Preface: Special issue on distances in optimization and graphs dedicated to the memory of Michel Deza

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It was with deep sadness that we heard about the passing away of Michel Deza a few days before the end of the year 2016. At first we received the information from another colleague, then the news spread over the newsletters of the research community close to Michel. In contact with Michel's wife and son, we decided therefore to change the dedication to this special issue, that was initially planned for an event organized in France and focused on distance geometry, to the memory of Michel. By doing that, we have enlarged the target of the special issue, and invited many colleagues close to Michel to contribute.

Michel's interest and contributions in the field of mathematics of distances are summarized in the wonderful Encyclopedia [1] that Michel co-authored with his wife Elena. The Encyclopedia was republished in 2016 in its 4th edition, and can already count thousands of citations in Google Scholar. Other scientific interests of Michel mainly include geometry, optimization and graph theory.

This special issue collects some original research contributions that are focused around the research interests and work of Michel Deza. Michel himself is co-author with M.D. Sikirić of one of the contributions (the one entitled “Generalized Cut and Metric Polytopes of Graphs and Simplicial Complexes”), as he had started to work on the topic with his co-author. Michel's wife also contributes to this special issue with a paper co-authored with Pavel Chebotarev and entitled “Hitting Time Quasi-metric and Its Forest Representation”. This paper relies on many of the several publications that Elena and Michel signed together. Michel's Deza son, Antoine, together with his daughter Anna (Michel's grand-daughter), also signed for this special issue an original contribution describing a new distance measure in lattice polytopes (“Distance between Vertices of Lattice Polytopes”, by A. Deza, A. Deza, Z. Guan and L. Pournin).

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Not only Michel's family wished to participate to the preparation of this collection, but also other colleagues that were close to him and to its research interests. The first article we received was the one authored by Michel Petitjean and entitled "Chirality in Metric Spaces". This article is not only an interesting overview of the concept of symmetry and chirality (which are very close to the concept of distance), but it also contains a nice personal dedication to Michel written by the author. The Guest Editors participated in the past to scientific events that were jointly organized by Michel Deza and Michel Petitjean, such as the conference¹ "Mathematics of Distances and Applications" (MDA12), held in Varna (Bulgaria) in 2012, as well as a special session at the conference² "Geometric Science of Information" (GSI13), held in Paris (France) in 2013.

In the paper authored by Peter Frankl [2], the author proposes an extension of some results on which he had previously worked with Michel. He integrated his definitions and theorems with some nice historical facts concerning the particular way he came to know Michel, and on the way they started to work together. We believe that the short story he tells us in his contribution is a nice example of Michel's way to living. This contribution was initially planned for this special issue, but it was then assigned to a regular issue by mistake.

Monique Laurent (who did her PhD under the supervision of Michel) and her co-author contribute to this special issue with an extension of the concept of perfect elimination orderings (already known for unweighted graphs) to matrices and weighted graphs (the paper is entitled "Perfect Elimination Orderings for Symmetric Matrices", by M. Laurent and S. Tanigawa). The contribution of Alain Hertz proposes a novel algorithm, which is based on the exact solution of an integer program, for the solution of the problem of finding a minimal subset of doubly resolving vertices (his paper is entitled "An IP-based Swapping Algorithm for the Metric Dimension and Minimal Doubly Resolving Set Problems in Hypercubes"). Nelson Maculan and his co-authors focused their article on the perfect edge domination problem defined on simple undirected graphs (the paper is entitled "Modelling and Solving the Perfect Edge Domination Problem").

Other contributions include the one of Juan Carlos Figueroa-Garcia and his co-authors, entitled "Representation of the Minkowski Metric as a Fuzzy Set", and the one of Jon Lee and co-authors, entitled "On a Nonconvex MINLP Formulation of the Euclidean Steiner Tree Problem in n -space: Missing Proofs". Jon Lee also co-authors another paper with Leo Liberti, entitled "On an SDP Relaxation for Kissing Number".

The second part of this special issue is devoted to distance geometry [3–5]. Douglas Gonçalves contributes with two articles to this part. For the article entitled "A Least-Squares Approach for Discretizable Distance Geometry Problems with Inexact Distances" where he is the only author, he proposes an extension of a well-known algorithmic framework for distance geometry in order to deal with uncertainty in the distance information. His second contribution (co-authored with Jérémy Omer and entitled "An Integer Programming Approach for the Search of Discretization Orders in Distance Geometry Problems") focuses instead on finding suitable vertex orders

¹ <http://www.foibg.com/conf/ITA2012/2012mda.htm>.

² <http://www.gsi2013.org/>.

that allow for discretizing the search space of distance geometry problems. In the same context, Alain Franc, together with his co-authors, proposes a discussion on the relationships between non-linear mapping and distance geometry (this paper is entitled “Nonlinear Mapping and Distance Geometry”).

While playing the role of Guest Editors, we wished to contribute with some original research to this special issue. Together with other colleagues, we co-authored together a paper where we have introduced some auxiliary graphs in the context of distance geometry, which can be exploited for the study of its solution set before the execution of any solution method (the paper is entitled “The K -discretization and K -incident Graphs for Discretizable Distance Geometry”). Moreover, one of us co-authored with other colleagues the paper “A Constrained Interval Approach to the Generalized Distance Geometry Problem” in the same context.

Finally, the paper entitled “An Application-based Characterization of Dynamical Distance Geometry Problems”, and co-authored by one of the Guest Editors, is the one that probably better reflects the topic of the event for which this special issue was initially planned. The distance geometry problem has various applications; some of them have recently been emerging in the scientific literature.

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References

1. Deza, M., Deza, E.: Encyclopedia of Distances. Springer, Berlin (2009). 604 pages
2. Frankl, P.: An exact result for $(0, \pm 1)$ -vector. Optim. Lett. **12**(5), 1011–1017 (2018)
3. Lavor, C., Liberti, L., Lodwick, W., da Costa, T.M.: An Introduction to Distance Geometry applied to Molecular Geometry, p. 56. Springer, New York (2017)
4. Liberti, L., Lavor, C., Maculan, N., Mucherino, A.: Euclidean distance geometry and applications. SIAM Review **56**(1), 3–69 (2014)
5. Mucherino, A., Lavor, C., Liberti, L., Maculan, N. (eds.): Distance Geometry: Theory Methods and Applications, p. 410. Springer, Berlin (2013)

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