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Comprehensive thematic *T*-matrix reference database: A 2015–2017 update

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ABSTRACT

The *T*-matrix method pioneered by Peter C. Waterman is one of the most versatile and efficient numerically exact computer solvers of the time-harmonic macroscopic Maxwell equations. It is widely used for the computation of electromagnetic scattering by single and composite particles, discrete random media, periodic structures (including metamaterials), and particles in the vicinity of plane or rough interfaces separating media with different refractive indices. This paper is the eighth update to the comprehensive thematic database of peer-reviewed *T*-matrix publications initiated in 2004 and lists relevant publications that have appeared since 2015. It also references a small number of earlier publications overlooked previously.

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1. Introduction

We initiated the thematic database of *T*-matrix publications on electromagnetic scattering by particles and particle groups in 2004 [1] and subsequently have published seven updates [2–8]. The current eighth update lists and classifies 249 new publications [9–257]. Most of the new entries have appeared since 2015, although a few older publications omitted inadvertently in Refs. [1–8] are also included. The current update is compiled by applying the same four general selection criteria:

- The database includes only publications dealing with the scattering of macroscopic time-harmonic electromagnetic fields.
- In general, publications on scattering by isolated infinite cylinders and systems of parallel infinite cylinders in unbounded space are excluded.
- Publications on the Lorenz–Mie theory and its various extensions to individual isotropic spherically symmetric scatterers are not covered.
- The database contains only references to books, peer-reviewed book chapters, and peer-reviewed journal papers, while unrefereed conference abstracts as well as Masters, PhD, and Habilitation dissertations are not covered.

Furthermore, we continue to use the same operational definition of the *T*-matrix method, i.e.,

> In the framework of the *T*-matrix method, the incident and scattered time-harmonic electric field vectors are expanded in series of suitable vector spherical wave functions; the relation between the columns of the respective expansion coefficients is established by means of a transition matrix (or *T* matrix). This concept applies to the entire scatterer or to separate parts of a composite scatterer.

As such, this definition encompasses what is often referred to as the multi-sphere method or the generalized Lorenz–Mie theory.

All publications included in our database are taken at their face value. In other words, the inclusion of a publication does not constitute any formal endorsement or quality certification on our part. However, we try to enhance the practical value of this database by classifying all references into a set of narrower subject categories. Depending on its specific content, a reference can appear in several subject categories.

As a rare deviation from the "no comment" rule, we would like to highlight the inclusion in this update of three recent monographs. The book by Jones et al. [115] is a long overdue comprehensive account of the entire field of optical tweezers and their

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applications, and also serves as a user guide to a public-domain MatLab toolbox called the Optical Tweezers Software. The fundamental and in many respects encyclopedic monograph by Kristensson [127] provides a systematic exposition of several important aspects of the electromagnetic scattering theory along with the presentation of the requisite mathematical apparatus and illustrative numerical results. Finally, the second edition of the book by Gouesbet and Gréhan [80] on generalized Lorenz–Mie theories includes a supplement summarizing important developments since 2011.

As always, we encourage the users of our reference database to e-mail us missing *T*-matrix publications as well as information on new books, book chapters, and peer-reviewed journal papers for inclusion in a forthcoming update.

2. Particles in infinite homogeneous space

2.1. Books, reviews, and tutorials

[80,104,105,115,116,127,129,152,243].

2.2. Mathematics of the T-matrix method

[16,127].

2.3. Extended boundary condition method and its modifications, generalizations, and alternatives

[16,61–64,128–130,145,225].

2.4. T-matrix theory and computations for anisotropic, chiral, gyrotropic, magnetic, and charged scatterers

[10,68,73,85,190].

2.5. Multi-sphere and superposition T-matrix methods and their modifications, including related mathematical tools

[48,49,146,190,207,237,241–243].

2.6. T-matrix theory and computations of electromagnetic scattering by periodic and aperiodic arrays of particles, photonic crystals, and metamaterials

[40,86,241–243,256].

2.7. T-matrix theory and computations of electromagnetic scattering by discrete random media and particulate surfaces

[14,49,83,143,144,151,152,154,163,183,217,255–257].

2.8. Relation of the T-matrix method to other theoretical approaches

[63,146,225].

2.9. Convergence of various implementations of the T-matrix method

[16,48,53,56,59–61,63,64,145,195,202,225].

2.10. Software implementations of the T-matrix method

[56,74,115,198,202,247].

2.11. T-matrix databases

[142].

2.12. T-matrix calculations for homogeneous spheroids

[11,15,16,18,19,23,24,27,28,35,37,38,43,47,57,59,69,75–78,81,82,93, 94,96–98,100,103,107,109,112–114,117,131,138,147–149,158,164,165, 169,174–177,179,181,185–187,189, 192,197,201–205,208,218,220,223–226,229,245,248,249,253].

2.13. T-matrix calculations for Chebyshev and generalized Chebyshev particles

[65,81,96,138,205].

2.14. T-matrix calculations for finite circular cylinders

[35,48,96–100,120,138,148,162,194,197,205,219,222,227,237].

2.15. T-matrix calculations for various rotationally symmetric particles

[34,59,73,216,238,239,246].

2.16. T-matrix calculations for ellipsoids, polyhedral scatterers, and other particles lacking axial symmetry

[23,42,44,68,73,167,170,207,212,213,250].

2.17. T-matrix calculations for layered and composite particles

[22,61,73,88,137,141,153,155,233,237].

2.18. T-matrix calculations for clusters of homogeneous and core–mantle spheres

[10,17,22,25,26,31,32,36,40,45,46,52,53,56,58,67,73,79,84,87,88,91, 92,104,110,111,118,119,121,122,126,133,136,139–144,146,151,152,154–156,159–163,166,168,171,180,182,183,190,193,195,196,199,209,210,211, 214,215,217,231–233,235,244,252,254,256,257].

2.19. T-matrix calculations for clusters of nonspherical, inhomogeneous, and optically active monomers

[72,106,146].

2.20. T-matrix calculations for particles with one or multiple (eccentric) inclusions

[22,88,137,141,153,155,167].

2.21. T-matrix calculations of optical resonances in nonspherical particles and multi-particle clusters

[31,45,84,92,103,104,159,180,182,210,230].

2.22. T-matrix calculations of optical and photophoretic forces and torques on small particles

[21,29,41,115,121–124,134,135,160,200].

2.23. T-matrix calculations of internal, surface, and near fields and near-field energy exchange

[16,31,53,92,163,182,183].

2.24. Illumination by shaped and pulsed beams

[10,21,25,26,106,119,123,124,134,135,257].