Approved by the Regents
May 19, 2011

PROMOTION RECOMMENDATION
The University of Michigan
College of Engineering

Anthony Grbic, assistant professor of electrical engineering and computer science, Department of Electrical Engineering and Computer Science, College of Engineering, is recommended for promotion to associate professor of electrical engineering and computer science, with tenure, Department of Electrical Engineering and Computer Science, College of Engineering.

Academic Degrees:

Ph.D.	2005	Electrical Engineering, University of Toronto
M.A.Sc.	2000	Electrical Engineering, University of Toronto
B.A.Sc.	1998	Electrical Engineering, University of Toronto (with Honors)

Professional Record:

2006 - present	Assistant Professor, Department of Electrical Engineering and Computer Science, University of Michigan
2000 – 2005	Ph.D. Research Assistant, Department of Electrical and Computer Engineering, University of Toronto
1998 – 2000	M.A.Sc. Research Assistant, Department of Electrical and Computer Engineering, University of Toronto
1997 – 2003	Tool and Process Engineer (summer and part-time), Chrysler Corporation, Brampton Assembly Plant, Ontario, Canada

Summary of Evaluation:

Teaching: Professor Grbic has made significant contributions to three important aspects of teaching during the past five years. These include 1) formal classroom teaching of both undergraduate and graduate courses, 2) development and enhancement of graduate and undergraduate courses and laboratories, and 3) mentoring of graduate students and significant effort towards recruiting and mentoring undergraduate students in research. Since joining Michigan he has taught three different courses, one at the sophomore level, EECS 230 (Electromagnetics I), one at the senior level, EECS 430 (Radiowave Propagation and Link Design), and one at the graduate level, EECS 598 (Special Topics in EECS: Electromagnetic Metamaterials). The development of an entirely new course, viz. EECS 598 (Electromagnetic Metamaterials), together with his effort to overhaul EECS 430 (Radiowave Propagation), an undergraduate major design course, are considered his major teaching contributions. As the field of Metamaterials is an emerging area in electromagnetics, textbooks and teaching materials are scarce. He has carefully prepared a complete set of lecture notes and coursepacks for his students. This course is very popular among graduate students. Modifications in EECS 430 are aimed at redesigning the course material, developing an entirely new coursepack, and expanding the design project. His teaching evaluations and comments from students for both undergraduate and graduate courses have been excellent. His average Q1, Q2, and class enrollment are 4.27, 4.4, and 25, respectively.

Professor Grbic has mentored nine undergraduate students on eleven different summer projects. He is chairing five Ph.D. and four M.S. students. His graduate students have won numerous awards and fellowships including: the Science, Mathematics and Research for Transformation (SMART) Scholarship from the Department of Defense, IEEE Microwave Theory and Techniques Graduate Fellowship Award, Graduate Assistance in Areas of National Need (GAAN) Fellowship, U.S. Department of Education, and

IEEE Microwave Theory and Techniques Undergraduate/Pre-Graduate Scholarship. These awards are a reflection of the quality of the students he mentors.

Research: Professor Grbic's research is in the field of applied electromagnetics, and specifically he is focusing in a relatively new area known as metamaterials. This emerging field of research aims at developing novel composite materials and structures with unique electromagnetic properties that are not observed in natural materials. He has taken a bold approach in carrying out his research that not only covers both theoretical and experimental aspects, but also covers a wide range of topics including (*i*) bulk metamaterials, (*ii*) sub-wavelength focusing and (*iii*) transmission-line based metamaterials. Over a very short period of time he has been able to establish himself as one of the leading authorities in this field through development of techniques for fabrication of novel negative-refractive-index (NRI) materials. For his research accomplishments, Professor Grbic received a Presidential Early Career Award for Scientists and Engineers (PECASE), a NSF Faculty Early Career Development Award (CAREER) and an AFOSR Young Investigator Award (YIP). He was also the recipient of a Henry Russel Award from the University of Michigan. Most of these awards came with significant amounts of funding for his research programs. He has also received grants from AFOSR (MURI and DURIP) and AFRL. Professor Grbic has an outstanding publication record and many of his research activities have been cited by popular articles in *Scientific American, Science, Nature, Physics World, Physics Today, New Scientist, Discover Magazine, EE Times, Physics News Update, Microwaves and RF,* and *Materials Today*.

