# Nikolay Mateev

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## EDUCATION:

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|---|---|---|
| 08/1994 – present | Cornell University, Ithaca, NY<br>*Ph.D. in Computer Science* (Expected Summer 2000)<br>Minor in Operations Research<br>Advisor: Professor Keshav Pingali | GPA: 4.1357 |
| 10/1988 – 7/1994 | Sofia University, Sofia, Bulgaria<br>*M.S. in Mathematics*, Specialization: Computing Systems | GPA: 6.00 (out of 6) |
| 09/1992 – 6/1993 | University of East Anglia, Norwich, England<br>*TEMPUS Visiting Student*, School of Mathematics | GPA: 91.4% |

## RESEARCH:

My research centers on developing the compiler technology and tools necessary for producing high-performance code. Accessing the data efficiently and exploiting memory hierarchies are keys to obtaining good performance. In my thesis, *A Generic Programming System for Sparse Matrix Computations,* I explore the problem of generating efficient sparse matrix codes from high-level specifications. My current research focuses on numerical applications. Many of the techniques are also applicable in other areas such as databases and multimedia.

## RECENT PUBLICATIONS:

- *A Framework for Sparse Matrix Code Synthesis from High-level Specifications*. SC2000, Dallas, TX, November 2000. (With N. Ahmed, K. Pingali and P. Stodghill.)
- *Next-generation Generic Programming and its Application to Sparse Matrix Computations*. International Conference on Supercomputing, Santa Fe, NM, May 2000. (With V. Kotlyar, K. Pingali and P. Stodghill.)
- *Tiling Imperfectly-nested Loop Nests*. SC2000, Dallas, TX, November 2000. (With N. Ahmed and K. Pingali.)
- *Synthesizing Transformations for Locality Enhancement of Imperfectly-nested Loop Nests*. International Conference on Supercomputing, Santa Fe, NM, May 2000. (With N. Ahmed and K. Pingali.)
- *Left-looking to Right-looking and vice versa: An Application of Fractal Symbolic Analysis to Linear Algebra Code Restructuring*. Euro-Par 2000, Munich, Germany, August 2000. (With V. Menon and K. Pingali.)
- *Fractal Symbolic Analysis for Program Transformations*. Technical Report TR2000-1781, Cornell University, Computer Science, February 2000. (With V. Menon and K. Pingali.)
- *An Analysis of Data Access Patterns in Integer Benchmarks*. HP Labs Internal Report, November 1997. (With P. Faraboschi and G. Brown.)

## OTHER PROJECTS:

- *Watermarking MPEG / JPEG.*
  Implemented a JPEG codec with built-in digital watermarking. The watermarking was based on the idea of using the round-off error during the quantization stage of DCT compression, and did not require any changes to the standard JPEG decoder. Error-correcting codes were used to improve the robustness of the watermark. The method was tested and demonstrated to work very well against common signal processing and geometric distortion attacks.
- *Algorithms for Control Dependence and SSA Form.*
  Implemented the Augmented Postdominator Tree (APT) data structure (a postdominator tree with additional information cached at some intermediate nodes) and the APT-based algorithm for computing control dependence. Demonstrated that the APT-based algorithm outperforms other widely used algorithms for computing control dependence.

## EXPERIENCE:

### Programming

- Cornell University, Ithaca, NY (1995 – present).
  *Graduate Research Assistant.*
  Participated in the development of the Bernoulli Sparse Compiler and other projects.
- HP Labs Cambridge, MA (Summer 1997).
  *Summer Intern.*
  Studied the data cache performance of SpecInt95 and other integer benchmarks on an embedded VLIW processor with very complex memory hierarchy. Identified an appropriate state of the art data prefetching algorithm, then adapted and implemented that algorithm in the Multiflow compiler.
- DECART Co., Bulgaria (1990 – 1992).
  *Programmer (part-time).*
  Developed graphics software.
- Bulgarian Army, Shtraklevo, Bulgaria (1986 – 1988).
  *Programmer.*
  Developed database and graphics software.

### Teaching Assistant

- Cornell University, Ithaca, NY (1994 – 1998).
  Theory of Computing, Analysis of Algorithms, Structure and Interpretation of Computer Programs.
- Sofia University, Bulgaria (1993 – 1994).
  Algebra.

## AWARDS:

Numerous awards at mathematical tournaments, including Third prize at the International Mathematical Olympiad (1986), and First (1986) and Second (1985) prizes at the Balkan Mathematical Olympiad.

## PROGRAMMING LANGUAGES:

C, Java, C++ , ML, FORTRAN, Pascal.