

PROMOTION RECOMMENDATION
The University of Michigan
College of Engineering

Fred L. Terry, Jr., associate professor of electrical engineering and computer science, with tenure, Department of Electrical Engineering and Computer Science, College of Engineering, is recommended for promotion to professor of electrical engineering and computer science, with tenure, Department of Electrical Engineering and Computer Science, College of Engineering.

Academic Degrees:

- Ph.D. 1985 Massachusetts Institute of Technology, Electrical Engineering and Computer Science, Cambridge, MA
M.S. 1981 Massachusetts Institute of Technology, Electrical Engineering, Cambridge, MA
B.S. 1981 Massachusetts Institute of Technology, Electrical Engineering, Cambridge, MA

Professional Record:

- 2005 - present Director, Solid State Electronics Laboratory
2004 - present Deputy Director, National Nanotechnology Infrastructure Network Site, University of Michigan
2001 - 2002 Visiting Associate Professor, Department of Electrical Engineering and Computer Science, Cornell University
1997 - 1998 Thrust Group Leader for Process Control, Center for Display Technology and Manufacturing
1996-1997 Technical Director, Center for Display Technology and Manufacturing
1991 - present Associate Professor (with tenure), Department of Electrical Engineering and Computer Science, University of Michigan
1985 - 1991 Assistant Professor, Department of Electrical Engineering and Computer Science, University of Michigan

Summary of Evaluation:

Teaching: Professor Terry has an outstanding record in teaching and curriculum development. He has been heavily involved in curriculum development and has made significant contributions in this area. He received the EECS faculty achievement award in 2002, and the EECS outstanding teaching award in 1992. He has taught at both undergraduate and graduate levels, and his teaching evaluations are representative of a caring and devoted teacher. His most important contribution to teaching has been his leadership in the overall circuits curriculum as well as the revision and teaching of the introductory circuits course EECS 215. This course has historically been among the most difficult to teach and most challenging to take by students in EECS. During a period of five years Professor Terry has made two significant revisions to this course, and successfully transformed it to one of the most useful courses in the department. His commitment to creating the most effective teaching tools and materials, is universally acknowledged by fellow faculty and students in his classes. His teaching evaluations have steadily improved, as attested to by the excellent scores he has received in this most difficult lower-level class.

Research: Professor Terry is a leading authority in the use of optical techniques to monitor and regulate semiconductor-manufacturing processes. His work on spectral ellipsometry has earned him high acclaim from academic researchers as an innovative, meticulously detailed and careful scientist who is not afraid to tackle the most difficult and oftentimes messy problems in his area. Methods developed by him and his

students are now standard practice at leading manufacturing tool vendors and start-up metrology companies. He has graduated 11 doctoral students post tenure, has supervised many MS and BS students, and has published in top journals and conferences. After sustaining a ten-year period of a very high-level of extramural support for his research program, during the period 2003-2005, he had no external research support. During this period, he accepted two director positions within the College for very high visibility research programs, he continued to publish, to submit research proposals in the areas of optical sensing and semiconductor manufacturing, and even more importantly, he worked to identify new research directions in nano-electronics and mid-infrared lasers. This effort paid off, and by 2006 he had re-established extramural research support and re-directed his research efforts in areas that appear to be well-founded for future growth.

Recent and Significant Publications:

- C. Xia, M. Kumar, O. P. Kulkarni, M. N. Islam, F. L. Terry, Jr., M. J. Freeman, M. Poulain, and G. Mazé, "Mid-infrared super continuum generation to 4.5 μm in ZBLAN fluoride fibers by nanosecond diode pumping," *Optics Letters* 31, pp. 2553-2555 (2006).
- Hsu-Ting Huang, Fred L. Terry, Jr., "Spectroscopic ellipsometry and reflectometry from gratings (Scatterometry) for critical dimension measurement and in situ, real-time process monitoring," *Thin Solid Films*, 455-456, pp. 828-836 (2004).
- Pete I. Klimecky, J. W. Grizzle, and Fred L. Terry, Jr. "Compensation for transient chamber wall condition using real-time plasma density feedback control in an inductively coupled plasma etcher," *Journal of Vacuum Science and Technology*, A 21, pp. 706-17 (2003).
- B. S. Stutzman, H. -T. Huang, and F. L. Terry, Jr., "Two-channel spectroscopic reflectometry for in situ monitoring of blanket and patterned structures during reactive ion etching," *Journal of Vacuum Science and Technology*, B18, pp.2785-93 (2000).
- L. I. Kamlet and F. L. Terry, Jr., "Dielectric Function Modeling for $\text{In}_{1-y}\text{Al}_y\text{As}$ on InP," *Thin Solid Films*, 313-4, pp. 435-441 (1998).
- T. L. Vincent, P. P. Khargonekar, and F. L. Terry, Jr., "An Extended Kalman Filtering-Based Method of Processing Reflectometry Data for Fast In-Situ Etch Rate Measurements," *IEEE Transactions on Semiconductor Manufacturing*, 10, pp. 42-51 (1997).

