

Summary of the Research done at Salalah College of Technology (SCOT)*

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<http://www.imsc.res.in/~jagan/khan-cv.html>
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This is the *Summary of the Research* done after joining the Salalah College of Technology, Salalah, (SCOT), Salalah, Sultanate of Oman.

MAIN FIELDS OF RESEARCH: *Mathematical Optics*

I am working towards a unified treatment of light beam optics and polarization, using the standard mathematical machinery of quantum mechanics. Dirac-*like* form of the Maxwell equations is well known in literature. Starting with the Dirac-*like* form of the Maxwells equations a unified treatment of light beam optics and polarization has been obtained. The traditional results (including aberrations) of the scalar optics are modified by the wavelength-dependent contributions. Some of the well-known results in polarization studies are realized as the leading-order limit of a more general framework of our formalism. The existing matrix representations of the Maxwells equations were found to be approximate for the formalism developed here; hence, an exact matrix representation of the Maxwells equations was derived.

A related study was made starting with the scalar approximation of the Maxwells equations. Using the analogy of the Helmholtz equation with the Klein-Gordon equation and the Feshbach-Villars approach to the Klein-Gordon equation a formalism utilizing the powerful techniques of quantum mechanics has been developed for scalar optics including aberrations. This provides an alternative to the traditional *square-root* approach and gives rise to wavelength-dependent contributions modifying the aberration coefficients.

Some of the results have been published and others have been communicated.

*Updated on Friday the 13 February 2015.

PATENTS

Quadricmeter is the instrument devised to identify (distinguish) and measure the various parameters (axis, foci, latera recta, directrix, etc.,) completely characterizing the important class of surfaces known as the quadratic surfaces. Quadratic surfaces (also known as quadrics) include a wide range of commonly encountered surfaces including, cone, cylinder, ellipsoid, elliptic cone, elliptic cylinder, elliptic hyperboloid, elliptic paraboloid, hyperbolic cylinder, hyperbolic paraboloid, paraboloid, sphere, and spheroid. Quadricmeter is a generalized form of the conventional spherometer and the lesser known cylindrometer (also known as the Cylindro-Spherometer). With a conventional spherometer it was possible only to measure the radii of spherical surfaces. Cylindrometer can measure the radii of curvature of a cylindrical surface in addition to the spherical surface. In both the spherometer and the cylindrometer one assumes the surface to be either spherical or cylindrical respectively. In the case of the quadricmeter, there are no such assumptions.

- Sameen Ahmed Khan,
Quadricmeter,
Official Journal of the Patent Office, Issue No. **43/2008**, Part-I, pp. 25296 (24 October 2008).
Application No.: **2126/MUM/2008 A**, International Classification: **B69G1/36**,
Controller General of Patents Designs and Trade Marks, Government of India.

http://ipindia.nic.in/ipr/patent/journal_archieve/journal_2008/patent_journal_2008.htm

http://ipindia.nic.in/ipr/patent/journal_archieve/journal_2008/pat_arch_102008/official

<http://www.patentoffice.nic.in/>, <http://www.ipindia.nic.in/>

(*patent in process*, <http://SameenAhmedKhan.webs.com/quadricmeter.html>).

- Sameen Ahmed Khan,
Conicmeter.
(*patent in process*, <http://SameenAhmedKhan.webs.com/conicmeter.html>).

PUBLICATIONS

Lecture Notes:

1. Sameen Ahmed Khan,
Lecture Notes in Physics,
Salalah College of Technology E-Learning Website,
<http://www.sct.edu.om/>, (2010).
The Notes cover the Two-Semester Sequence of *Physics for Engineering*.
2. Sameen Ahmed Khan,
Physics Laboratory Manual,
Salalah College of Technology E-Learning Website,
<http://www.sct.edu.om/>, (2010).
The Notes cover over twenty experiments for the Two-Semester Sequence of *Physics for Engineering*.

Contributions to International Reports:

1. ..., Sameen Ahmed KHAN, ..., (*one of the 500+ Contributors, from 325 Institutions*), **International Linear Collider Reference Design Report**, (*Four Volumes*)
ILC Global Design Report and World Wide Study,
(August 2007).
ILC: International Linear Collider.
(Digital Object Identifier (**DOI**), <http://dx.doi.org/10.2172/914731>).
E-Print arXiv: <http://arxiv.org/abs/0712.1950/>, <http://arxiv.org/abs/0709.1893/>,
<http://arxiv.org/abs/0712.2361/> and <http://arxiv.org/abs/0712.2356/>.
2. ..., Sameen Ahmed KHAN, ..., (*one of the Signatories*),
Letter of Intent (LOI), **The International Large Detector Letter of Intent**,
ILD Concept Group, International Linear Collider (ILC)
DESY 2009-87, FERMILAB-PUB-09-682-E, KEK Report 2009-6, (February 2010).
(Digital Object Identifier (**DOI**), <http://dx.doi.org/10.2172/975166>).
E-Print arXiv: <http://arxiv.org/abs/1006.3396/>.
3. ..., S. A. KHAN, ..., (*one of the 2400 Signatories, from 408 Institutions*),
International Linear Collider Technical Design Report, (*Five Volumes*)
ILC Global Design Effort (GDE), (Wednesday the 12 June 2013).
ILC: International Linear Collider.
(Digital Object Identifier (**DOI**), <http://dx.doi.org/>).
E-Print arXiv: <http://arxiv.org/abs/1306.6327/>, <http://arxiv.org/abs/1306.6352/>,
<http://arxiv.org/abs/1306.6353/>, <http://arxiv.org/abs/1306.6328/> and
<http://arxiv.org/abs/1306.6329/>.

