Novelty

Convex Optimization
Euclidean Distance Geometry

It is customary to publish novel scientific results in some established Journal, whereas book writing is usually reserved for gathering important historical artifacts in one place. There is so much background material, with one third of this book in appendices, that to publish pithy papers would make them esoteric. Our intended purpose is to instead reach a broader audience.

We hope the following manifest of novel results will be of particular interest:

p.123 *Conic independence* is introduced as a natural extension to linear and affine independence; a new tool in convex analysis most useful for manipulation of cones.

p.149 Arcane theorems of alternative *generalized inequality* are simply derived from cone *membership relations*; generalizations of *Farkas' lemma* translated to the geometry of convex cones.

p.223, p.227 The *kissing-number of sphere packing* (first solved by Isaac Newton) and *trilateration* or *localization* are shown to be convex optimization problems.

p.238 We show how to elegantly include *torsion* or *dihedral* angle constraints into the *molecular conformation problem.*

p.269 Geometrical proof: *Schoenberg criterion* for a Euclidean distance matrix.

p.286 We experimentally demonstrate a conjecture of Borg & Groenen by reconstructing a map of the USA using only ordinal (comparative) distance information.

p.6, p.303 There is an equality, relating the convex cone of Euclidean distance matrices to the positive semidefinite cone, apparently overlooked in the literature; an equality between two large convex Euclidean bodies.

p.347 The *Schoenberg criterion* for a Euclidean distance matrix is revealed to be a discretized *membership relation* (or *dual generalized inequalities*) between the EDM cone and its dual.

p.357 We present an arguably good 3-dimensional polyhedral analogue, to the isomorphically 6-dimensional positive semidefinite cone, as an aid to understand semidefinite programming.

p.385 We show how to constrain rank in the form $\operatorname{rank} G = \rho$ for any small semidefinite program.