OPTICAL AND SURFACE METROLOGY APPLIED TO THE STUDY OF PHOTOGRAPHIC SURFACES

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The field of optical surface metrology is well suited to the study of cultural heritage. Advances in electronics, optics and faster computing in the past ten years have revolutionized the fields of 2D contact surface profilometry and optical and surface metrology. The antiquated surface metrology contact methodologies, which irreversibly perturb surfaces, were never considered by cultural heritage institutions and although still useful in industry are quickly becoming a tool of the past. New optical surface metrology tools such as confocal surface topometry use light to probe surfaces rapidly and risk-free, and yield a wealth of areal data unachievable with 2D contact methods. Such instrumentation enables non-perturbing (non-contact, non-destructive and non-invasive) examination of delicate and sensitive surfaces of the wide range of historic and artistic works encompassing the cultural heritage accumulated by mankind. Confocal surface topometry joins the growing cadre of non-perturbing techniques such as optical coherence tomography, which provide new approaches and possibilities for the study of surfaces of individual historic and artistic works as well as art historical collection based studies.

The Conservation Department at George Eastman House International Museum of Photography and Film has been testing the value and practicality of tools from the field of optical metrology since 2005. Collaboration with NanoFocus, AG, developer and manufacturer of confocal surface topometry systems, has allowed for the successful testing of the µsurf confocal topometer to probe and examine the delicate and sensitive surfaces of numerous types of historical and fine art photographic images. Confocal surface topometry provides quantitative data of the surface geometry; an array of (xyz) points in 3D space that reflects the topographical nature of the photograph surface. This paper focuses on the application of confocal surface topometry to the study of daguerreotypes, the first commercially viable photograph making its debut in 1839, and the 20th century silver gelatine photographs. Confocal surface topometry is ideally suited for the examination of the surface geometry of the daguerreotype image – a metallic surface structure and topography of silver, mercury and gold – independent of the illumination and optical properties, thereby providing quantitative metrics of the daguerreotype's surface ultra-fine structure; measure surface and any changes in structure affected by deterioration mechanisms and/or evaluate restorative conservation treatments.

This presentation will discuss the confocal principle, briefly cover the early history of photography and daguerreotypy, and provide examples of confocal topometry applied to the examination and assessment of conservation treatments of daguerreotypes and silver gelatine photographs.