



FORM 100
Personal Data Form
PART I

Date
2009/10/01

Family name Wolkowicz	Given name Henry	Initial(s) of all given names H	Personal identification no. (PIN) 11131
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I hold a faculty position at an eligible Canadian college (complete Appendices B1 and C)

I do not or will not hold an academic appointment at a Canadian postsecondary institution

Place of employment other than a Canadian postsecondary Institution (give address in Appendix A)

APPOINTMENT AT A POSTSECONDARY INSTITUTION

Title of position Professor	Tenured or tenure-track academic appointment Yes <input checked="" type="checkbox"/> No <input type="checkbox"/>
Department Combinatorics and Optimization	Part-time appointment <input type="checkbox"/> Full-time appointment <input checked="" type="checkbox"/>
Campus	<ul style="list-style-type: none"> For all non-tenured or non tenure-track academic appointment and Emeritus Professors, complete Appendices B & C For life-time Emeritus Professor and part-time positions, complete Appendix C
Canadian postsecondary institution Waterloo	

ACADEMIC BACKGROUND

Degree	Name of discipline	Institution	Country	Date yyyy/mm
Bachelor's	Bachelor of Arts	McGill	CANADA	1972/06
Master's	Applied Mathematics	McGill	CANADA	1975/09
Doctorate	Mathematics	McGill	CANADA	1978/10

TRAINING OF HIGHLY QUALIFIED PERSONNEL

Indicate the number of students, fellows and other research personnel that you:

	Currently		Over the past six years (excluding the current year)		Total
	Supervised	Co-supervised	Supervised	Co-supervised	
Undergraduate			5		5
Master's	1		5		6
Doctoral	1	1	3		5
Postdoctoral	1		4	1	6
Others			3	1	4
Total	3	1	20	2	26

Personal identification no. (PIN)

11131

Family name

Wolkowicz

ACADEMIC, RESEARCH AND INDUSTRIAL EXPERIENCE (use one additional page if necessary)

Position held (begin with current)	Organization	Department	Period (yyyy/mm to yyyy/mm)
Professor	Waterloo	Combinatorics and Optimization	1986/06
Research Associate	University of Toulouse	Laboratoire Approx. & Opt.	1999/06 to 1999/07
Research Fellow	Princeton University	Civil Eng. and Operations Res.	1992/06 to 1993/09
Research Visitor	Rutgers University	DIMACS	1992/06 to 1993/09
Associate Chair Graduate Affairs	University of Waterloo	Combinatorics and Optimization	1990/09 to 1991/09
Assoc. Professor	University of Delaware	Math. Sciences	1985/06 to 1986/06
Assoc. Professor	Emory University	Math. and Comp. Sc.	1984/06 to 1985/06
Research Associate	University of Maryland, College Park	Math.	1983/09 to 1983/12
Assist and Assoc. Professor	University of Alberta	Mathematics and Statistics	1978/06 to 1985/06

Personal identification no. (PIN)

11131

Family name

Wolkowicz

RESEARCH SUPPORT

Family name and initial(s) of applicant	Title of proposal, funding source and program, and time commitment (hours/month)	Amount per year	Years of tenure (yyyy)
List all sources of support (including NSERC grants and university start-up funds) held as an applicant or a co-applicant: a) support held in the past four (4) years but now completed; b) support currently held, and c) support applied for. For group grants, indicate the percentage of the funding directly applicable to your research. Use additional pages as required.			
a) Support held in the past 4 years			
Tamas Terlaky	New Interior Point Methods and Software for Convex Conic-Linear Optimizatio and Their Application to Solve VLSI Circuit Layout Problems MITACS NCE 15 hours/month	130,000 (7%) 130,000 (7%) 160,000 (8%) 160,000 (8%) 145,000 (7%)	2002 2003 2004 2005 2006
Tony Vannelli, Raouf Boutaba, and Miguel Anjos	Broadband and Metrics: Modeling, Measurement and Optimization Bell (BUL) Bell University Labs 10 hours/month	94,250 (25%) 115,900 (23%) 110,000 (52%) 30,000 (67%)	2003 2004 2005 2006
Henry Wolkowicz (with Tony Vannelli)	/Large Scale/MOPTA 6 conference MITACS Conference grants 1 hours/month	5,000 5,000	2004 2006
c) Support applied for			
Henry Wolkowicz	Efficient and Robust Algorithms for Hard, Large Scale, Numerical Optimization NSERC Discovery Grant 40 hours/month	75,800(100%) 77,800(100%) 77,800(100%) 75,800(100%) 75,800(100%)	2007 2008 2009 2010 2011

Highly Qualified Personnel (HQP)

Provide personal data about the HQP that you currently, or over the past six years, have supervised or co-supervised.

