cone Cracking," *International Journal of Solids and Structures; Special Topics in the Theory of Elasticity: A Volume in Honor of Professor John Dundurs*, **32**, #3/4, pp 329-340 (1995).
33. Hill, L.R. and Farris, T.N., "Spectral Boundary Element Method for Transient Heat Conduction," *International Journal of Numerical Methods in Heat & Fluid Flow*, **5**, #9, pp 813-827 (1995).
34. Doyle, J.F. and Farris, T.N., "Structural Mechanics Modeling of the Impact of a Double Cantilever Beam," *International Journal of Fracture*, **76**, pp 311-326 (1996).
35. Ahn, Y., Chandrasekar, S., and Farris, T.N., "Determination of Surface Residual Stresses in Machined Ceramics using Indentation Fracture," *ASME Journal of Manufacturing Science and Engineering*, **118**, #4, pp 483-489 (1996).
36. Madhavan, V., Farris, T.N., Chandrasekar, S., and Craig, L., "FEM Comparison of Ball and Roller Bullgears," *STLE Tribology Transactions*, **39**, 2, pp 286-295 (1996).
37. Farris, T.N., "Effect of Overlapping Wheel Passages on Residual Stress in Rail Corners," *Wear*, **191**, #1-2, pp 226-236 (1996).
38. Ju, Y. and Farris, T.N., "Spectral Analysis of Two-Dimensional Contact Problems," *ASME Journal of Tribology*, **118**, #2, pp 320-328 (1996).
39. Blair, K.B., Krousgrill, C.M., and Farris, T.N., "Non-linear Dynamic Response of Shallow Arches to Harmonic Forcing," *Journal of Sound and Vibration*, **194**, #3, pp 355-367 (1996).
40. Szolwinski, M.P. and Farris, T.N., "Mechanics of Fretting Fatigue Crack Formation," *Wear*, **198**, pp 93-107 (1996).
41. Ju, Y. and Farris, T.N., "FFT Thermoelastic Solutions for Moving Heat Sources," *ASME Journal of Tribology*, **119**, #1, pp 156-162 (1997).
42. Chandrasekar, S. and Farris, T.N., "Machining and Surface Finishing of Brittle Solids," *SADHANA-Academy Proceedings in Engineering Sciences*, **22**, Part 3, pp 473-481 (1997).
43. Bulsara, V.H., Ahn, Y., Chandrasekar, S., and Farris, T.N., "Polishing and Lapping Temperatures," *ASME Journal of Tribology*, **119**, #1, pp 163-170 (1997).
44. McVeigh, P.A. and Farris, T.N. "Finite Element Analysis of Fretting Stresses," *ASME Journal of Tribology*, **119**, #4, pp 797-801 (1997)
45. Blair, K.B., Krousgrill, C.M., and Farris, T.N., "Harmonic Balance and Continuation Techniques in the Dynamic Analysis of Duffing's Equation," *Journal of Sound and Vibration*, **202**(5), pp 717-731 (1997).

46. Chang, S.H., Balasubramhanya, S., Chandrasekar, S., Farris, T.N., and Hashimoto, F., "Forces and Specific Energy in Superfinishing of Hardened Steel," *Annals of the CIRP*, **46**(1) pp 257-260 (1997).
47. Hill, L.R. and Farris, T.N., "Three-Dimensional Piezoelectric Boundary Element Method," *AIAA Journal*, **36**(1) pp 102-108 (1998).
48. Bulsara, V.H., Chandrasekar, S., and Farris, T.N., "Mechanics of Polishing," *ASME Journal of Applied Mechanics*, **65**(2) pp 410-416 (1998).
49. Harish, G. and Farris, T.N., "Shell Modeling of Fretting in Riveted Lapjoints," *AIAA Journal*, **6**(6) pp 1087-1093 (1998).
50. Ahn, Y., Farris, T.N., and Chandrasekar, S., "Sliding Microindentation Fracture of Brittle Materials: Role of Elastic Stress Fields," *Mechanics of Materials*, **29**(3-4) pp 143-152 (1998).
51. Szolwinski, M.P. and Farris, T.N., "Observation, Analysis and Prediction of Fretting Fatigue in 2024-T351 Aluminum Alloy," *Wear*, **221**(1), pp 24-36 (1998).
52. Ju, Y., Farris, T.N., and Chandrasekar, S., "Theoretical Analysis of Heat Partition and Temperatures in Grinding," *ASME Journal of Tribology*, **120**(4) pp 789-794 (1998).
53. Hill, L.R. and Farris, T.N., "Piezoelectric Boundary Element Crack Closure Calculation of 3D Strain Energy Release Rates," *Journal of Intelligent Material Systems and Structures*, **9**(4) (1998).
54. Szolwinski, M.P., Harish, G., Farris T.N., and Sakagami, T., "In-Situ Measurement of Near-Surface Fretting Contact Temperatures in an Aluminum Alloy," *ASME Journal of Tribology*, **121**(1) pp 11-19 (color plots p 340) (1999).
55. Szolwinski, M.P., Matlik, J.F., and Farris, T.N., "Effects of HCF Loading on Fretting Fatigue Crack Nucleation," *International Journal of Fatigue*, **21**, pp 671-677 (1999).
56. McVeigh, P.A., Harish, G., Farris, T.N. and Szolwinski, M.P., "Modeling Contact Conditions in Nominally-Flat Contacts for Application to Fretting Fatigue of Turbine Engine Components," *International Journal of Fatigue*, **21**, pp S157-165 (1999).
57. Szolwinski, M.P., Harish, G., McVeigh, P.A. and Farris, T.N., "Experimental Study of Fretting Crack Nucleation in Aerospace Alloys with Emphasis on Life Prediction," *ASTM STP 1367, Fretting Fatigue: Current Technologies and Practices*, D.W. Hoepfner, V. Chandrasekaran and C.B. Elliot, Eds, pp 267-281 (2000).
58. Harish, G., Szolwinski, M.P., Farris, T.N. and Sakagami, T., "Evaluation of Fretting Stresses Through Full-Field Temperature Measurements," *ASTM STP 1367, Fretting Fatigue: Current Technologies and Practices*, D.W. Hoepfner, V. Chandrasekaran and C.B. Elliot, Eds, pp 423-435 (2000).
59. Farris, T.N., Szolwinski, M.P. and Harish, G., "Fretting in Aerospace Structures and Materials," *ASTM STP 1367, Fretting Fatigue: Current Technologies and Practices*, D.W. Hoepfner, V. Chandrasekaran and C.B. Elliot, Eds pp 523-537 (2000).
60. Chang, S-H., Farris, T.N., and Chandrasekar, S., "Contact Mechanics of Superfinishing," *ASME Journal of Tribology*, **122**, #2, pp 388-393 (2000).