A. Review Articles and Book Chapters

1. Sameen Ahmed Khan,
The Foldy-Wouthuysen Transformation Technique in Optics,
Chapter-2 in:
Advances in Imaging and Electron Physics, Editor: Peter W. Hawkes,
(Elsevier, 2008) **Vol. 152**, pp. 49-78 (August 2008).
(ISBN-10: 0123742196 and ISBN-13: 978-0-12-374219-3).
(Digital Object Identifier (**DOI**), [http://dx.doi.org/10.1016/S1076-5670\(08\)00602-2](http://dx.doi.org/10.1016/S1076-5670(08)00602-2)).
2. Sameen Ahmed Khan,
Number Theory and Resistor Networks,
Chapter-5 in:
Resistors: Theory of Operation, Behavior and Safety Regulations,
Editor: Roy Abi Zeid Daou,
(Nova Science Publishers, New York, 2013, <http://www.novapublishers.com/>).
pp. 99-154 (May 2013).
(Hard Cover: pp. 99-154, ISBN-10: 1622577884 and ISBN-13: 978-1-62257-788-0).
(ebook: pp. 99-154, ISBN-10: 1626187959 and ISBN-13: 978-1-62618-795-5).

3. Sameen Ahmed Khan,
Coordinate Geometric Generalization of the Spherometer and Cylindrometer,
Chapter-8 in:
Advances in Engineering Research, Volume 10,
 Editor: Victoria M. Petrova,
 (Nova Science Publishers, New York, 2015, <http://www.novapublishers.com/>).
 pp. 163-190 (10 July 2015).
 (Hard Cover: pp. 163-190, ISBN-10: 1634827848 and ISBN-13: 978-1-63482-784-3).
 (ebook: pp. 163-190, ISBN-10: 1634828151 and ISBN-13: 978-1-63482-815-4).

B. Refereed Publications

1. Sameen Ahmed Khan,
Maxwell Optics of Quasiparaxial Beams,
Optik-International Journal for Light and Electron Optics, 121(5), 408-416 (March 2010).
 (<http://www.elsevier-deutschland.de/ijleo/>).
 (Digital Object Identifier (DOI), <http://dx.doi.org/10.1016/j.ijleo.2008.07.027>).
2. Sameen Ahmed Khan,
Can the Photon Velocity be derived from the Klein-Gordon equation?,
Optik-International Journal for Light and Electron Optics, 122(15), 1324-1325 (August 2011).
 (<http://www.elsevier-deutschland.de/ijleo/>).
 (Digital Object Identifier (DOI), <http://dx.doi.org/10.1016/j.ijleo.2010.08.016>).
 (Available online since Saturday the 23 October 2010).
3. Sameen Ahmed Khan,
Farey Sequences and Resistor Networks,
Mathematical Sciences - Proceedings of the Indian Academy of Sciences, 122(2), 153-182 (May 2012).
 (Publication of the Indian Academy of Sciences (IAS), Copublished with Springer), (Digital Object Identifier (DOI), <http://dx.doi.org/10.1007/s12044-012-0066-7>);
Larger Version as E-Print arXiv: <http://arxiv.org/abs/1004.3346/>.
4. Sameen Ahmed Khan,
Aberrations in Maxwell Optics,
Optik-International Journal for Light and Electron Optics, 125(3), 968-978 (February 2014).
 (<http://www.elsevier-deutschland.de/ijleo/>).
 (Digital Object Identifier (DOI), <http://dx.doi.org/10.1016/j.ijleo.2013.07.097>).
 (Available online since Saturday the 09 November 2013).
5. Sameen Ahmed Khan and Farooq Ahmed Khan,
Phenomenon of Motion of Salt along the Walls of the Container,
International Journal of Current Engineering and Technology (IJCET), 5(1), 368-370 (February 2015).
 ISSN: 2277-4106 and 2347-5161 (<http://inpressco.com/category/ijcet/>).
 (Digital Object Identifier (DOI), <http://dx.doi.org/10.14741/Ijcet/22774106/5.1.2015.66>)

The corrections to the traditional descriptions rigorously derived in the above articles have a significant bearing on the celebrated Scherzer Theorem in the wavelength-dependent regime in electron microscopy and the algebraically equivalent system of fiber optics. I shall be applying for a patent in the near future.