			Personal identification no. (PIN)	Family name
			11131	Wolkowicz
Name	Type of HQP Training and Status	Years Supervised or Co-supervised	Title of Project or Thesis	Present Position
Nathan Krislock	Doctoral (In Progress)	Supervised 2005 -	Robust Solution of Nearest Matrix Problems	student Univ. Waterloo
Oleg Grodzevich	Doctoral (In Progress)	Co-supervised 2005 -	Robust Solutions of Hard Mathematical Programming	student Univ. Waterloo
Simon Schurr	Postdoctoral (In Progress)	Supervised 2006 - 2008	Optimality Conditions and Constraint Qualifications in Opt.	postdoc Univ. Waterloo
Jiawei Qian	Undergraduate (Completed)	Supervised 2006 - 2006	Robust Solutions of Sensor Localization Problems	student at Univ. of Waterloo
Marina Potapchik	joint superv. (Completed)	Co-supervised 2006 - 2006	Portfolio Selection under Nonsmooth Convex Transaction	PhD completed. Special joint supervision.
Veronica Piccalli	Postdoctoral (Completed)	Supervised 2006 - 2006	Euclidean Distance Matrices and Sensor Localization	Lecturer at University of Rome "La Sapienza"
Matthias Takouda	Postdoctoral (Completed)	Co-supervised 2005 - 2006	Nearest Correlation Matrices using SDP	Research Position at UQAM Montreal
Yichuan Ding	Master's (In Progress)	Supervised 2005 - 2006	Semidefinite Relaxations of Hard Combinatorial Problems	student at Univ. of Waterloo
Hua Wei	Doctoral (Completed)	Supervised 2003 - 2006	Numerical Stability in LP and SDP	Quantitative Investment Anal, Tetrem Capital Partners, Man.
Jamie Sikora	Undergraduate (Completed)	Supervised 2005 - 2005	Euclidean Distance Matrix Problems using SDP	graduate student at Univ. of Waterloo
Joseph Young	Master's (Not Completed)	Supervised 2005 - 2005	Exploiting Sparsity in Large Scale Computing	Graduate student at Rice University
Oleg Grodzevich	Master's (Completed)	Supervised 2004 - 2005	Regularization Using a Parameterized Trust Region	PhD student
David Tweedle	Undergraduate (Completed)	Supervised 2004 - 2004	Solving Euclidean Distance Matrix Problems using SDP	graduate student at Univ. of Waterloo
Veronica Piccalli	Postdoctoral (Completed)	Supervised 2004 - 2004	Euclidean Distance Matrices and Sensor Localization	Lecturer at University of Rome "La Sapienza"
Abdo Alfakih	Postdoctoral (Completed)	Supervised 2003 - 2004	Robust Solutions of Euclidean Distance Matrix Problems	Prof. at Univ. of Windsor
Charles Fortin	Undergraduate (Completed)	Supervised 2003 - 2004	Trust Region Subproblems	finishing PhD , Graduate Student, Univ. of Waterloo
Kathrin Schaecke	Master's (Completed)	Supervised 2003 - 2004	The Kronecker Product	Securities Analyst, TD Bank Financial Group, Toronto
Suliman Al-Homidan	Res. Associate (Completed)	Supervised 2003 - 2004	Efficient Solutions for Nearest Matrix Problems using SDP	Chair Mathematical Sciences Dept , King Saud University
Mike Froh	Master's (Completed)	Supervised 2002 - 2003	Trust Region Subproblems and Linear Least-Squares Regulariza	PhD student in Toronto
Pawoumodom L. Takouda	visiting grad. (Completed)	Supervised 2002 - 2002	Nearest Matrix Problems Using SDP	Research Assoc. UQAM, Montreal

Highly Qualified Personnel (HQP)

Provide personal data about the HQP that you currently, or over the past six years, have supervised or co-supervised.