61. Szolwinski, M.P. and Farris, T.N., "Linking Riveting Process Parameters to the Fatigue Performance of Riveted Aircraft Structures," *AIAA Journal of Aircraft*, **37**(1) pp 130-137 (2000).
62. Madhavan, V., Chandrasekar, S. and Farris, T.N., "Machining as a Wedge Indentation," *ASME Journal of Applied Mechanics*, **67**(1) pp 128-139 (2000).
63. Farris, T.N., Harish, G., Tiece, C., Sakagami, T., Szolwinski, M.P., "Experimental Tools for Characterizing Fretting Contacts," *JSME International Journal Series A-Mechanics and Material Engineering*, **43**(4) pp 374-383 (2000).
64. Goryacheva, I.G., Rajeev, P.T. and Farris, T.N., "Wear in Partial Slip Contact," *ASME Journal of Tribology*, **123**(4) pp 848-856 (2001).
65. Ackroyd, B., Akcan, S., Chhabra, P., Krishnamurthy, K., Madhavan, V., Chandrasekar, S., Compton, W.D., and Farris, T.N., "Exploration of Contact Conditions in Machining," *Proceedings of the I MECH E, Journal Part B, Engineering Manufacture*, **215**(B4) pp 493-507 (2001).
66. Kompella, S., Farris, T.N., and Chandrasekar, S., "Techniques for Rapid Characterization of Grinding Wheel-Workpiece Combinations," *Proceedings of the I MECH E Journal, Part B, Engineering Manufacture*, **215**(B10) pp 1385-1395 (2001).
67. Madhavan, V., Chandrasekar, S. and Farris, T.N., "Direct Observations of the Chip-Tool Interface in the Low Speed Cutting of Pure Metals," *ASME Journal of Tribology*, **124**(3) pp 617-626 (2002).
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63. Harish, G. and Farris, T.N., "An Integrated Approach for Prediction of Fretting Crack Nucleation in Riveted Lap Joints," *Proc. 40<sup>th</sup> AIAA/ASME/ASCE/ASC Structures, Structural Dynamics, and Materials Conf.*, CD, St Louis, MO, April 1999.
64. McVeigh, P.A. and Farris, T.N., "Analysis of Surface Stresses and Stress Intensity Factors Present During Fretting Fatigue," *Proc. 40<sup>th</sup> AIAA/ASME/ASCE/ASC Structures, Structural Dynamics, and Materials Conf.*, v 2, pp 1188-1196, CD-ROM, St Louis, MO, April 1999.
65. Szolwinski, M.P., Tieche, C., Harish, G., Farris, T.N., Sakagami, T., and Heinstejn, M., "Mechanics of Finite Width Fretting Contacts," *Proc. SEM Conf. on Theoretical, Experimental and Computational Mechanics*, pp 314-317, Cincinnati, June 1999.
66. Sakagami, T., Harish, G., Farris, T.N., and Szolwinski, M.P., "Observing and Modeling of Widespread Fatigue Damage in Riveted Aircraft Structures," *Proc. SEM Conf. on Theoretical, Experimental and Computational Mechanics*, pp 686-689, Cincinnati, June 1999.
67. Harish, G., Farris, T.N., and Szolwinski, M.P., "Fretting Crack Nucleation in Riveted Lap Joints: Predictions and Experiments," *Proc. ICAF '99, Structural Integrity for the Next Millennium*, pp 1107-1115, Seattle, WA, July 1999.
68. Farris, T.N., Harish, G., Tieche, C, Sakagami, T., and Szolwinski, M.P., "Experimental Tools for Characterizing Fretting Contacts," *Proc. Int. Conf. on Advanced Technology in Experimental Mechanics*, pp 256-263, Ube, Japan, July 1999 (Keynote Lecture).
69. Farris, T.N., Harish, G., Szolwinski, M.P., and Sakagami, T., "Observing and Modeling Fretting Fatigue in Lap Joints," *Proc. JSME Annual Meeting*, paper #1026, pp 265-268, Tokyo, July 1999 (Invited Lecture).
70. Ju, Y., Farris, T.N., and Chandrasekar, S., "Effects of Grinding Conditions on Heat Partition and Temperatures in Grinding," *The Advancing Frontier of Engineering Tribology: Proc 1999 STLE/ASME H.S. Cheng Tribology Surveillance*, pp 90-95, Orlando, October 1999.
71. Akcan, S., Shah, S., Moylan, S.P., Chhabra, P.N., Chandrasekar, S. and Farris, T.N., "Characteristics of White Layers Formed in Steels by Machining," *ASME MED Vol. 10, Manufacturing Science and Engineering*, pp 789-795, Nashville, TN, November 1999.
72. Chang, S.H., Farris, T.N., and Chandrasekar, S., "Experimental Characterization of Superfinishing," *ASME MED Vol. 10, Manufacturing Science and Engineering*, pp 411-421, Nashville, TN, November 1999.
73. Harish, G., Farris, T.N., Wang, H., and Grandt, A.F., "Nucleation and Growth of Cracks in Lapjoints," *Proc. USAF Aircraft Structural Integrity Program*, 23 pages, San Antonio, TX, November-December 1999.
74. Farris, T.N., Harish, G., McVeigh, P.A., and Murthy, H., "Prediction and Observation of Fretting Fatigue of Ti-6Al-4V Subjected to Blade/Disk Type Contacts," *Proc of the 5<sup>th</sup> National Turbine Engine High Cycle Fatigue (HCF) Conference* on CD, Session 13, 11 pages, Chandler, AZ, March 2000.
75. Murthy, H., Harish, G. and Farris, T.N., "Influence of Contact Profile on Fretting Crack Nucleation in a Titanium Alloy," *Proc. 41<sup>st</sup> AIAA/ASME/ASCE/ASC Structures, Structural Dynamics, and Materials Conf.*, CD, Atlanta, GA, April 2000.