Service: Professor Terry has had an outstanding service record. He has a passion for impact through service to students, staff, and faculty, for which he was recognized in 2006 by receiving the College of Engineering Service Excellence Award. He has effectively served in several highly demanding service and administrative roles. His service as program and chief program advisor to students in the EE program is notable in both its quantity, and quality. Simultaneously, he is serving as the director of Solid State Electronics Laboratory (SSEL), one of the largest laboratories in the College of Engineering, and its fabrication facility the Michigan Nanofabrication Facility (MNF). He has been responsible for coordinating and supervising the \$48M expansion of the MNF, a task that is both time consuming and requires technical knowledge and attention to details. He also served as co-chair of the Martin Luther King Organizing Committee in 2005/2006. He has been active in his professional community through conferences, journal editorship, and consulting.

External Reviewers:

Reviewer (A): "Dr. Terry has been one of [the] leading researchers in the field of spectroscopic ellipsometry... Recently, he has developed a quite remarkable method for ellipsometry data analysis. In this work...he showed that three-dimensional grating structures formed on substrates can be determined in real time... I believe that his invited talk has been one of the most important talks in ICSE-3 [International Conference on Software Engineering]."

Reviewer (B): "Fred's work has stood out because of both its originality and its applicability to industry. Fred had both the vision and the courage to tackle this problem that many others have dismissed as too difficult."

Reviewer (C): "In 1997, I was asked to write a similar evaluation of Fred. At that time, my conclusion was that Fred had done some nice, solid work, but was not ready yet for promotion. Since then, Fred has started the work on the spectroscopic ellipsometry of diffractive structures, mainly with application to photolithography... Fred is considered as one of the originators of the field, and as a result is considered to be one of the world's experts, as evidence[d] by the invited talk he gave at [ICSE-3]."

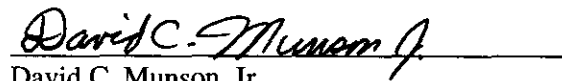
Reviewer (D): "His work has developed innovative experimental measurement hardware, physics based models, and real-time algorithms for extraction of wafer and process parameters. His ideas have had a large impact. I am familiar with at least two start-up companies that have directly or indirectly used ideas developed in his work. Fred is among the very best researchers in real-time, in-situ process monitoring and control."

Reviewer (E): "Fred has demonstrated that he is an inventive and skilled experimentalist who tackles tough and sometimes messy problems that others have shied away from. These problems tend to be very practical and of industrial importance, and so his work has immediate and beneficial impact. There is no question in my mind about the quality of Fred's scholarly work."

Reviewer (F): "Fred's ideas on enhancing metrology with process models are now accepted industry practice and appear in several widely-used commercial metrology products. Fred's research is creative, meticulous in its detail, and extremely thorough. In my view, Fred is among the top three researchers of his peer group in our research community."

Review (G): "The quality of his work is absolutely outstanding... His work on normal-incidence spectroscopic ellipsometry is pioneering, sophisticated and brilliant. It is major, scholarly work that is having significant impact on commercial semiconductor integrated circuit critical dimension metrology. His is the leading academic-institution work in this field in the world, to the best of my knowledge."

Summary of Recommendation: Professor Fred Terry is a highly accomplished researcher with an international reputation for pioneering and important academic work in spectral ellipsometry. His methods have become accepted practice in industry. Since tenure, Professor Terry has made major strides in improving his teaching and is now among our top tier of instructors of undergraduate students. He has demonstrated an exceptional degree of dedication to, and leadership in, his department through service as undergraduate chief program advisor, SSEL director, and overseeing the design and construction of a new expansion to the MNF. It is with the support of the College of Engineering Executive Committee that I recommend Fred L. Terry, Jr. for promotion to professor of electrical engineering and computer science, with tenure, Department of Electrical Engineering and Computer Science, College of Engineering.


David C. Munson, Jr.
Robert J. Vlasic Dean of Engineering
College of Engineering

May 2007