			Personal identification no. (PIN)	Family name
			11131	Wolkowicz
Name	Type of HQP Training and Status	Years Supervised or Co-supervised	Title of Project or Thesis	Present Position
Charles Fortin	Master's (Completed)	Supervised 2001 - 2002	A Survey of the Trust Region Subproblem within SDP	lecturer at College in Montreal
Maria Gonzalez	Res. Associate (Completed)	Supervised 2001 - 2002	Large Scale Linear Programming Problems	Prof. UNIVERSIDAD SIMON BOLIVAR
Renata Sotirov	Postdoctoral (Completed)	Supervised 2001 - 2002	Efficient Solutions of Semidefinite Programming Relaxations	Research position at Tilburg University
Leo Tzou	Undergraduate (Completed)	Supervised 2001 - 2001	Optimal Control Barrier path for Interior Point Methods	(finishing) PhD student at Univ. Washington, Seattle
Miguel Anjos	Doctoral (Completed)	Supervised 1999 - 2001	New Convex Relaxations for the Maximum Cut and VLSI Layout	Prof. Management Sc. at Univ. of Waterloo
Serge Kruk	Doctoral (Completed)	Supervised 1999 - 2001	High Accuracy Algorithms for the Solutions of Semidefinite L	Prof., Dept. Math. & Stats, Oakland University

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Personal information collected on this form and appendices will be stored in the Personal Information Bank for the appropriate program.

Version française disponible



PROTECTED WHEN COMPLETED

PART II. Contributions (over the last six years: 2000-2006)**1. Most Significant Contributions to Research/Practical Applications**

Notation: Euclidean Distance Matrix, EDM; Gauss Newton, GN; Linear Progr., LP; Nonlinear Progr., NLP; Quadratic Assignment Problem, QAP; Quadratic Programming Problem, QP; Semidefinite Progr., SDP; Sequential Quadratic Progr. with Quadratic Constraints, SQQP; Trust Region Subproblem, TRS.

Square brackets around numbers preceded by **RP,RS,RB**, refer to my research, from the last 6 years, i.e. **papers published/papers submitted/books**, respectively, which are listed in the Research Contribution section of this Form 100; whereas, square brackets around numbers refer to the references at the end of Form 101.

My publications are generally with colleagues and students. I contribute my fair share to the research. The authors of the publications are given in alphabetical order. In the case of the Handbook [RB12], my co-authors insisted that my name come first as recognition of my share of the work. Several of my papers have high numbers of citations. In addition, I have been invited to give several plenary talks on my research.

(I) Semidefinite Programming: Theory, Algorithms, and Applications

SDP, is, arguably, the hottest area of research in Optimization during the last 15 years. The reason lies in the topics in the title of the Handbook [RB12]. The elegant *theory*, efficient *algorithms*, and many important *applications* have popularized SDP. I was the chief editor for the handbook and also contributed three chapters, [RB8],[RB9],[RB10]. This handbook is currently considered to be *the main* reference for SDP. I was asked to edit this handbook since I have made major contributions to all three areas in the title. This includes: **(A)** Strong duality results in the early 1980s, e.g. [4]. The strong duality results are proving particularly important now, since many SDP relaxations of hard discrete optimization problems result in failure of Slater's constraint qualification, i.e. loss of strict feasibility, e.g. for QAP [16], for graph partitioning [15], for EDM [RB9], and more recently for sensor localization [RS1]. **(B)** In addition, the work on chordality and positive definite completions [8] has found many applications including the application to solving large scale sparse SDPs, e.g. it is part of the SDPA software package [7].