76. Slavik, D.C., McClain, R.D., Farris, T.N. and Murthy, H., "Fatigue Crack Initiation Modeling for Applications with Stress Gradients in Ti-6Al-4V, *Proc. of the 6<sup>th</sup> National Turbine Engine High Cycle Fatigue (HCF) Conf*, CD Presentation 1, Jacksonville, FL, March 2001.
77. Hartle, M.S., Farris, T.N., Matlik, J.F. and Rajeev, P.T., "A Hybrid Approach to 3D Edge of Contact Stress Analysis using Singular Integral Equations," *Proc of the 6<sup>th</sup> National Turbine Engine High Cycle Fatigue (HCF) Conference*, CD Presentation 42, Jacksonville, FL, March 2001. Farris, T.N., Murthy, H., Perez-Ruberte, E. and Rajeev, P.T., "Experimental Characterization of Fretting Fatigue of Engine Alloys," *Proc. of the 6<sup>th</sup> National Turbine Engine High Cycle Fatigue (HCF) Conf*, CD Presentation 19, Jacksonville, FL, March 2001.
79. Rajeev, P. T. and Farris, T. N., "Two Dimensional Contact of Dissimilar/Anisotropic Materials," in *Proceedings of 42nd AIAA/ASME/ASCE/AHS/ASC Structures, Structural Dynamics and Materials Conference*, **1**, pp 515-522, Seattle, WA, 2001.
80. Murthy, H., Farris, T.N., and Slavik, D.C. "Fretting Fatigue of Ti-6Al-4V Subjected to Blade/Disk Contact Loading," *Materials Science Research International Special Technical Publication 1---Materials Science for the 21<sup>st</sup> Century*, Conference on Materials Science for the 21<sup>st</sup> Century to celebrate the 50<sup>th</sup> Anniversary of Japan Society of Materials Science, Osaka, May 2001, pp 200-207.
81. Murthy, H., Rajeev, P.T. and Farris, T.N., "Fretting Fatigue in Turbine Engine Blade/Disk Contacts," *Proc. of the 13<sup>th</sup> PERC Symposium*, Huntsville, AL, October 2001, pp 330-338.
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83. Calcaterra, J. and Farris, T.N., "Analysis of Turbine Engine Attachment Fatigue Using Integral Equation Methods," *Proc. USAF Aircraft Structural Integrity Program Conference*, Williamsburg, VA, December 2001.
84. Rajeev, P.T. and Farris, T.N., "Load History Effects in Fretting of Dissimilar Contacting Materials," in *Proceedings of 43rd AIAA/ASME/ASCE/AHS/ASC Structures, Structural Dynamics and Materials Conference*, Denver, CO, April 2002.
85. Murthy, H., Farris, T.N. and Okane, M. "Investigation of Fretting Characteristics of Turbine Materials at Higher Temperatures," in *Proceedings of 43rd AIAA/ASME/ASCE/AHS/ASC Structures, Structural Dynamics and Materials Conference*, Denver, CO, April 2002.
86. Farris, T.N., Murthy, H. and Matlik, J.F., "Fretting Fatigue of Contacts between Engine Alloys of Dissimilar Elastic Properties," *Proc of the 7<sup>th</sup> National Turbine Engine High Cycle Fatigue (HCF) Conference*, West Palm Beach, FL, May 2002.
87. Murthy, H., Rajeev, P.T. and Farris, T.N., "Fretting Fatigue of Ti6Al4V/Ti6Al4V and Ti6Al4V/In718 Subjected to Blade/Disk Contact Loading," *Fatigue 2002 The 8<sup>th</sup> International Fretting Fatigue Congress*, Stockholm, Sweden, Ed A.F. Blom, EMAS, Volume 3, pp 2153-2160, June 2002.