Recent and Significant Publications:

A. Grbic and G.V. Eleftheriades, "Overcoming the diffraction limit with a planar left-handed transmission-line lens," *Physical Review Letters*, vol. 92, no. 11, 117403, March 19, 2004 (featured on the cover of the March issue).

A.Grbic, L. Jiang, R. Merlin, "Near-field plates: subdiffraction focusing with patterned surfaces," *Science*, vol. 320, no. 5874, pp. 511-513, April 25, 2008.

A. Grbic and R. Merlin, "Near-field focusing plates and their design," *IEEE Transactions on Antennas and Propagation*, vol. 56, no. 10, pp. 3159-3165, October 2008.

M. F. Imani and A. Grbic, "Tailoring near-field patterns with concentrically corrugated plates," *Applied Physics Letters*, vol. 95, pp. 111107, September 2009.

S. M. Rudolph and A. Grbic, "The design of broadband, volumetric NRI media using multiconductor transmission-line analysis," *IEEE Transactions on Antennas and Propagation*, vol. 58, pp. 1144-1154, April 2010.

G. Gok and A. Grbic, "Tensor transmission-line metamaterials," *IEEE Transactions on Antennas and Propagation*, vol. 58, pp. 1559 – 1566, May 2010.

The impact of his work is evident from the fact that his publications are highly cited (his two most cited papers have 250 and 200 citations), and that they are attracting the attention of both the engineering and physics communities.

Service: Professor Grbic has been serving on the ECE Publicity Committee, the EE Graduate committee, and has been an academic advisor for the area of Applied Electromagnetics and RF Circuits. Professor Grbic has also been actively engaged in activities to improve the diversity and climate by going out of his way to include minorities and female graduate students and post-docs in his research group and paying special attention to their success in our graduate program. Professor Grbic also has an exemplary record of service in the Institute of Electrical and Electronics Engineers (IEEE). He serves as an associate editor for the IEEE Antennas and Wireless Propagation Letters, a leading journal in his field. He was selected to serve as the technical program co-chair for the 2012 IEEE International Symposium on Antennas and Propagation to be held in Chicago, IL.

External Reviewers:

Reviewer A: "Tony is one of the young stars of the field of metamaterials … His creative work is widely recognized in the community ..."

Reviewer B: "…Prof. Grbic's experiment was substantial, and the results so clear and well presented they helped the superlens concept gain acceptance. ... He is one of the next generation metamaterials experts, and has defined his own space within the field."

Reviewer C: "... his ... works, have attracted a lot of attention in the scientific and engineering communities, and have inspired several other groups to follow in his footsteps."

Reviewer D: "... [his] promotion would do no less than continue to foster the extraordinary capabilities of the candidate as well as to promote the goals of the Department of EECS and the College of Engineering..."

Reviewer E: "His contributions to the metamaterials area have been outstanding … His metamaterial work has already attained national and international recognition, particularly for his super-resolution negative-refractive-index transmission-line lens."

Reviewer F: "The work that Prof. Grbic has done has demonstrated, for the first time, that it is possible to make compact planar lefthanded structures by utilizing the backward-wave nature of certain types of planar periodic structures. This is a tremendous practical advancement in the field, and represents a very important discovery."

Reviewer G: "Anthony has distinguished himself from the crowd in this area by working on topics that are his own creation, e.g. the wideband negative index material, and particularly the near field focusing plates..."

Summary of Recommendation: Professor Grbic is a prominent and productive member of the Department of Electrical Engineering and Computer Science. He has made significant contributions to the field of applied electromagnetics, specifically to the concept and applications of metamaterials. He is an excellent teacher and mentor, and he is a leader who contributes both in external and internal service. It is with the support of the College of Engineering Executive Committee that I recommend Professor Anthony Grbic for promotion to associate 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 2011