(II) Robust Algorithms for SDP

The early algorithms for SDP were developed following the success of the primal-dual interior point methods for LP. I was involved in, arguably, the most popular of the Newton search directions for SDP, i.e. the so-called HKM direction, [10]. As for the other popular search directions, the HKM direction suffers from ill-conditioning. During the last few years I have emphasized designing algorithms that are robust and can solve SDPs to high accuracy. The paper [R6] presents an algorithm for solving SDP that highlights several important novel aspects: **(A)** I avoid the symmetrizations that allow for Newton's method, but introduces ill-conditioning. I apply the GN approach on the overdetermined perturbed optimality conditions, see also [R13]. **(B)** I avoid finding the matrix representations of the linear transformations of the constraints in the $\overline{\text{SDP}}$. I apply a preconditioned conjugate gradient method that explicitly exploits the structure of the linear transformations. **(C)** The stability of the optimality conditions allows for a crossover to an affine scaling GN direction that obtains quadratic convergence and high accuracy. **(D)** The use of the linear transformations allows for exact primal-dual feasibility at each iteration. The approach has been used in other papers as well, e.g. [1],[RS1].

(III) Robust Algorithms for Large Scale LP

There has been a revolution in optimization since the successful implementation of interior point methods for LP in the late '80s. In particular, large scale LPs can be solved efficiently using primal-dual path-following interior point methods. The classical approach modifies the optimality conditions for the log-barrier problem with fixed barrier parameter to avoid ill-conditioning. Then, the linearized

system is solved to find the Newton search direction. The block structure of this linearized system is exploited by using block Gaussian elimination. For the popular so-called *normal equations* approach, small errors in the solution of the normal equations get magnified during the back substitution phase. Therefore, the primal residual must be carefully controlled and one can safely expect 8 decimal accuracy on a double precision computer. In [RS3], we present a different paradigm for these methods. We use a different block elimination scheme that does *not* result in an ill-conditioned linear system in general, i.e. the backsolve does not magnify small errors for nondegenerate LPs. Moreover, we use an iterative method that directly exploits sparsity. Our algorithm solves the NETLIB set of problems to higher accuracy, and it outperforms the LIPSOL LP package (cpu time) on large scale problems.

(IV) Strong Duality for Quadratic-Quadratic Programs

The new paradigm in optimization is convex versus nonconvex rather than linear versus nonlinear, i.e. (many) convex problems can be solved in polynomial time, whereas (many) nonconvex problems are NP-hard. Therefore, it is important to recognize hidden convexity, i.e. problems where strong duality holds. The TRS is one such problem, i.e. this is the minimization of a nonconvex (quadratic) objective subject to a nonconvex (quadratic) constraint and yet strong duality holds, [14]. The homogeneous QAP (the minimization of a quadratic (matrix variable) objective subject to orthogonal constraints on the matrix variables, $X^T X = I$) looks visibly like a TRS. If we add the redundant constraints $X X^T = I$, then strong duality holds, [R14]. This surprising result, along with the projected eigenvalue bound [9] and the SDP relaxation for QAP [16], led to the solution of the *Nugent 30 QAP* for the first time, [2]. Other results related to strong duality are in [3],[R11].

(V) Regularization and TRS

In [R1], we present and test a new method for regularization of ill-conditioned problems, such as those that arise in image restoration or mathematical processing of medical data. The method extends the traditional *trust-region subproblem*, TRS, approach that makes use of the *L-curve maximum curvature criterion*, a strategy recently proposed to find a good regularization parameter. We apply a parameterized trust region approach to estimate the region of maximum curvature of the L-curve and find the regularized solution. This exploits the close connections between various parameters used to solve TRS in [R5]. In addition, [R5] resolves the so-called *hard case* for TRS.

2. Research Contributions and Practical Applications (2000–2006)

Primary source of funding is NSERC. For [R1], funding by a Bell University Laboratories grant. For [R2], funding by a MITACS grant.