88. Rajeev, P.T., Murthy, H. and Farris, T.N., "Load History Effects on Fretting Contacts of Isotropic Materials," *Proc of ASME Turbo Expo 2002*, Amsterdam, June 2002, GT 2002-30297.
89. Farris, T.N., Murthy, H., Garcia, D.B., Matlik, J.F., "Fretting Fatigue of Single Crystal/Polycrystalline Nickel Subjected to Blade/Disk Contact Loading," *Proc. World Space Congress*, Houston, TX, IAC-02-I.1.08, October 2002.
90. Narayanan, V., Krishnamurthy, K., Hwang, J., Kompella, S., Chandrasekar, S., Farris, T.N., and Madhavan, V., "Measurement of Temperature Field at the Tool-Chip Interface," *Proc. Of NSF Workshop on Research Needs in Thermal Aspects of Material Removal Processes*, Ed R. Komanduri, Stillwater, OK, pp 63-69, June 2003.
91. Hwang, J., Kompella, S., Hanna, I., Chandrasekar, S. and Farris, T.N., "Analysis and Measurement of Grinding Temperatures," *Proc. Of NSF Workshop on Research Needs in Thermal Aspects of Material Removal Processes*, Ed R. Komanduri, Stillwater, OK, pp 202-212, June 2003.
92. Murthy, H. and Farris, T.N., "Elevated Temperature Fretting of Turbine Materials Subjected to Engine Type Loading," in *Proceedings of 44<sup>th</sup> AIAA/ASME/ASCE/AHS/ASC Structures, Structural Dynamics and Materials Conference*, Norfolk, VA, April 2003.
93. Matlik, J.F. and Farris, T.N., "High Temperature, High Frequency Fretting Fatigue Investigations," AIAA 2003-1681 in *Proceedings of 44<sup>th</sup> AIAA/ASME/ASCE/AHS/ASC Structures, Structural Dynamics and Materials Conference*, Norfolk, VA, April 2003 [Outstanding Student Paper].
94. Farris, T.N., Murthy, H. and Matlik, J.F., "Fretting Fatigue of Contacts between Engine Alloys of Dissimilar Elastic Properties," *Proc of the 8<sup>th</sup> National Turbine Engine High Cycle Fatigue (HCF) Conference*, Monterey, CA, April 2003.
95. Widdle, Jr., R.D., Farris, T.N., Bajaj, A.K., Davies, P., "Modeling the contact stiffness between a 2D Voronoi Honeycomb and a Flat Rigid Surface," in *Mechanical Properties of Nanostructured Materials and Nanocomposites*, I. Ovid'ko, C.S. Pande, R. Krishnamoorti, E. Lavernia, G. Skandan, eds., Materials Research Society Symposium Proceedings, V. 791, 2004.
96. Matlik, J.F. and Farris, T.N., "Fretting of Single Crystal/Polycrystalline Nickel Contacts at Elevated Temperature and Frequency," AIAA 2004-1551 in *Proceedings of 45<sup>th</sup> AIAA/ASME/ASCE/AHS/ASC Structures, Structural Dynamics and Materials Conference*, Palm Springs, CA, April 2004.
97. Farris, T.N., Murthy, H. and Gao, G., "High-Temperature Fretting Fatigue," *Proc of the 9<sup>th</sup> National Turbine Engine High Cycle Fatigue (HCF) Conference*, Pinehurst, NC, April 2004.
98. Murthy, H. and Farris, T.N., "High Temperature Fretting Fatigue of Single Crystal Nickel," *Proc of the 10<sup>th</sup> National Turbine Engine High Cycle Fatigue (HCF) Conference*, New Orleans, LA, March 2005.
99. Gean, M. and Farris, T.N., "Finite Element Analysis of the Mechanics of Blade/Disk Contacts," AIAA 2005-1907 in *Proceedings of 46<sup>th</sup> AIAA/ASME/ASCE/AHS/ASC Structures, Structural Dynamics and Materials Conference*, Austin, TX, April 2005.

