Preface

Jos Sturm (1971–2003) passed away on Saturday, December 6th, 2003, after having suffered a cerebral hemorrhage a few months earlier.

His unexpected and premature death greatly saddened those in the mathematical programming community who knew him as a warm and generous person, and as a very promising young researcher.

The workshop *Large Scale Nonlinear and Semidefinite Programming*, held in Waterloo, Ontario, in June 2004, was subsequently dedicated to his memory, and included a special memorial session. Participants were invited to submit papers presented at the workshop for publication in an issue of *Mathematical Programming B*, and the result is this collection of papers.

In this foreword, we will discuss some of the work and research of Jos' short but influential career.

Jos completed his PhD studies at the Econometric Institute and the Tinbergen Institute of the Erasmus University in Rotterdam, The Netherlands, under supervision of Shuzhong Zhang in September 1997. The title of the thesis was *Primal-Dual Interior Point Approach to Semidefinite Programming*, and semidefinite programming (SDP) would remain the main focus of his research interest.

Jos spent the academic year 1997/1998 as a post-doctoral fellow at the Communications Research Laboratory (CRL) of McMaster University, Hamilton, Canada, in the group of Zhi-Quan (Tom) Luo. In this period he was actively developing the software package SeDuMi, an implementation of algorithmic ideas for semidefinite and second order cone programming developed in his thesis.

The key ideas implemented in SeDuMi may be traced back to the following papers written during his PhD.

- In the paper:

  Sturm, J.F., and Zhang, S., 'Symmetric primal-dual path following algorithms for semidefinite programming', *Applied Numerical Mathematics*, **29**, 301–315, 1999,

  the authors independently (re)discovered the search direction for SDP that is now known as the Nesterov-Todd direction.

- In the subsequent work:

  Luo, Z.-Q., Sturm, J.F., and Zhang, S., 'Superlinear Convergence of a Symmetric Primal-Dual Path Following Algorithm for Semidefinite Programming', *SIAM Journal on Optimization*, **8**(1), February 1998, 59–81,

  the authors derived a superlinearly convergent predictor-corrector method that uses the Nesterov-Todd direction.

- The paper:

  Luo, Z.-Q., Sturm, J.F., and Zhang, S. (2000), 'Conic convex programming and self-dual embedding', *Optimization Methods and Software*, **14**, 169–218,

was one of the first to extend the homogeneous self-dual embedding idea from linear programming to SDP.

- Although the paper:

  Sturm, J.F., and Zhang, S., 'On a Wide Region of Centers and Primal-Dual Interior Point Algorithms for Linear Programming', *Mathematics of Operations Research*, **22**, 408 – 431, 1997,

  was on linear programming, it introduced the type of target and step-length selection strategies used in SeDuMi for SDP.

Jos would actively develop algorithmic ideas for future implementation in SeDuMi throughout his career, and a fine example is his paper: 'Avoiding numerical cancelation in the interior point method for solving semidefinite programs', *Mathematical Programming, Series B*, **95**(2), 219–247, 2003.

Another notable paper from his PhD period was on 'Error bounds for linear matrix inequalities', *SIAM Journal on Optimization*, **10**(4), pp. 1228–1248, 2000.

During his post-doc period Jos demonstrated his versatility as a researcher by doing work in electrical engineering applications, including the joint work:

Davidson, T.N., Luo, Z.-Q., Sturm, J.F., 'Linear Matrix Inequality Formulation of Spectral Mask Constraints', *IEEE Transactions on Signal Processing*, **50**(11), 2702–2715, 2002.

After his post-doctoral fellowship at McMaster, he returned to The Netherlands, and from October 1998 to January 2001, he was a lecturer at Maastricht University, at the Department of Quantitative Economics.

In January 2000, his PhD thesis was awarded the Gijs de Leve prize for the best thesis in operations research in the years 1997-1999 in The Netherlands.

In February 2001, Jos was appointed as an Associate Professor at Tilburg University. In July 2001, he was awarded the prestigious *Vernieuwingsimpuls* (Innovation) grant of The Netherlands Organization for Scientific Research (NWO).

In this period, Jos also became interested in linear matrix inequality representations of certain nonnegative quadratic maps, and this work may perhaps be best described as an extension of the S-procedure used in control theory. Two representative joint papers on this work are

- Sturm, J.F., and Zhang, S., On Cones of Nonnegative Quadratic Functions, *Mathematics of Operations Research*, **28**, 246 – 267, 2003,

- Luo, Z.Q., Sturm, J.F. and Zhang, S., 'Multivariate Nonnegative Quadratic Mappings', *SIAM Journal on Optimization*, **14**, 1140 – 1162, 2004,

the latter being Jos' last published paper.

Jos was editor of the newsletter SIAG/Optimization Views-and-News of the SIAM Activity Group on Optimization (SIAG/OPT), and a council member-at-large of the Mathematical Programming Society (MPS).

His collected scholarly works include more than 30 papers, and his PhD thesis was published in edited form in the volume 'High performance optimization', Frenk et al. eds., Kluwer Academic Press, 2000.

He is survived by his wife Changqing and daughter Stefanie, his brother Pim, and parents Frans and Els.

Erling Andersen
Etienne de Klerk
Levent Tunçel
Henry Wolkowicz
Shuzhong Zhang