• **Articles in refereed publications:** (published or accepted) ([R1] to [R14])

- [R1] M.F. Anjos, M. Desroches, A. Haque, **O. Grodzevich**, **H. Wei**, and H. Wolkowicz. Multi-stage investment decision under contingent demand for networking planning. In *Proceedings of the 2006 IEEE GLOBECOM Conference in San Francisco*, accepted June/06, 2006.
- O. Grodzevich** and H. Wolkowicz. Regularization using a parameterized trust region subproblem. *Math. Programming*, (CORR 2005-11):accepted Jan. 6/06, 2006.
- [R2] A. Alfakih and H. Wolkowicz. Necessary and sufficient trace inequalities for Euclidean distance matrices. *Linear and Multilinear Algebra*, to appear(CORR 2005-21):Accepted May/06, 2006.
- [R3] S. AL-Homidan and H. Wolkowicz. Approximate and exact completion problems for Euclidean distance matrices using semidefinite programming. *Linear Algebra Appl.*, 406:109–141, 2005.
- [R4] L. Tunçel and H. Wolkowicz. Strengthened existence and uniqueness conditions for search directions in semidefinite programming. *Linear Algebra Appl.*, 400:31–60, 2005.
- [R5] **C. Fortin** and H. Wolkowicz. The trust region subproblem and semidefinite programming. *Optimization Methods and Software*, 19(1):41–67, 2004. special issue dedicated to Jochem Zowes 60th birthday, Guest Editors: Florian Jarre and Michal Kocvara.
- [R6] H. Wolkowicz. Solving semidefinite programs using preconditioned conjugate gradients. *Optim. Methods Softw.*, 19(6):653–672, 2004.

- [R7] S. Kruk and H. Wolkowicz. Convergence of an infeasible short-step path-following algorithm based on the Gauss-Newton direction. *J. Appl. Math.*, 10:517–534, 2003.
- [R8] **M.F. Anjos** and H. Wolkowicz. Geometry of semidefinite max-cut relaxations via ranks. *J. Comb. Optim.*, 6:237–270, 2002.
- [R9] **M.F. Anjos** and H. Wolkowicz. Semidefinite programming for discrete optimization and matrix completion problems. *Discrete Appl. Math.*, 123/124:507–571, 2002.
- [R10] **M.F. Anjos** and H. Wolkowicz. A strengthened SDP relaxation via a second lifting for the Max-Cut problem. *Discrete Appl. Math.*, 119:79–106, 2002.
- [R11] H. Wolkowicz. A note on lack of strong duality for quadratic problems with orthogonal constraints. *European J. Oper. Res.*, 143(2):356–364, 2002.
- [R12] A. Alfakih and H. Wolkowicz. Two theorems on Euclidean distance matrices and Gale transform. *Linear Algebra Appl.*, 340(1-3):149–154, 2001.
- [R13] **S. Kruk**, M. Muramatsu, F. Rendl, R.J. Vanderbei, and H. Wolkowicz. The Gauss-Newton direction in linear and semidefinite programming. *Optimization Methods and Software*, 15(1):1–27, 2001.
- [R14] K.M. Anstreicher and H. Wolkowicz. On Lagrangian relaxation of quadratic matrix constraints. *SIAM J. Matrix Anal. Appl.*, 22(1):41–55, 2000.

• **Articles in refereed publications:** (submitted) ([RS1] to [RS5])

- [RS1] **N. Krislock**, V. Piccialli, and H. Wolkowicz. Robust semidefinite programming approaches for sensor network localization with anchors. Technical Report CORR 2006-12, submitted April/06, University of Waterloo, Waterloo, Ontario, 2006.
- [RS2] **M. Potapchik**, L. Tunçel, and H. Wolkowicz. Large scale portfolio optimization with piecewise linear transaction costs. Technical Report CORR 2006-19, submitted Sept./06, University of Waterloo, Waterloo, Ontario, 2006.
- [RS3] M. Gonzalez-Lima, **H. Wei**, and H. Wolkowicz. A stable iterative method for linear programming. Technical Report CORR 2004-26, University of Waterloo, Waterloo, Ontario, 2004. submitted 2006.
- [RS4] **H. Wei** and H. Wolkowicz. Generating and solving hard instances in semidefinite programming. Technical Report CORR 2006-01, University of Waterloo, Waterloo, Ontario, 2006. Submitted to Math. Progr. Jan/06; Accepted subject to revision Sept/06.
- [RS5] **Y. Ding** and H. Wolkowicz. A matrix-lifting semidefinite relaxation for the quadratic assignment problem. Technical Report CORR 2006-22, submitted Oct./06, University of Waterloo, Waterloo, Ontario, 2006.

