SPIE Student Chapter
Univ Politécnica de Madrid Chapter

Activity Report

Advisor:	Prof. Juan Carlos Miñano
President:	Bharathwaj Narasimhan
Vice-President:	Milena Nikolic
Secretary:	João Mendes Lopes

Chapter Roster

1. Guillermo del Campo Jiménez
2. Jiayao Liu
3. João Mendes-Lopes
4. Marta Victoria
5. Appan Narasimhan Bharathwaj
6. Milena Nikolic
7. Isabel Miñano
8. David Soria
9. Anne Teupner (in process)
10. Jore Gorospe Ballestros
11. Jie Song
12. Adam Philip Hirst(in process)

1   Yearly Activities

1.1   Optics Lecture and overview of the activities for this year:

We had 2 lectures highlighting pre-publication research which serve as a precursor for the main talk to be held in various conferences across the globe. This also serves as a good platform for information exchange among different participants about their research and gives more room towards having wider perspective in their respective fields of interests. In addition to the lectures, we were able to invite Dr. Julio Chaves for a talk on "Non – imaging optical design techniques in Thermal applications". We were also able to successively conduct a seminar on scientific presentation by Dr. Jean-luc Doumont. We had a massive turn out for the event and it immensely helped a lot of students.

1.1.1   Jiayao Liu (presented in SPIE Optics + Photonics, SD 2014)

Title:
Double surface imaging designs with unconstrained object to image mapping under rotational symmetry

Abstract:
In this work, we present a novel imaging design formed by two optical surfaces with rotational symmetry. In these designs, both object and image shapes are given but mapping from object to image is obtained through the design process. In the examples considered, the image from a planar object surface is virtual and located at infinity and is seen from a known pupil, which can emulate a human eye. The differential equation method is used to provide single optical surface imaging designs by considering the local properties of the imaging surface and the wavefronts. In the first introductory part, both the rotational symmetrical and the freeform single surface imaging designs are presented using the differential equation method. In these designs, not only the mapping is obtained in the design process, but also the shape of the object is found. In the second part, the method is extended to two surface designs with rotational symmetry and the astigmatism of the image has been studied. By adding one more optical surface to the system, the shape of the rotational symmetrical object can be designed while controlling the tangential rays and sagittal rays simultaneously. As a result, designs without astigmatism (at the small pupil limit) on a planar object surface have been obtained.

Jiayao Liu was also chosen to represent the chapter at SPIE leadership workshop at SPIE Optics + Photonics, SD 2014.

1.1.2   Milena Nikolic (presented in SPIE Optics + Photonics, SD 2014)

Title:
Conditions for perfect focusing multiple point sources with the SMS design method
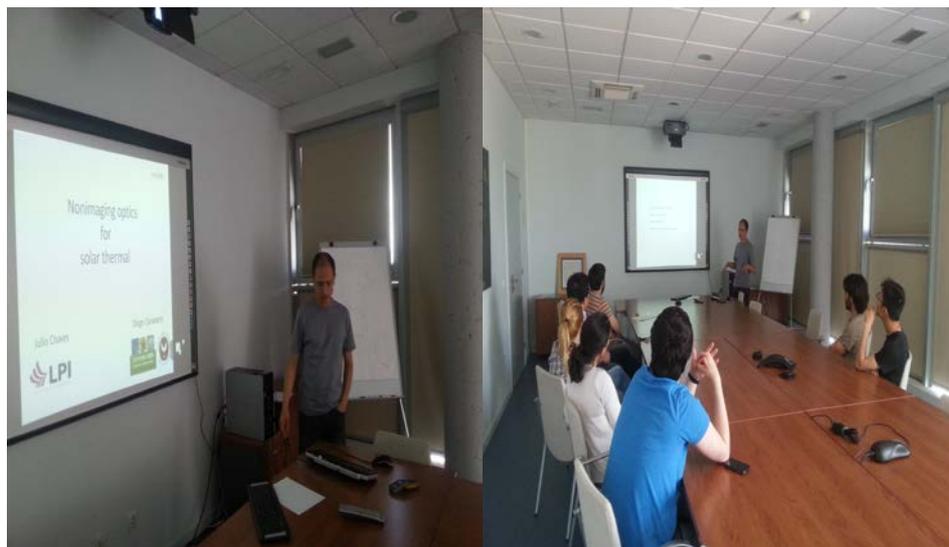
Abstract:

In this work, we demonstrate how it is possible to sharply image multiple object points. The Simultaneous Multiple Surface (SMS) design method has usually been presented as a method to couple N wave-front pairs with N surfaces, but recent findings show that when using N surfaces, we can obtain M image points when N<M under certain conditions.
We present the evolution of SMS method, from its basics, to imaging two object points through one surface, the transition from two to three objet points obtained by increasing the parallelism, and getting to the designs of six surfaces imaging up to eight object points. These designs are limited with the condition that the surfaces cannot be placed at the aperture stop.

In the process of maximizing the object points to sharp image, we try to exhaust the degrees of freedom of aspherics and free-forms. We conjecture that maximal SMS designs are very close to a good solution, hence using them as a starting point for the optimization will lead us faster to a final optical system. We suggest here different optimization strategies which combined with the SMS method are proven to give the best solution. Through the example of imaging with the high aspect ratio, we compare the results obtained optimizing the rotational lens and using a combination of SMS method and optimization, showing that the second approach is giving significantly smaller value of overall RMS spot diameter.

Special Lecture by Júlio Chaves:

Our research group consists of leading experts in the field of Non-imaging optics and we were honored by the visit of Dr. Júlio Chaves, who to his credit has a lot of publications in the same field. We requested him to give us a talk as a part of the student chapter activity on "Non – imaging optical design techniques in Thermal applications". It was an insightful talk and we were surprised to see the application of non-imaging design techniques applied to a variety of applications outside of optics.

Abstract:

The presentation covers non-imaging optics designs for solar thermal applications. It describes étendue-matched Fresnel concentrators that are optimized for multiple receivers. Also described are parabolic trough-type concentrators with secondary elements that significantly increase concentration. Modifications to these designs bring the center of gravity of the optic closer to the receiver, easing mechanical torque on the supporting mechanical structure.

About our speaker:

Júlio Chaves received his PhD in physics from the Technical University of Lisbon. Chaves did postgraduate work at the Technical University of Madrid. He then moved to California, United States, and joined Light Prescriptions Innovators (or LPI). Later he moved back to Madrid, Spain, and since then has been working with LPI.

Workshop on "How to prepare yourself for a talk" by Dr. Jean-luc Doumont

We had the wonderful opportunity of hosting Dr. Jean-luc Doumont when he gave a wonderful talk and workshop on technical writing on 28th May 2014. This was conducted as a part of the SPIE guest lecturer series and was held in the Telecommunications department of UPM. This event was made open to the entire university for all majors since technical writing is very important when it comes to scientific publications. The event was a great success and we had a huge turnout.

Abstract

Strong oral presentation skills are a key to success for engineers, scientists, and other professionals, yet many speakers are at a loss to tackle the task. Systematic as they otherwise can be in their work, they go at it intuitively, sometimes haphazardly, with much good will but seldom good results. Based on Dr Doumont's book "Trees, maps, and theorems" about effective communication for rational minds, this lecture proposes a systematic way to prepare and deliver presentations. Among others, it covers structure, slides, and delivery, as well as stage fright.

About our speaker

An engineer from the Louvain School of Engineering and PhD in applied physics from Stanford University, Jean-luc Doumont now devotes his time and energy to training engineers, scientists, business people, and other rational minds in effective communication, pedagogy, statistical thinking, and related themes. Articulate, entertaining, and thought-provoking, Dr Doumont is a popular invited speaker worldwide, in particular at international scientific conferences, research laboratories, and top-ranked universities. For additional information, visit www.principiae.be.

We also had a small dinner outing with our chapter members to commemorate the year end.

2   Financial Statement

SPIE student chapter fund	+ 376,67 €
Monthly presentations	125€
End of year dinner	-221.10€
Current Balance	**30.57€**

3   Election

We had an election to decide our new chapter officers and the following individuals were chosen as the officer bearers for this year.

President – Bharathwaj Narasimhan
Vice President – Milena Nikolic
Secretary - João Mendes-Lopes