Biographical Sketch

Donald C. Dilworth
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A. PROFESSIONAL PREPARATION

College/University	Major	Degree &Year
MIT	Physics	B.S. 1961

B. ACADEMIC/PROFESSIONAL APPOINTMENTS

President, OSD, Inc., 1976 to present
Senior Principle Development Engineer; Honeywell, Inc., 1970 to 1976
Engineering Director, Baus Optics Inc., 1967 to 1969

C. PUBLICATIONS

1. D.C. Dilworth; "New Tools for the Lens Designer", SPIE 7060, pp. 70600B-70600B-11. (2008)
2. D.C. Dilworth; "Lens tolerances: Software eliminates the guesswork", LaserFocusWorld. (2007)
3. D.C. Dilworth; "Optical design using the SYNOPSYS software package", 3d International Conference on optics-photonics design & fabrication "ODF 2002", Tokyo. (2002)
4. D.C. Dilworth; "Expert systems in lens design", SPIE 1354, 357, (1990)
5. D.C. Dilworth; "Fast MTF Calculation in the Presence of Diffraction", Appl. Opt. 11, 1101, (1972).
6. D.C. Dilworth; Synopsys: A State-Of-The-Art Package For Lens Design, SPIE 0766, Recent Trends in Optical Systems Design and Computer Lens Design Workshop, (10 June 1987);
7. D.C. Dilworth; "Pseudo-second-derivative Matrix and its Application to Automatic Lens Design", Appl. Opt., 17, 3372, (1978). http://www.osdoptics.com/PSD_II.pdf
8. D.C. Dilworth; "Improved convergence with the pseudo-second-derivative (PSD) Optimization Method", SPIE Vol. 399, 159, (1983). http://www.osdoptics.com/PSD_III.pdf
9. D.C. Dilworth; Current Status Of The Synthesis Of Optical Systems (SYNOPSYS) Lens Design Program, SPIE 0237, 1980 International Lens Design Conference, (16 September 1980)
10. D.C. Dilworth; "An Infrared Alignment Telescope", SPIE Vol. 483, 45, (1984).
11. D.C. Dilworth; All the world's lenses: a database of over 20,000 lenses from the patent literature, SPIE 2537, Novel Optical Systems Design and Optimization, (11 August 1995)
12. D.C. Dilworth; "Automatic Lens Optimization: Recent Improvements", SPIE Vol. 554, 191, (1986).

13. D.C. Dilworth; “A Multilevel Approach to User-friendly Lens Design”, SPIE Vol. 655, 6, (1986).

14. D.C. Dilworth; “Applications of Artificial Intelligence to Computer-aided Lens Design”, SPIE Vol. 766, 91, (1987).

15. D.C. Dilworth; and David Shafer; “Man versus Machine; a Lens Design Challenge”, SPIE Vol. 8841, 88410G-1, (2013)

16. D.C. Dilworth; Novel global optimization algorithms: binary construction and the saddle-point method, SPIE 8486, Current Developments in Lens Design and Optical Engineering XIII, 84860A (11 October 2012)

17. Donald C. Dilworth, SYNOPSYS Supplement to Joseph M. Geary’s “Introduction to Lens Design,” Willmann-Bell, Richmond (2013).

18. D.C. Dilworth; “A zoom lens from scratch: the case for number crunching,” D.C. Dilworth, Proc. SPIE, 9947, Current Developments in Lens Design and Optical Engineering XVII, 994702 (27 September 2016)

19. D.C. Dilworth; New tools for the design of freeform mirrors, SPIE 10375, Current Developments in Lens Design and Optical Engineering XVIII, 1037502 (23 August 2017);

20. D.C. Dilworth; Lens Design: Automatic and Quasi-Autonomous Computational Methods and Techniques (IPH001), Iop Publishing Ltd (October 31, 2018)

21. Livshits, I, and Dilworth, DC; Trends in optical design from 1988 to 2018… where to from here? **https://doi.org/10.1515/aot-2018-0025**

22. Livshits, I, and Dilworth, DC; Practical tutorial: A simple strategy to start a pinhole lens design; https://doi.org/10.1515/aot-2015-0024

23. SYNOPSYS--a lens design computer program package
Donald Dilworth
Proc. SPIE. 1354, 1990 Intl Lens Design Conf

24. The Ascendency of Numerical Methods in Lens Design
Don Dilworth
Advancement in physics often results from analyzing numerical data and then creating a theoretical model that can explain and predict those data. In the field of lens design, the reverse is true: longstanding theoretical understanding is being overtaken by more powerful numerical methods.

