



# Comsol Optical Wave Simulation

**Michal Rosen-Zvi**



## **Comsol Optical Wave Simulation:**

*Optical Waveguides and Devices Modeling and Visualization Using COMSOL Multiphysics Volume 1* Hee Lim, 2018-10-19

This pictorial manuscript is a step by step graphical illustrations for waveguides and devices modeling and computational physics simulation using COMSOL Multiphysics with Ray Optics Wave Optics and AC DC Electrostatics modules All the example models investigated and visualized with the help of Finite Element Analysis are referenced from the standard USA undergraduate text on Optical Guided Waves and Devices by Richard Syms and John Cozens The simulations include the use of geometrical ray tracings for point source and full electromagnetic waves source employing the Maxwell s wave equations for plane wave input Both 2D and 3D simulation results will help in visualize the electromagnetic field propagating inside the waveguides and devices Readers without fundamental handle on optics modeling are suggested to read the Optics Modeling and Visualization with COMSOL Multiphysics A step by step graphical instruction manuscripts for detailed discussion These models may be expanded to post graduate research and industrial photonics waveguides and devices development There are 46 chapters of different 2D and 3D optical waveguides devices structures modeled and simulated in Volume 1 and 2 Volume 1 models include 3D single mode optical fiber planar waveguide channel waveguide longitudinal and transverse phase modulator surface plasmon optical square waveguide tapered waveguide FTIR beamsplitter in ray tracing and electromagnetic wave solvers full prism coupler halved prism coupler plano convex overlay lens overlay Luneburg lens geodesic lens with control setup for resulted electric field comparison corrugated gratings transmission and reflection gratings chirped grating lens beam expander grating grating coupler chirped grating coupler buried channel waveguide Volume 2 models continue with the ridge channel waveguide strip loaded channel waveguide GaAs GaAlAs planar waveguide GaAs GaAlAs heterostructure waveguide radiation leaks at fiber bend radiation leaks at waveguide bend c axis Calcite polarizer waveguide integrated optic normal reflector horn channel waveguide Y Junction waveguide optical phase modulator cut off modulator electro optic Mach Zehnder interferometer waveguide parallel coupling waveguide electro optic directional coupler single polished fiber directional coupler double polished fiber directional coupler tunable coupling strength of polished double fiber coupler cross sectional coaxial fiber coupler 2D directional coupler with tapered coupling corrugated reflection gratings optical fiber grating on half polished fiber coupler and track changing reflector with grating assisted coupling fiber

*Optics Modeling and Visualization with Comsol Multiphysics* Hee C. Lim, 2018-08 This manuscript is a step by step graphical instructions for COMSOL Multiphysics with Ray Optics Module and Wave Optics module modeling and computational physics simulation All the example models investigated and visualized with the help of Finite Element Analysis are referenced from the standard USA undergraduate text on Optics by E Hecht The simulations include the use of geometrical ray tracings for point source hemispherical and conic rays as well as full electromagnetic waves source employing the Maxwell s wave equations for Gaussian waves input Both 2D and 3D computational physics approach will be

discussed with the introduction of the trick of the trades meshings and modeling skill besides setup options that are skillfully hidden in the simulation software from plain sight The geometrical model covers 2D and 3D electromagnetic waves propagation in user defined refractive index domain Laws of Refraction for 2D converging and diverging lens Laws of Reflection for specular mirrors 3D Prism 3D Prism mirror equivalent system Polarizations for 3D linear polarizers 3D circular polarizer 3D linear wave retarder such as half wave plate quarter wave plate the Theory of Superposition for the 2D Young s double slits Wavefront splitting interference experiment 3D thin film uniform thickness Amplitude splitting interference experiment 2D Michelson interferometer Mirrored interference setup with the 1D interference fringes line graph Fermat s principle for 2D single slits diffraction 3D circular aperture diffraction experiment 3D rectangular slit diffraction experiment 3D diffraction gratings experiment with Fresnel near field and Fraunhofer far field diffraction pattern diffraction pattern Sinc function observation discussions the Limitation of ray tracing physics vs full electromagnetic waves simulations in the physics of optics the Babinet s principle of transparent openings or opaque obstacles diffraction slit and finally the Modern optics of 2D and 3D LASER cavity multiphysics models with the application of multiple release time of rays for Stimulated Emission lasing One of the most important and crucial component of the computational physics subject the user customizable library of material properties that governs the realisticality of the final modeled results is highlighted in the appendix section

