Thursday, October 10

Time Slot	Company	Presenter	Presentation title
10:00	IOGS	Yvan SORTAIS	Status on the round robin-test of freeform surfaces
10:20	TNO	Tiberiu CECCOTTI	Wave-Optics Modelling of Beams Affected by Mid-Spatial Frequencies
10:40	V-Optics	Kevin CONTRERAS	phase shifting deflectometry
11:00	HOLO3	Jean-Pierre CHAMBARD	multi-camera deflectometry setup for the measurement of optical freeform surface
11:20	WyseLight	Maxime BORDOUX	Absolute shape measurement with coaxial deflectometry: towards interferometric accuracy
11:40	Imagine Optic	Rafael PORCAR	Metrology of freeform optics from product development up to mass production
12:00	Leonardo	Costa EMANUELE	Freeform afocal telescopes optimization
12:20		**Lunch**	
14:00	ONERA	Florence DE LA BARRIÈRE	Freeform catoptric TMA for uncooled microbolometers or cooled infrared sensors
14:20	REOSC/IOGS	Agnes VINOY	Design of a freeform four-mirror system with a wide field of view and high angular resolution in the visible and near-infrared spectrum
14:40	LAM	Jiawei LIU	Curved freeform sensors for high-end scientific applications
15:00	REOSC	Eric RUCH	Freeform Mirrors in Space Optics
15:20	Bertin	Sacha PLUSKWA	C-CLEF freeform mirrors: manufacturing and metrology
15:40		**Coffee break + end**	
16:10	Gaggione	Jean Pierre LAURET	Anamorphic freeform imaging lens
16:30	SPIRAL	Laurent GALINIER & Bertrand SIMON	Introducing spiral optics and its first application in ophthalmology
16:50	ESSILOR	Guillaume GED	Metrological characterization of myopia control lenses
17:10		**Closing**	Remerciement / SFO-Calcul Optique / FORS / ONERA / SYNOPSYS

Invited speakers

- TNO - Tiberiu CECCOTTI

Wave-Optics Modelling of Beams Affected by Mid-Spatial Frequencies

The manufacturing of optical surfaces using sub-aperture techniques such as Single Point Diamond Turning (SPDT) and Magneto-Rheological Finishing (MRF) often introduces residual shape errors, commonly referred to as mid-spatial frequency (MSF) errors. These errors, which occur between low-frequency form errors and high-frequency roughness, are critical to the performance of optical systems. Eliminating MSF errors is challenging due to the need for iterative polishing and the difficulty in accurately modeling these errors, often leading to a risk of over-specification.

- WyseLight - Maxime BORDOUX

Absolute shape measurement with coaxial deflectometry: towards interferometric accuracy

Deflectometry (shape measurement of a mirror from the distortion of the image of a monitor screen displaying fringes) has been known for a long time, but suffers from intrinsic features that make accurate absolute measurements very difficult. In particular, all the metrological quality depends on the ultra precise identification of the system geometry: ray trajectories in the object space, shape of the monitor screen, position of this screen and position of one point of the measured object, all these in the camera frame of reference. We present an instrument that permits all these identifications in a simple push-button way. The fundamental ambiguity of deflectometry (a single measurement may correspond to an infinite number of object shapes, due to the unknown constant after slopes integration) is raised with our patented coaxial deflectometry approach: two measurements are made with an axial movement of the camera, and only one shape is compatible with these two measurements. We present the identification methodology of the system, and results for absolute measurements of spheres, aspheres and freeforms, within a λ/40 accuracy, with some comparisons with results obtained with a Taylor-Hobson LUPHOScan®.

- Bertin - Sacha PLUSKWA

C-CLEF freeform mirrors: manufacturing and metrology

The GMT-Consortium Large Earth Finder (G-CLEF) is a cross-dispersed, optical band echelle spectrograph to be delivered as the first light scientific instrument for the Giant Magellan Telescope (GMT). In that context, Bertin Technologies (formerly Winlight System and Bertin Winlight) has been tasked with manufacturing and controlling several optics within the instrument, including the two main mirrors, both being off-axis aspherical surfaces. In this presentation, we will explore the manufacturing and measurement process of these mirrors.

- ONERA - Florence DE LA BARRIÈRE

Freeform catoptric TMA for uncooled microbolometers or cooled infrared sensors

In order to reduce costs and increase revisit times in optical payloads for Earth observation, deploying small satellites working in constellations is envisioned. However, in such small satellites one objective is to optimise the use of the available volume for the optical payload. In this context, the use of off-axis reflective telescopes allows to remove the constraints related to chromatism and central obscuration. In addition, using freeform optics allows to improve the compactness of such systems while maintaining or improving the imaging performance. We studied combinations of freeform mirrors for compact imaging optical payloads using cooled or uncooled infrared detectors, each type of detector imposes its own constraints.

Invited speakers

- IOGS - Agnes VINOY

Design of a freeform four-mirror system with a wide field of view and high angular resolution in the visible and near-infrared spectrum

Situational awareness requires systems with a wide field of view and a high angular resolution. To meet both requirements, it is possible to use freeform optics and a curved sensor which also lead to more compact systems. In this presentation, we present the design and optimization of a four-mirror system with a wide field of view (65°x13.5°) and a high angular resolution of 10 arc seconds using these solutions to reach new performances in a relatively small volume.

- LAM - Jianwei LIU

Curved Freeform Sensors in the Design of Space Optical Imaging Systems

This paper explores the potential of curved freeform sensors in high-end scientific space imaging applications, including planetary exploration and aurora monitoring. The study begins by introducing an off-axis three-mirror imaging system that integrates curved freeform sensors with freeform optics, focusing on their potential application in planetary science. This design achieves a sixfold increase in the field of view and doubles the relative aperture compared to traditional three-mirror systems utilizing conic mirrors. Moreover, compared to freeform optical designs based on flat and spherical detectors, this system reduces overall volume by 80% and 50%, respectively, while maintaining comparable image quality.

- Reosc - Eric RUCH

Freeform Mirrors in Space Optics

The increasing demand for optical systems providing better image quality in a smaller volume has led to the introduction of freeform optics in space instruments. This presentation will focus on the design and manufacturing challenges of the freeform mirrors of two specific instruments: the Microcarb spectometer built for ADS and the CNES that will be launched in 2025 and the LSTM (Land Surface Temperature Monitoring) instrument for an ESA mission in the frame of the Copernicus program.

- Gaggione - Jean Pierre LAURET

Anamorphic freeform imaging lens

In the world of imaging, freeforms have opened up huge application fields, in particular in telescope designs where they allow compact optical designs while avoiding central occultations. And we can also imagine many other application fields. We propose here to investigate a practical application of freeforms through a case study: the design and manufacturing of an imaging lens which projects the image of a small object while applying an anamorphosis to it, which means that the magnification is not the same horizontally and vertically. This case study will show us that in general, the use of freeforms allows introducing new functions to a regular imaging lens.