25. Design of an ultraviolet projection lens by using a global search algorithm and computer optimization
Jan 2017
Nenad Zoric, Irina Livshits, Don Dilworth, Sergey Okishev
This paper describes a method for designing an ultraviolet (UV) projection lens for microlithography. Our approach for meeting this objective is to use a starting design automatically obtained by the DSEARCH feature in the SYNOPSYS™ lens design program. We describe the steps for getting a desired starting point for the projection lens

26. Combination of global-optimization and expert-systems techniques in optical design
Jan 1993
Steve C. Johnston, Alan Greynolds, David Y. Wang, Don Dilworth
We describe a novel method of determining potentially successful starting designs by utilizing an expert systems algorithm which operates on a database of previously well-designed optical systems. The database is composed of systems created by a `not-so-local' optimization algorithm, and a collection of previously well-designed system

Proc. SPIE. 1780, Lens and Optical Systems Design

27. Lower Atmosphere Composition and Temperature Experiment
Sep 1974
W. R. Williamson, D. R. Shafer, Don Dilworth
The Lower Atmospheric Composition and Temperature Experiment (LACATE) is a development program within the Advanced Application Flight Experiments (AAFE) Project Office at the NASA Langley Research Center. The ultimate objective of the LACATE is to determine the vertical distribution of certain atmospheric constituents and

D. SYNERGISTIC ACTIVITIES

Example 1: Mr. Dilworth has developed software algorithms that improve the performance and convergence rate for lens design tasks by several orders of magnitude. His PSD algorithm remains the gold standard for lens design software and has not been matched by any other commercial program.

Example 2: With the software tools and source code for the SYNOPSYS™ program, Mr. Dilworth has frequently and quickly added unique features to the code, often in response to a user's request. A typical feature of this kind is the ability to characterize and raytrace a variety of DOE surface types.

E. COLLABORATORS AND OTHER AFFILIATIONS

Collaborators: D. C. Dilworth and David Shafer; David Shafer Optical Design

Mr. Dilworth has collaborated with the distinguished lens design expert David Shafer on a friendly lens design competition. This involved the design of a difficult lens while relying on extensive experience and deep knowledge of aberration theory, and then comparing those results with those obtained by running the most powerful lens optimization and global search routine in the world, with little user input other than a description of the design goals. The algorithm emerged as a clear winner, equaling and often surpassing the best results from a human expert. The algorithm was written by Mr. Dilworth.

Patents:

Patent / Application Number	Name	Issue / Publication Date
CN106462077	Photolithography apparatus comprising projection system for control of image size	02/22/2017
EP0886961	Split lens video display system	12/30/1998
EP3134772	Photolithography apparatus comprising projection system for control of image size	03/14/2018

KR20160141861	Photolithography apparatus comprising projection system for control of image size	12/09/2016
SG11201608670P	Photolithography apparatus comprising projection system for control of image size	11/29/2016
TW201602733	Photolithography apparatus comprising projection system for control of image size	01/16/2016
US 3565511	Telecentric lens system for providing an image with the principal rays parallel to the optical axis and normal to the focal plane	02/23/1971
US 4116537	Thermal compensation apparatus	09/26/1978
US 4720183	Extreme wide angle eyepiece with minimal aberrations	01/19/1988
US 5742421	Split lens video display system	04/21/1998
US 9939734	Photolithography apparatus comprising projection system for control of image size	04/10/2018
WO9732233	Split lens video display system	09/04/1997
WO2015162147	Photolithography apparatus comprising projection system for control of image size	10/29/2015