**Optical Waveguides and Devices Modeling and Visualization Using COMSOL Multiphysics Volume 2** Hee Lim, 2018-10-20 This pictorial manuscript is a step by step graphical illustrations for waveguides and devices modeling and computational physics simulation using COMSOL Multiphysics with Ray Optics Wave Optics and AC DC Electrostatics modules All the example models investigated and visualized with the help of Finite Element Analysis are referenced from the standard USA undergraduate text on Optical Guided Waves and Devices by Richard Syms and John Cozens The simulations include the use of geometrical ray tracings for point source and full electromagnetic waves source employing the Maxwell s wave equations for plane wave input Both 2D and 3D simulation results will help in visualize the electromagnetic field propagating inside the waveguides and devices Readers without fundamental handle on optics modeling are suggested to read the Optics Modeling and Visualization with COMSOL Multiphysics A step by step graphical instruction manuscripts for detailed discussion These models may be expanded to post graduate research and industrial photonics waveguides and devices development There are 46 chapters of different 2D and 3D optical waveguides devices structures modeled and simulated in Volume 1 and 2 Volume 1 models include 3D single mode optical fiber planar waveguide channel waveguide longitudinal and transverse phase modulator surface plasmon optical square waveguide tapered waveguide FTIR beamsplitter in ray tracing and electromagnetic wave solvers full prism coupler halved prism coupler plano convex overlay lens overlay Luneburg lens geodesic lens with control setup for resulted electric field comparison corrugated gratings transmission and reflection gratings chirped grating lens beam expander grating grating coupler chirped grating coupler

buried channel waveguide Volume 2 models continue with the ridge channel waveguide strip loaded channel waveguide GaAs GaAlAs planar waveguide GaAs GaAlAs heterostructure waveguide radiation leaks at fiber bend radiation leaks at waveguide bend c axis Calcite polarizer waveguide integrated optic normal reflector horn channel waveguide Y Junction waveguide optical phase modulator cut off modulator electro optic Mach Zehnder interferometer waveguide parallel coupling waveguide electro optic directional coupler single polished fiber directional coupler double polished fiber directional coupler tunable coupling strength of polished double fiber coupler cross sectional coaxial fiber coupler 2D directional coupler with tapered coupling corrugated reflection gratings optical fiber grating on half polished fiber coupler and track changing reflector with grating assisted coupling fiber

**Research advances in nanosciences, micro and nanotechnologies. Volume V** José Abraham Balderas López, Mónica Rosalía Jaime Fonseca, 2025-03-02 Many of the great advances in materials medical and measurement devices have been the result of research in the area of nanotechnology a multidisciplinary field to which many research groups in the world are dedicating their human and economic efforts A spectacular development of nanotechnology in the medical field was for instance the obtaining in record time of vaccines to face the recent COVID 19 pandemic others important advances are in the field of semiconductor devices with the development of integrated circuits with greater density of active elements as well as new light emitting devices or semiconductor materials for applications in optoelectronics It is not surprising then that many research groups in Mexico are devoted to do research in this field of science and technology especially due the fact of the transfer of industries which are expecting to be moved to the country as result of the nearshoring that is the transfer of factories from the country of origin to places close to the market Because of these facts the National Polytechnic Institute one of the best research institutions in Mexico is carrying out active research in the field of nanotechnology in its multiple disciplines Some of these results are summarized in this new volume which constitutes the fifth in a series of books generated as result of investigations of members of the nanoscience and micro nanotechnologies network of the National Polytechnic Institute

**Perovskite Solar Cells** Pravin Kumar Singh, Dilip Kumar Dwivedi, 2025-11-03 Perovskite solar cells PSCs represent a groundbreaking advancement in renewable energy offering a pathway to high efficiency sustainable energy solutions This work provides a comprehensive exploration of perovskite materials innovative device architectures and advanced modeling techniques It delves into the synthesis and characterization of perovskites interface engineering stability improvements and fabrication methods for enhancing performance and addresses the scalability challenges and environmental impacts of PSCs showcasing their potential to drive sustainability in energy systems The integration of PSCs into hybrid and tandem solar systems as well as their applications in large scale photovoltaics wearable devices and consumer electronics is examined in depth The work serves as a valuable resource for professionals graduate students and researchers in materials science renewable energy and electrical engineering It highlights the transformative role of PSCs in reducing carbon emissions and achieving global energy goals making it

indispensable for specialists aiming to pioneer sustainable technologies      *Advances and Applications in Electroceramics II*  
K. M. Nair, Shashank Priya, 2012-10-23 With contributed papers from the 2011 Materials Science Dielectric Ceramic  
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mechanical and chemical engineering materials and or ceramics and chemistry      *Advanced Materials* Ivan A.  
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Al-Wahsh, Abdellatif Akjouj, Abdelkrim Talbi, Eman A. Abdel-Ghaffar, Madiha Amrani, El Houssaine El Boudouti, 2026-03-13  
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by simple examples Each chapter introduces and defines the sensing resonances their localized paths and applications Many  
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Narottam Das, 2012-10-03 Optical communication is very much useful in telecommunication systems data processing and  
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desired destination and a receiver that reproduces the message from the received optical signal It presents up to date results  
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