100. Kumari, S. and Farris, T.N., "Statistical Analysis of Effect of Surface Profile on Fretting Fatigue Life for Ti-6Al-4V," *Proceedings of 47<sup>th</sup> AIAA/ASME/ASCE/AHS/ASC Structures, Structural Dynamics and Materials Conference*, Newport, RI, May 2006.
101. Gean, M.C. and Farris, T.N., "Elevated Temperature Fretting Fatigue of Ti-17," *Proc of the 5<sup>th</sup> Int Sym on Fretting Fatigue*, Montreal, April 2007.
102. Sreeram, S., Garcia, D.B., Gean, M.C., Murthy, H., and Farris, T.N., "Fretting Fatigue Testing of Laser Shock Peened Ti-6Al-4V," *Proc of the 5<sup>th</sup> Int Sym on Fretting Fatigue*, Montreal, April 2007.
103. Kumari, S. and Farris, T.N., "Statistical Study of Ti-6Al-4V with Contact Surface Profile and Friction Variation," *Proc of the 5<sup>th</sup> Int Sym on Fretting Fatigue*, (Keynote Paper) Montreal, April 2007.
104. Sundaram, N. and Farris, T.N., "Mechanics of Doubly-Connected Contacts," *ASME Applied Mechanics and Materials Conference*, Austin, June 2007.
105. Gean, M.C. and Farris, T.N., "Mechanics Modeling of Firtree Dovetail Contacts," *Proceedings of 49<sup>th</sup> AIAA/ASME/ASCE/AHS/ASC Structures, Structural Dynamics and Materials Conference*, Schaumburg, IL, April 2008.
106. Sundaram, N. and Farris, T.N., "Recent Progress in Numerical and Analytical 2D Contact Mechanics," Drucker Medalist Symposium, ASME International Mechanical Engineering Congress and Exposition, Boston, MA, May 2008.
107. Gean, M.C, Tate, N.J., and Farris, T.N., "Fretting Fatigue of Nickel Based Superalloys at Elevated Temperature," *Proceedings of 50<sup>th</sup> AIAA/ASME/ASCE/AHS/ASC Structures, Structural Dynamics and Materials Conference*, Palm Springs, CA, May 2009.

#### **h. Publications in Commercial Magazines**

1. Hucker, S.A., Mann, J.B., Farris, T.N., and Chandrasekar, S., "Thermal Aspects of Grinding with Superabrasives: Part I," *Abrasives Magazine*, Oct/Nov 1996, pp 24-27.
2. Hucker, S.A., Mann, J.B., Farris, T.N., and Chandrasekar, S., "Thermal Aspects of Grinding with Superabrasives: Part II," *Abrasives Magazine*, Dec 1996/Jan 1997, pp 5-7,28-30.
3. Hwang, J., Kompella, S., Chandrasekar, S., and Farris, T.N., "Direct Measurement of Workpiece Temperature Field in Surface Grinding," *Abrasives Magazine*, April/May 2002, pp 15-18.

#### **i. Book Reviews**

1. *Principles of Abrasive Machining*, MC Shaw, Reviewed by S. Chandrasekar and T.N. Farris, *Applied Mechanics Reviews*, **50**(12, Part 1), p B121, December 1997

#### **Invited Presentations**

1. "Contact Loading Fracture in Rails," Michigan State University, Department of Metallurgy, Mechanics and Materials Science, May 1987.

2. "The Body Force Method Applied to 3-Dimensional Crack Problems," Purdue Geomechanics Seminar, October 1988.
3. "Wave Propagation in Cracked Beams," Arizona State University, Department of Mechanical and Aerospace Engineering, February 1989.
4. "Cylindrical Cracking of Composites," Alcoa Technical Center, Pittsburgh, PA, November 1990.
5. "Some Mathematical Issues in Fracture," University of Maryland, Institute for Physical Science and Technology, February 1991.
6. "Ceramic Machining," Kyushu University, Fukuoka, Japan, June 1991.
7. "Applications of Fracture Mechanics in Ceramic Machining," Nagoya University, Nagoya, Japan, July 1991.
8. "Applications of Fracture Mechanics in Tribology," Meeting of Japan Society of Materials Science Fracture Mechanics subcommittee on Tribology, Kyoto, Japan, July 1991.
9. "Surface Finishing Processes for Ceramics," Nippon Steel, Chiba, Japan, August 1991.
10. "Surface Finishing Processes for Magnetic Recording Head Ceramics," Alps Electric Company, Niigata, Japan, August 1991.
11. "Mechanics of Fine Finishing Processes for Ceramics," Cambridge University Engineering Department, October 1991.
12. "A GLOBAL/LOCAL Approach to Wave Propagation in Cracked Beams," Oxford University Engineering Department, October 1991.
13. "Mechanics of Fine Finishing of Ceramics," Northwestern University Mechanics Colloquia, March 1992.
14. "Purdue Grinding Research," Norton Company, September 1993.
15. "The Nature of Ground Surfaces," Workshop on the Mechanics and Materials Science of Contact: Issues and Opportunities, Vanderbilt University, July 1994.
16. "Thermal Aspects of Grinding," Purdue University Materials Engineering Seminar, January 1995.
17. "Fretting Fatigue of Aging Aircraft," EUROMECH Fretting Symposium, Oxford, March 1996.
18. "Thermal Aspects of Grinding," University of Kentucky Mechanical Engineering Colloquium, May 1997.
19. "Manufacturing of Precision Mechanical Components: Global/Local Mechanics of Grinding," University of Texas Manufacturing 2002 Lecture Series, Feb 1998.
20. "Mechanics of Fretting Fatigue," University of Texas Solids, Structures and Materials Seminar, Feb 1998.
21. "Fretting Fatigue of Aerospace Structures," United Technologies Research Center, April 1999.



