

## PROMOTION RECOMMENDATION

University of Michigan  
College of Engineering

Igor Markov, 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

Red Diploma	1994	Kiev University, Ukraine, Mathematics
M.S.	1994	University of California, Los Angeles, Mathematics
Ph.D.	2001	University of California, Los Angeles, Computer Science

### Professional Record

2000–present	Assistant Professor of Electrical Engineering and Computer Science, University of Michigan
1996-2000	Research Assistant, University of California, Los Angeles
1994-1996	Teaching Assistant/Associate, University of California, Los Angeles
1995	Software Engineer, Parametric Technology Corporation

### Summary of Evaluation:

**Teaching:** Professor Markov has taught courses at all levels of the program, from large introductory undergraduate courses to small specialty seminars for graduate students. He is dedicated to teaching, and presents material in the classroom in a rigorous and challenging way. Although some students express certain difficulties in working with him, his teaching evaluations have been good, with Q1/Q2 scores averaging 3.9/3.9. He publishes many papers with his students, including undergraduates whose research he supervises: in fact, he has already supervised 13 undergraduate projects. He has had two students complete their Ph.D. degrees under his supervision, and is currently working with five more. He has also coached student teams which participated in the ACM SIGDA CADathalon programming competitions, and his teams have won or shared first place twice. In addition, Professor Markov has contributed to curricular development by restructuring EECS 281 (formerly EECS 380), developing a new set of projects and integrating the use of an “autograder,” which provides immediate feedback to students.

**Research:** Professor Markov is a highly respected researcher in the field of Electronic Design Automation. He has developed algorithms and software tools that are used to design VLSI circuits; his software tools in particular have not only been used in academia, but also in industry, where some of the circuits designed with them are now being sold. Within the broad field of EDA, he has made contributions on a number of different topics, including VLSI circuit placement, synthesis of reversible logic, combinatorial optimization, and circuit verification. More recently, Professor Markov has also done research in quantum circuit design, and his work on this topic has gathered the attention of leading researchers in the field. His high-performance quantum simulation program, QuIDDPro, has been particularly well-received. Professor Markov has published quite a large number of papers in the premiere publication venues in the field, and has obtained significant funding as PI or co-PI of more than a dozen research grants, including an NSF CAREER award. Other awards he has received include the ACM Special Interest Group on Design Automation (SIGDA) Outstanding New Faculty Award and a recent Best Paper Award at DATE, one of the leading conferences on design automation.

### Recent and Significant Publications:

- F. A. Aloul, K. A. Sakallah, and I. L. Markov, "Efficient Symmetry Breaking for Boolean Satisfiability", to appear in *IEEE Transactions on Computers*, 2006.
- K. M. Svore, A. W. Cross, I. L. Chuang, A. V. Aho and I. L. Markov, "A Layered Software Architecture for Quantum Computing Design Tools", to appear in *IEEE Computer*, 2006.
- V. V. Shende\*, S. S. Bullock, I. L. Markov, "Synthesis of Quantum Logic Circuits," to appear in *IEEE Transactions on Computer-Aided Design*, 2006.
- A. Ramani, F. A. Aloul, I. L. Markov and K. A. Sakallah, "Breaking Instance-Independent Symmetries in Exact Graph Coloring," to appear in *Journal of Artificial Intelligence Research*, 2005.
- K.-H. Chang, I. L. Markov and V. Bertacco, "Post-Placement Rewiring and Rebuffering by Exhaustive Search For Functional Symmetries," *ACM/IEEE International Conference Computer-Aided Design (ICCAD)*, pp. 56-63, San Jose, CA, November 2005.
- K.-H. Chang, V. Bertacco and I. L. Markov, "Simulation-based Bug Trace Minimization with BMC-based Refinement," *ACM/IEEE International Conference Computer-Aided Design (ICCAD)*, pp. 1045-1051, San Jose, CA, November 2005.
- G. F. Viamontes, I. L. Markov and J. P. Hayes, "Graph-based Simulation of Quantum Computation in the Density Matrix Representation," *Quantum Information and Computation*, vol.5, no.2 pp. 113-130, February 2005.
- S. N. Adya and I. L. Markov, "Combinatorial Techniques for Mixed-size Placement," *ACM Transactions on Design Automation of Electronic Systems*, vol. 10, no. 5, January 2005.
- S. N. Adya, S. Chaturvedi, J. A. Roy, D. A. Papa and I. L. Markov, "Unification of Partitioning, Floorplanning and Placement," *ACM/IEEE International Conference Computer-Aided Design (ICCAD)*, San Jose, CA, November 2004, pp. 550-557.
- P. T. Darga, M. H. Liffiton, K. A. Sakallah and I. L. Markov, "Exploiting Structure in Symmetry Generation for CNF," *ACM/IEEE Design Automation Conference (DAC)*, San Diego, California, June 2004, pp. 530-534.

Service: Professor Markov has strong professional service contributions: he has served on the technical program committees of a number of top-notch conferences, has been on several NSF review panels, and is an editor of the ACM SIGDA bi-weekly newsletter. His internal service record is typical of that for an untenured faculty member: he has served as an undergraduate advisor and as a member of the committee that oversees the Department's Computing Organization.

### External Reviewers:

Reviewer (A): "Dr. Markov is already internationally recognized as one of the world's leading researchers in the fields of physical design and synthesis for VLSI and quantum computing."

Reviewer (B): "It is rare to see an assistant professor to be able [sic] to engage in multiple areas and be able to get his work accepted by multiple communities in a short period of time."

Reviewer (C): "He is among the best junior professors in CAD of his [cohort], and his work is visible worldwide."

Reviewer (D): "Igor is very prominent in the community of integrated circuit CAD and design automation researchers. He's done visible, excellent work on large-scale chip layout, on large-scale combinatorial optimization, and most recently, on quantum computing."

Reviewer (E): "Prof. Markov has made numerous theoretical contributions to placement, of which many of his papers and awards are a great attestation. But in addition, Igor has always ensured the practical application of his ideas. This is of particular importance in an applied science such as electronic design automation. The bookshelf project in GSRC is one example, where his algorithms are really put to the test. We at [my institution] have benefited significantly from interactions with Igor."

Reviewer (F): "... making progress in this new field [quantum circuit design] requires individuals with extraordinary insight and capability. Igor Markov is clearly among these individuals having made several fundamental contributions that are having a clear impact on the development of quantum compilers and gate simulators."

Reviewer (G): "Igor is a rising star in the field of VLSI CAD."

Summary of Recommendation: Professor Markov is a highly respected researcher who has made important contributions to the fields of electronic design automation (VLSI CAD) including quantum circuit design; he is a rigorous instructor who challenges his students, working closely with them to produce and publish high-quality research; and he is active in external and internal service. It is with the support of the College of Engineering Executive Committee that I recommend him for promotion to associate professor of electrical engineering and computer science, with tenure, Department of Electrical Engineering and Computer Science, College of Engineering.



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Ronald Gibala  
Interim Dean, College of Engineering

May 2006