



ABCDEF



Scientific Report

First name / Family name	Rengmao/Wu
Nationality	China
Name of the <i>Host Organisation</i>	Universidad Politécnica de Madrid
First Name / family name of the <i>Scientific Coordinator</i>	Pablo/Benítez
Period of the fellowship	01/08/2013 to 31/07/2014

I – SCIENTIFIC ACTIVITY DURING YOUR FELLOWSHIP

1. I have established the mathematical design model for one single freeform surface illumination problem.
2. A numerical method has been developed to find the solution of the illumination design problem.
3. Influence of the characteristics of light source and target on the Monge-Ampère equation method in freeform optics design has been revealed during my fellowship.

II – PUBLICATION(S) DURING YOUR FELLOWSHIP

1. Rengmao Wu, Yaqin Zhang, Mohamed M. Sulman, Zhenrong Zheng, Pablo Benítez, and Juan C. Miñano, "Initial design with L^2 Monge-Kantorovich theory for the Monge-Ampère equation method in freeform surface illumination design," *Opt. Express* **22**, 16161-16177 (2014).

Abstract: The Monge-Ampère (MA) equation arising in illumination design is highly nonlinear so that the convergence of the MA method is strongly determined by the initial design. We address the initial design of the MA method in this paper with the L^2 Monge-Kantorovich (LMK) theory. An efficient approach is proposed to find the optimal mapping of the LMK problem. The characteristics of the new approach are introduced and the limitations of the LMK theory in illumination design are presented. Three examples, including the beam shaping of collimated beam and point light source, are given to illustrate the potential benefits of the LMK theory in the initial design. The results show the MA method converges more stably and faster with the application of the LMK theory in the initial design.



2. **Rengmao Wu, Pablo Benítez, Yaqin Zhang, and Juan C. Miñano, "Influence of the characteristics of a light source and target on the Monge–Ampère equation method in freeform optics design," *Opt. Lett.* 39, 634-637 (2014).**

Abstract: It was previously demonstrated in [Wu et al., *Opt. Lett.* 38(2), 229–231 (2013)] the problem of freeform surface illumination design can be converted into a nonlinear boundary problem for the elliptic Monge–Ampère equation based on ideal source assumption. But, how the Monge–Ampère equation method is affected by the characteristics of light source and target was not discussed there. This letter systematically analyzes the influence of discontinuity, non-convexity and connectivity of light source and target on the Monge–Ampère equation method and presents some intrinsic features of this design method. These features are applied in practical examples in freeform optics design.

3. **Rengmao Wu, Pablo Benítez, and Juan C. Miñano, "The Monge-Ampère equation method in freeform optics design," in *Classical Optics 2014, OSA Technical Digest (online) (Optical Society of America, 2014), paper ITh4A.5.***

Abstract: The Monge-Ampère equation method could be the most advanced point source algorithm of freeform optics design. This paper introduces this method, and outlines two key issues that should be tackled to improve this method.

All the papers outlined here were published during my fellowship.

III – ATTENDED SEMINARS, WORKHOPS, CONFERENCES

Seminar:

ABCDE Seminar 2013

Place: Metropolitan Hotel Athens, Leoforos Syngrou 385, 175 64, Athens, Greece

Date: 31 October - 1 November 2013

Conference:

International Optical Design Conference (IODC)

Place: The Fairmont Orchid, Kohala Coast, Hawaii, USA

Date: 22-26 June 2014

IV – RESEARCH EXCHANGE PROGRAMME (REP)

Katholieke Universiteit Leuven (KU Leuven)	Belgium	Youri Meuret	06-12/01/2014
Vrije Universiteit Brussel (VUB)	Belgium	Fabian Duerr	13-19/01/2014

I made presentations to introduce my work during these two visits. Besides, both the hosts prepared a topic that I can work on together with them during my visit. These two visits are interesting and impressive.