22. "Experimental Tools for Characterizing Fretting Contacts," Keynote Lecture at Int. Conf. on Advanced Technology in Experimental Mechanics, Ube, Japan, July 1999.
23. "Observing and Modeling Fretting Fatigue in Lap Joints," Invited paper at JSME Annual Meeting, Tokyo, July 1999.
24. "Fretting Fatigue of Aerospace Structures," Osaka University, July 1999.
25. "Fretting Fatigue of Aerospace Structures," Georgia Tech, April 2000.
26. "Temperature Measurements in Fretting," Toyama University, May 2001.
27. "Fretting Fatigue of Aircraft Engines," University of Michigan, November 2001.
28. "Heat Partition and Temperatures in Grinding," Michigan Tech, December 2001.
29. "Mechanics of Fretting Fatigue," Oxford University Engineering Department, January 2003.
30. "Fretting Fatigue of Lapjoints," National Research Council, Ottawa, Canada, July 2003.
31. "Fretting Fatigue of Aerospace Structures," University of Florida, October 2003.
32. "Fretting Fatigue," GE GRC Advanced Mechanical Technologies Seminar Series, Albany, NY, June 2004.
33. "Fretting Fatigue of Aerospace Structures," Northwestern University, January 2005
34. "Fretting Fatigue of Aerospace Structures," University of Illinois, February 2005.
35. "Fretting Fatigue of Aerospace Structures," Korean Advanced Institute of Science and Technology, Seoul, December 2005
36. "Fretting Fatigue of Aerospace Structures," Rice University, February 2006.
37. "Fretting Fatigue of Aerospace Structures," Iowa State University, March 2007.

**Research Funding** (Totaling more than \$22 million of which TNF's share is >\$5 million)

1. T.N. Farris, PI, "Wear Model Development for Engineering Ceramics," NSF Engineering Initiation Award, September 1, 1987 to August 31, 1990, \$60,000.
2. T.N. Farris, PI, "Cylindrical Cracking of Composites," Alcoa Foundation Grant, May 1, 1989 to August 31, 1991, \$15,000.
3. S. Chandrasekar and T.N. Farris, co-PIs, "Engineering Research Equipment Grant: Surface Finishing of Ceramics; Acquisition of Lapping Equipment and Interference Microscope," NSF, August 1, 1989 to January 31, 1991, \$74,000.
4. T.N. Farris, PI, "Presidential Young Investigator Award in Tribology," NSF, September 1, 1990 to August 31, 1996, \$312,500.
5. T.N. Farris and S. Chandrasekar, co-PIs, "Controlled Stress CBN Grinding of Bearing Steels," Timken, September 1, 1990 to August 31, 1994, \$130,000 (TNF's share is \$65,000).

6. T.N. Farris, PI, Japan Society for Promotion of Science Fellowship for two months summer tour through several Japanese Universities in 1991. The fellowship included all travel expenses and stipend equivalent to full salary, approximately \$15,000.
7. S. Chandrasekar, H.T. Yang, D.C. Anderson, and T.N. Farris, co-PIs, "Intelligent Design Analysis for Manufactured Components," NSF Engineering Research Center for Intelligent Manufacturing Systems (TNF's share is \$173,111 for December 1991 to September 1994).
8. T.N. Farris, PI, "Residual Stresses in Rail Corners," Association of American Railroads, June 1992 to December 1993, \$24,665.
9. T.N. Farris, PI, "Calculation of Turbine Disk/Blade Attachment Stress Intensity Factors," Indiana Space Grant Consortium, September 1992 to August 1993, \$6,504.
10. T.N. Farris, PI, "CBN Grinding of M2 Steel: Manufacturing Aspects," Cummins Engine Company, November 1, 1992 to June 30, 1994, \$51,414.
11. A.F. Grandt, PI, T.N. Farris, B.M. Hillberry, E.P. Kvam, G.P. McCabe, C.T. and Sun, co-PIs, "Materials Degradation and Fatigue in Aerospace Structures," AFOSR, July 1, 1993 to June 30, 1997, \$3,160,000 (TNF's share is \$451,711).
12. T.N. Farris, PI, "Mechanics of Roller Straightening," Association of American Railroads, September 1, 1993 to December 31, 1994, \$29,678.
13. S. Chandrasekar, W.D. Compton, J.F. Tu, and T.N. Farris, co-PIs, "Engineering Research Equipment Grant: High-Speed, Precision Cylindrical Grinding," NSF, September 1, 1994 to August 31, 1996, \$165,000.
14. T.N. Farris and S. Chandrasekar, co-PIs, "Analysis of Bullgear/Bearing Assembly," Naval Surface Warfare Center, July 1, 1994 to December 31, 1994, \$24,600 (TNF's share is \$12,300).
15. T.N. Farris, PI, "Mechanics of Ceramic Machining," NIST, August 1, 1994 to July 31, 1996, \$90,300.
16. J.J. Solberg, PI, D.C. Anderson, S. Chandrasekar, W.D. Compton, T.N. Farris, and J.M. Woodall, co-PIs, "Center for Collaborative Manufacturing," NSF, October 1994 to September 1999, \$10,000,000.
17. S. Heister, G.A. Blaisdell, T.N. Farris, and S.P. Schneider, co-PIs, "Aerospace Post-Processing Visualization Laboratory," AFOSR, December 1994 to December 2002, \$91,266.
18. S. Chandrasekar and T.N. Farris, co-PIs, "Single Step Finish Machining of Hardened Steels Using CBN Tools," Cummins Engine Company, January 1, 1995 to December 31, 1996, \$110,000 (TNF's share is \$55,000).
19. T.N. Farris and S. Chandrasekar, co-PIs, "Simulation of Quenching of Steels," A Finkl & Sons Co and Horsburgh & Scott, January 1, 1995 to August 31, 1998, \$125,000 (TNF's share is \$62,500).
20. S. Chandrasekar and T.N. Farris, co-PIs, "Semi-Automatic SiC Slicing System," Rogers Tool Works, December 1, 1994 to May 31, 1997, \$65,000 (TNF's share is \$32,500).