• **Other Refereed Publications: Books; Chapters; Reviews** ([RB1] to [RB14])

- [RB1] H. Wolkowicz. Semidefinite programming. In Leslie Hogben, editor, *CRC Handbook of Linear Algebra (HLA)*, to appear, Oct/06. CRC Press, Bacon Raton, FL, 2006.
- [RB2] H. Wolkowicz. Book review of: Optimization: Insights and Applications, by Brinkhuis and Tikhomirov. *IEEE Control Systems Magazine*, page to appear, 2006.
- [RB3] V. Piccialli and H. Wolkowicz. Solution to problem 34-6.1. *IMAGE-The Bulletin of the International Linear Algebra Society*, 35:33–34, 2005.
- [RB4] P. Pardalos and H. Wolkowicz, editors. *Novel Approaches to Hard Discrete Optimization*, The Fields Institute for Research in Mathematical Sciences, Communications Series, Providence, RI, 2003. American Mathematical Society.
- [RB5] P. Pardalos and H. Wolkowicz, editors. *New Approaches to Hard Discrete Optimization*, volume 6 #3. Kluwer Academic Publishers, Hingham, MA, 2002. Papers from the workshop held at the University of Waterloo, ON, May, 2001, J. Comb. Opt.
- [RB6] H. Wolkowicz. Semidefinite programming. In P.M. Pardalos and M.G.C. Resende, editors, *Handbook of Applied Optimization*, pages 40–50. Oxford University Press, New York, 2002.

- [RB7] H. Wolkowicz. Duality for semidefinite programming. In *Encyclopedia of Optimization*. Kluwer Academic Publishers, Boston, MA, 2001.
- [RB8] H. Wolkowicz. Semidefinite programming approaches to the quadratic assignment problem. In P.M. Pardalos and L. Pitsoulis, editors, *Nonlinear Assignment Problems: Algorithms and Applications*, volume 7, pages 143–174. Kluwer Academic Publishers, Dordrecht, 2000.
- [RB9] A. Alfakih and H. Wolkowicz. Matrix completion problems. In H. Wolkowicz, R. Saigal, and L. Vandenberghe, editors, *Handbook of Semidefinite Programming: Theory, Algorithms, and Applications*, pages 533–545. Kluwer Academic Publishers, Boston, MA, 2000.
- [RB10] Y.E. Nesterov, H. Wolkowicz, and Y. Ye. Semidefinite programming relaxations of nonconvex quadratic optimization. In H. Wolkowicz, R. Saigal, and L. Vandenberghe, editors, *Handbook of Semidefinite Programming: Theory, Algorithms, and Applications*, pages 361–420. Kluwer Academic Publishers, Boston, MA, 2000.
- [RB11] **S. Kruk** and H. Wolkowicz. General nonlinear programming. In H. Wolkowicz, R. Saigal, and L. Vandenberghe, editors, *Handbook of Semidefinite Programming: Theory, Algorithms, and Applications*, pages 563–575. Kluwer Academic Publishers, Boston, MA, 2000.
- [RB12] H. Wolkowicz, R. Saigal, and L. Vandenberghe, editors. *HANDBOOK OF SEMIDEFINITE PROGRAMMING: Theory, Algorithms, and Applications*. Kluwer Academic Publishers, Boston, MA, 2000. xxvi+654 pages.
- [RB13] E Andersen, E de Klerk, L Tuncel, H Wolkowicz, and S Zhang editors. *Large Scale Nonlinear and Semidefinite Programming, Special Issue in memory of Jos Sturm*, Math. Programming, Ser. B. to appear, 2007.
- [RB14] R Bhatia, R Guralnick, S Kirkland, and H Wolkowicz, editors. *12th ILAS Conference Proceeding, Regina 2005*, Linear Algebra and Its Applications, to appear, 2007.

3. Other Evidence of Impact and Contributions

- **Elected:**

Chair, SIAM Activity Group on Opt. 2000-2004;
SIAM Council member, 2006-8.