C. E-Prints

<http://arXiv.org/>

1. Sameen Ahmed Khan,
The bounds of the set of equivalent resistances of n equal resistors combined in series and in parallel,
37 pages, *E-Print arXiv*: <http://arxiv.org/abs/1004.3346/>.
(Wednesday the 21 April 2010).
2. Sameen Ahmed Khan,
Primes in Geometric-Arithmetic Progression,
19 pages, *E-Print arXiv*: <http://arxiv.org/abs/1203.2083>.
(Friday the 09 March 2012).
3. Sameen Ahmed Khan,
Coordinate Geometric Generalization of the Spherometer and Cylindrometer,
35 pages, *E-Print archive arXiv*: <http://arxiv.org/abs/1311.3602/>.
(Thursday the 14 November 2013).

D. Expository Publications

1. Sameen Ahmed Khan,
Microsoft Excel in the Physics Classroom,
in *Proceedings of The Third Annual Conference for Middle East Teachers of Mathematics, Science and Computing (METSMaC 2007)*,
The Petroleum Institute, Abu Dhabi, United Arab Emirates, 17-19 March 2007.
Editors: Seán M. Stewart, Janet E. Olearski, Peter Rodgers, Douglas Thompson and Emer A. Hayes, pp. 171-175 (2007).
2. Sameen Ahmed Khan,
Data Analysis Using Microsoft Excel in the Physics Laboratory,
Bulletin of the IAPT, **24**(6), 184-186 (June 2007).
(**IAPT**: Indian Association of Physics Teachers).
3. Sameen Ahmed Khan,
Cylindro-Spherometer,
Bulletin of the IAPT, **26**(1), 4-6 (January 2009).
(**IAPT**: Indian Association of Physics Teachers).
4. Sameen Ahmed Khan,
Quadratic Surfaces in Science and Engineering,
Bulletin of the IAPT, **Volume 2**(11), 327-330 (November 2010).
(**IAPT**: Indian Association of Physics Teachers).
5. Sameen Ahmed Khan,
Cylindrometer,
The Physics Teacher, **48**(9), 607 (December 2010).
(**AAPT**: American Association of Physics Teachers).
(Digital Object Identifier (**DOI**), <http://dx.doi.org/10.1119/1.3517029>).
6. Sameen Ahmed Khan,
How many equivalent resistances?,
Resonance Journal of Science Education, **17**(5), 468-475 (May 2012).
(Monthly Publication of the Indian Academy of Sciences (**IAS**), Copublished with Springer),
(Digital Object Identifier (**DOI**), <http://dx.doi.org/10.1007/s12045-012-0050-7>);
Larger Version as E-Print arXiv: <http://arxiv.org/abs/1004.3346/>.

7. Sameen Ahmed Khan,
Speed of Sound in Air at varying Temperatures,
Bulletin of the IAPT, **4**(5), 116-117 (May 2012).
(**IAPT**: Indian Association of Physics Teachers).
8. Sameen Ahmed Khan,
Floating Ring Magnets,
Bulletin of the IAPT, **4**(6), 145 (June 2012).
(**IAPT**: Indian Association of Physics Teachers).
9. Sameen Ahmed Khan,
Coordinate Geometric Approach to Spherometer,
Bulletin of the IAPT, **5**(6), 139-142 (June 2013).
(**IAPT**: Indian Association of Physics Teachers).
E-Print arXiv: <http://arxiv.org/abs/1309.1951/>.
10. Sameen Ahmed Khan,
Set Theoretic approach to Resistor Networks,
Physics Education, **29** (4), Article Number: 5 (October-December 2013).
(Quarterly e-Journal devoted to Physics Pedagogy, by IAPT).
(**IAPT**: Indian Association of Physics Teachers).

Integer Sequences

<http://www.research.att.com/~njas/sequences/>,

<http://NeilSloane.com/>

<http://oeis.org/> ,

<http://www.oeisf.org/>

<http://SameenAhmedKhan.webs.com/integer-sequences.html>

- **Integer Sequences in Resistor Networks:**
Sequence A174283, Sequence A174284, Sequence A174285, Sequence A174286, Sequence A176497, Sequence A176498, Sequence A176499, Sequence A176500, Sequence A176501 and Sequence A176502.
- **Integer Sequences for Primes in Arithmetic Progression:**
Sequence A206037, Sequence A206038, Sequence A206039, Sequence A206040, Sequence A206041, Sequence A206042, Sequence A206043, Sequence A206044, Sequence A206045, Sequence A227281, Sequence A227282, Sequence A227283, Sequence A227284, Sequence A227285 and Sequence A227286.
- **Integer Sequences for Primes in Geometric-Arithmetic Progression:**
Sequence A209202, Sequence A209203, Sequence A209204, Sequence A209205, Sequence A209206, Sequence A209207, Sequence A209208, Sequence A209209, Sequence A209210 and Sequence A227280.

N. J. A. Sloane (*Editor*), *The On-Line Encyclopedia of Integer Sequences*, published electronically at: <http://oeis.org/> (2012).

<http://SameenAhmedKhan.webs.com/integer-sequences.html>.

Popular Writings:

I have a keen interest in the theme, *Science for Development*, resulting in **190+** popular articles (**110+** of these were published during my stay at the Salalah College of Technology) in National/International Journals, Magazines, Bulletins/Newsletters and Conference Proceedings across the continents (<http://SameenAhmedKhan.webs.com/popular-writings.html>).