21. T.N. Farris and S. Chandrasekar, co-PIs, "A Basic Study of Superfinishing," Timken Research, September 1, 1996 to August 31, 1999, \$50,000 (TNF's share is \$25,000).
22. S. Chandrasekar and T.N. Farris, co-PIs, "Diamond Polishing of Electronic Substrate Materials," GE Superabrasives, January 1, 1997 to December 31, 1997, \$32,000 (TNF's share is \$16,000).
23. S. Chandrasekar and T.N. Farris, co-PIs, "Process Performance Model for Hard Turning," Caterpillar, January 15, 1997 to December 31, 1998, \$183,501 (TNF's share is \$91,750).
24. T.N. Farris, PI, "Fretting Fatigue Feature Testing," GE Aircraft Engines, March 15, 1997 to December 14, 1998, \$105,394.
25. S. Chandrasekar, W.D. Compton, and T.N. Farris, co-PIs, "Use of Polishing Process Model as an Example for Manufacturing System Design," NSF, September 15, 1997 to August 31, 2000, \$205,919 (TNF's share is \$67,365).
26. T.N. Farris and S. Chandrasekar, co-PIs, "Mapping of Residual Stress," Cummins Engine Company, October 1, 1997 to September 30, 1998, \$41,387. (TNF's share is \$20,693).
27. S. Chandrasekar and T.N. Farris, co-PIs, "High-Precision Honing of Hard Steels," Cummins Engine Company, October 1, 1997 to September 30, 1999, \$100,000 (TNF's share is \$50,000).
28. A.F. Grandt, PI, T.N. Farris and B.M. Hillberry, co-PIs, "Analysis of Widespread Fatigue Damage in Aircraft Structures," AFOSR, February 1, 1998 to November 30, 1998, \$210,000 (TNF's share is \$67,556).
29. T.N. Farris, PI, "Fretting Fatigue of Flat, Titanium Surfaces," UDRI, March 1, 1998 to August 20, 1999, \$184,570.
30. S. Chandrasekar and T.N. Farris, co-PIs, "Grinding of Thermally Sprayed Silicon-Bronze Alloys for Enhanced Painting Performance," GM, April 1, 1998 to December 31, 1998, \$60,000 (TNF's share is \$30,000).
31. T.N. Farris, PI, "Forward Outer Seal/Rabbit Edge-of-Contact Testing," GEAE, June 1, 1998 to December 31, 1999, \$74,675.
32. T.N. Farris and S. Chandrasekar, co-PIs, "The Effect of Processing on Mechanical Properties of Fiber Reinforced Aluminum Alloys," ART, January 1, 1999 to December 31, 1999, \$70,000 (TNF's share is \$35,000).
33. S. Chandrasekar, W.D. Compton, T.N. Farris, and K.P. Trumble, "Center for Materials Processing and Tribology," July 1, 1998-, TNF's share of gifts to date is \$38,600.
34. T.N. Farris and A.F. Grandt, Jr., co-PIs, "Advanced High Cycle Fatigue Life Assurance Methodologies," UDRI, April 1, 1999-March 31, 2002, \$669,290 (TNF's share is \$469,290).
35. T.N. Farris, PI, "Amelioration of Fretting Fatigue of Titanium," GE Aircraft Engines, July 1, 2000-December 31, 2001, \$99,560.
36. T.N. Farris, PI, "Fretting Fatigue Testing for LSP Technologies, Inc.," LSP Technologies, Inc., November 1, 2000-December 31, 2000, \$5550.