- talks: average 10 talks/short-courses per year. A selection follows:

Due to family emergency, I cancelled Two Plenary invited talks: *Workshop on Advances in Cont. Opt.*, Iceland July/06; and Intern. Conference on Numer. Analysis and Opt., Beijing, Sept/06.

Invited Plenary talks:

Two hour invited presentation on future programs at at MSRI, during SAC meeting, Nov. 10/06

Two invitations to IMA, Univ. of Minnesota: Jan/07 and Mar/02;

Three invitations to BIRS, Banff, Alta: Oct/06; invited plenary talk at Opt. and Eng. Appl., BIRS, Nov/06; organizer of session on Numer. Lin. Alg. at CAIMS May/07;

Southern Ontario Matrices and Statistics Day, University of Windsor, June/2005; Franco-Canadian Workshop on Combinatorial Algorithms, McMaster University, Aug/2005; WCOM, Seattle, May/04; First Joint Canada/France Meeting in the Mathematical Sciences, Toulouse, July/2004; Western Canada Linear Algebra Meeting, May/2000;

Special Courses given:

Short course at Eighth SIAM Conference on Optimization, Stockholm, May/05; course on Optimization at the Fields Institute, spring, 2002; course on SDP at CRM, University of Montreal, July, 2002; 2 week course on Optimization, Cortona, Italy, Aug. 2002; 2 week course, Rio, Brazil, April, 2001;

- **Member of the Editorial Board of journals and book series:**

SIAM Book Series on Fundamentals of Algorithms; Optimization and Engineering, OPTE, (Kluwer); J. of Computational Optimization and Applications, COAP; Canadian Applied Mathematics Quarterly, CAMQ; Encyclopedia of Optimization II, Springer; Mathematical Programming Glossary; Algorithmic Operations Research, (FACETS Inc.); J. of Combinatorial Optimization, JOCO, (Kluwer)

Canadian Applied Mathematics Quarterly; American J. of Mathematical and Management Sciences; Associate Editor of several Special Issues in Linear Algebra and its Applications as well as Mathematical Programming.

- **Consulting** Bell University Laboratories, 2002-2006 (with 3 graduate students).

- **Organization of conferences and workshops:**

Chair of program committee for ICCOPT II/MOPTA-7, McMaster Univ., Aug/07. (the major continuous optimization conference of the year);

Organizer of Numerical Linear Algebra and Optimization session at CAIMS/07;

Chair, Joint Program and Organization of MOPTA-6, Univ. of Waterloo, Aug/06;

Chair, Joint Program and Organization of SIAM Conference on Optimization, Stockholm, May/05. (the major continuous optimization conference of the year);

Joint organizer of the conference “Large Scale Nonlinear and Semidefinite Programming”, Waterloo, May/04;

Joint organizer of the conference “Novel Approaches to Hard Discrete Optimization”, Waterloo, Apr/01;

I have organized sessions at other conferences.

- External examiner of five PhD and three Masters theses. Evaluation for promotion for three academics per year, on average. Refereeing 12 papers per year, on average. Book reviews 2 per year, on average. Math. Reviews 4 per year.

4. Delays in Research Activity

Due to a family crisis and my involvement in the organization of three conferences during 3 months in summer/06, I was delayed in completing several projects, e.g. my work on a book on SDP.

5. Data on HQP Training

I have been involved with 26 HQPs. Many of them specifically sought me out in order to work with me. This has resulted in many joint publications, consulting work, and jobs for the HQPs. These jobs include both University positions as well as consulting positions.



**SEND ONE
ORIGINAL ONLY
DO NOT
PHOTOCOPY**

**APPENDIX A
Personal Data
(Form 100)**

Complete this appendix (i) if you are an applicant or co-applicant applying for the first time; (ii) if you need to update information submitted with a previous application; or (iii) if you do not hold an appointment at a Canadian postsecondary institution. For updates, include only the revised information in addition to the date, your name and your PIN.

This information will be used by NSERC primarily to contact applicants and award holders. It may also be used to identify prospective reviewers and committee members, and to generate statistics. It will not be seen or used in the adjudication process.