37. S. Chandrasekar and T.N. Farris, co-PIs, "Grinding Process Monitoring," Norton Saint-Gobain, November 1, 2000-October 31, 2001, \$57,897 (TNF's share is \$25,000).
38. T.H. Siegmund, PI, T.N. Farris co-PI with several others at Purdue, Honeywell and the National Composites Center, "Low-Cost Carbon-Carbon Technology for Pervasive Growth," Indiana 21<sup>st</sup> Century Research and Technology Fund, March 2001-February 2003 (TNF's share is \$68,562).
39. S.Chandrasekar, W.D. Compton, T.N. Farris, and K.P. Trumble, co-Pis, "Formation of Nano-Crystalline Structures by High Velocity Deformation and Application to Materials Design," Trask Trust Fund, May 2001-February 2001, \$58,334 (TNF's share is \$15,000).
40. S. Chandrasekar, W.D. Compton, and T.N. Farris, co-PIs, "Micro-Scale Characterization of Machining Interfaces," NSF, August 15, 2001-July 31, 2004, \$180,000 (TNF's share is \$41,237).
41. T.N. Farris, PI, "Mechanics of Blade/Disk Contacts," GE Aircraft Engines, April 2002-November 2007, \$235,000.
42. T.N. Farris, PI, "Fretting Fatigue Modeling," Rolls-Royce, January 2002-December 2003, \$70,000.
43. T.N. Farris, PI, "Fretting Fatigue Testing for LSP Technologies, Inc.," LSP Technologies, Inc., May 2002-December 2002, \$20,400.
44. T.N. Farris, PI, "SSME Single Crystal Cracking Contact Fatigue Test," Pratt & Whitney, Oct 2002-February 2005, \$170,000.
45. T.N. Farris and A.F. Grandt, Jr., co-PIs, "Fundamentals of Fretting Applied to Anisotropic Materials," AFOSR, September 2002-January 2006, \$263,000 (TNF's share is \$175,500).
46. S.D. Heister and W.E. Anderson, co-PIs, "Combustion Instability and Film Cooling Studies for Hydrocarbon Engines," NASA Marshall, January 2003-August 2005, TNF subcontract of \$32,821.
47. T.N. Farris, PI, "Fretting Fatigue Testing of Aluminum," Analytical Processes/Engineered Solutions, Inc., June 2003-April 2005, \$100,000.
48. T.N. Farris, PI, "High-Temperature Fretting Fatigue Feature Testing," GE Aircraft Engines, September 2003-December 2004, \$125,294.
49. T.N. Farris, PI, "Fretting Fatigue of Turbine Materials for Propulsion System Prognosis," DARPA through sub-contract with GE Aircraft Engines, August 2004-December 2007, \$217,200.
50. S. Chandrasekar, PI, W.D. Compton, co-PI, T.N. Farris, co-PI, D.R. McKinnis, co-PI, K. Trumble, co-PI, "Sustainable Manufacturing Systems for Discrete Products Sector," 21<sup>st</sup> Century Research and Technology Fund, August 2003-July 2007, \$1,287,100 (TNF share is \$57,291).
51. S. Chandrasekar, PI, and T.N. Farris, co-PI, "High Speed Grinding of Stainless Steel," Gillette Technology Center, November 2004-April 2005, \$23,917 (TNF share is \$11,958).
52. T.N. Farris, PI, "Analysis of Fretting Fatigue of Turbine Materials," Pratt & Whitney, October 2004-December 2007, \$110,000.

53. T.N. Farris, PI, "F110 Experimental Evaluation of Fretting Fatigue for Turbine Disk – Airfoil Attachments," GEAE, January 2005-June 2006, \$99,763.
54. T.N. Farris, PI, "Gear Prognosis," NAVY STTR through Vextec, Phase I, September 2007-February 2008, \$21,000, Phase II, July 2008-March 2012, \$450,000.
55. T.N. Farris, PI, "Fretting Fatigue of Turbine Materials for Propulsion System Prognosis," DARPA through sub-contract with GE Aircraft Engines, December 2007-March 2009, \$100,700.

## **Equipment Donations**

1. S. Chandrasekar and T.N. Farris, co-PIs, "Infrared Microscope," IBM Tucson, January 1989, \$15,000.
2. T.N. Farris and S. Chandrasekar, co-PIs, "Talysurf 4 Profilometry Equipment," Timken Research, March 1990, \$15,000.
3. T.N. Farris and S. Chandrasekar, co-PIs, "Rolling Contact Fatigue Equipment," Timken Research, May 1992, \$40,600.
4. T.N. Farris and S. Chandrasekar, co-PIs, "Seibu Superfinishing Machine," Timken Development, May 1995, \$80,000.
5. S. Swain, S. Chandrasekar, and T.N. Farris, co-PIs, "Hardinge Superprecision Lathe," Hardinge Brothers, April 1996, \$190,000.
6. T.N. Farris and S. Chandrasekar, co-PIs, "Centerless Grinder," Cummins and Cincinnati Milacron, December 1996, \$50,000.
7. T.N. Farris and S. Chandrasekar, co-PIs, "X-Ray Diffraction Equipment," Cummins, December 1997, \$140,000.

## **Reviewer for the following journals:**

*Acta Materialia; AIAA Journal; AIAA Journal of Aircraft; AIAA Journal of Propulsion and Power; ASCE Journal of Engineering Mechanics; ASME Advances in Information Storage Systems; ASME Journal of Applied Mechanics; ASME Journal of Engineering Materials and Technology; ASME Journal of Manufacturing Science and Engineering; ASME Journal of Tribology; ASTM Special Technical Publication; Composites Science and Technology; Engineering Analysis with Boundary Elements; Engineering Fracture Mechanics; International Journal of Fracture; International Journal of Modeling and Simulation; International Journal for Numerical Methods in Engineering; International Journal of Solids and Structures; Journal of Elasticity; Journal of Machining Science and Technology; Journal of Sound and Vibration; Journal of the American Ceramic Society; Journal of the Mechanics and Physics of Solids; Mathematics & Mechanics of Solids; SEM Experimental Mechanics; STLE Tribology Transactions; Structural Engineering and Mechanics; and Wear.*