			Date 2009/10/01
Family name Wolkowicz	Given name Henry	Initial(s) of all given names H	Personal identification no. (PIN) 11131
Position and complete mailing address if your primary place of employment is not a Canadian postsecondary institution or if your current mailing address is temporary			If address is temporary, indicate: Starting date Leaving date
Telephone number 1 (519) 888-4567 35589	Facsimile number	E-mail address hwolkowicz@uwaterloo.ca	
Telephone number (alternate)	Give an alternate telephone number only if you can be reached at that number during business hours.	Gender (completion optional) <input checked="" type="checkbox"/> Male <input type="checkbox"/> Female	
LANGUAGE CAPABILITY			
English	Read <input checked="" type="checkbox"/>	Write <input checked="" type="checkbox"/>	Speak <input checked="" type="checkbox"/>
French	Read <input type="checkbox"/>	Write <input type="checkbox"/>	Speak <input type="checkbox"/>
I wish to receive my correspondence:		in English <input checked="" type="checkbox"/>	in French <input type="checkbox"/>
AREA(S) OF EXPERTISE			
Provide a maximum of 10 key words that describe your area(s) of expertise. Use commas to separate them. If you have expertise with particular instruments and techniques, specify which one(s). Cone Optimization, Semidefinite Programming, Continuous Approximation - Hard Problems, Numerical Linear Algebra, Nonlinear Programming, Linear Programming, Continuous Approximation, Eigenvalue Problems, Sensor Localization, Trust Region Algorithms			Research subject code(s) Primary 2956 Secondary 2955



Appendix D (Form 100) Consent to Provide Limited Personal Information About Highly Qualified Personnel (HQP) to NSERC

NSERC applicants are required to describe their contributions to the training or supervision of highly qualified personnel (HQP) by providing certain details about the individuals they have trained or supervised during the six years prior to their current application. HQP information must be entered on the Personal Data Form (Form 100). This information includes the trainee's name, type of HQP training (e.g., undergraduate, master's, technical etc.) and status (completed, in-progress, incomplete), years supervised or co-supervised, title of the project or thesis, and the individual's present position.

Based on the federal *Privacy Act* rules governing the collection of personal information, applicants are asked to obtain consent from the individuals they have supervised before providing personal data about them to NSERC. In seeking this consent, the NSERC applicant must inform these individuals what data will be supplied, and assure them that it will only be used by NSERC for the purpose of assessing the applicant's contribution to HQP training. To reduce seeking consent for multiple applications, applicants will only need to seek consent one time for a six-year period. If the trainee provides consent by e-mail, the response must include confirmation that they have read and agree to the text of the consent form.

When consent cannot be obtained, applicants are asked to not provide names, or other combinations of data, that would identify those supervised. However, they may still provide the type of HQP training and status, years supervised or co-supervised, a general description of the project or thesis, and a general indication of the individual's present position if known.

An example of entering HQP information on Form 100 (with and without consent):

Name	Type of HQP Training and Status	Years Supervised or Co-supervised	Title of Project or Thesis	Present Position
Consent Received from Marie Roy				
Roy, Marie	Undergraduate (Completed)	Supervised 1994 - 1997	Isotope geochemistry in petroleum engineering	V-P (Research), Earth Analytics Inc., Calgary, Alberta
Consent Not Obtained from Marie Roy				
(name withheld)	Undergraduate (Completed)	Supervised 1994 - 1997	Isotope geochemistry	research executive in petroleum industry - western Canada

Consent Form

Name of Trainee	
Applicant Information	
Name Wolkowicz, Henry H	
Department Combinatorics and Optimization	Postsecondary Institution Waterloo
<p>I hereby allow the above-named applicant to include limited personal data about me in grant applications submitted for consideration to NSERC for the next six years. This limited data will only include my name, type of HQP training and status, years supervised or co-supervised, title of the project or thesis and, to the best of the applicant's knowledge, my position title and company or organization at the time the application is submitted. I understand that NSERC will protect this data in accordance with the <i>Privacy Act</i>, and that it will only be used in processes that assess the applicant's contributions to the training of highly qualified personnel (HQP), including confidential peer review.</p>	
_____	_____
Trainee's signature	Date
<p>Note: This form must be retained by the applicant and made available to NSERC upon request.</p>	