UNC CHARLOTTE
The WILLIAM STATES LEE COLLEGE *of* ENGINEERING

Senior Design Project Description for FALL 2015
Project Title: Microchiseling Techniques (UNCC_CHIS)

Supporter: UNCC Charlotte

Supporter Technical Representative: ASSIGNED

Faculty Mentor: __x__ ASSIGNED _____ TBD (check one)
Single Team __X__ Dual Team _____ (check one)
Personnel (EN/ET): _____ E, _____ Cp, _____ Cv, __3-4__ M, _____ SE

(Complete if the number of students required is known)

Expected person-hours: (250 per student)

Description of Project:

Freeform and mutli-scale optics are changing the way optical systems are designed. Many of these optics are manufactured by ultra-precision diamond machining. Optics that have a freeform shape but also incorporate a sub-wavelength pattern, such as a curved blazed grating for an imaging spectrometer or the anti-reflective coating on a moth's eye have many desirable properties but are difficult to manufacture. In this project a device for micro-patterning an optic of arbitrary shape using a diamond tool or stylus will be designed and tested.

Initial Project Requirements (e.g. weight, size, etc.):

Size and weight: Must fit within a 150 mm cube and have a mass less than 2 kg.

Mounting: Device must mount on a Moore Nanotechnology 350 FG machine in DH 108.

Movement: The device will use the axes of the Moore Nanotechnology 350 FG to move in space over the surface of an optic and cut a pattern in that surface with a diamond point or other suitable tool. The device must control the depth of the cutting either by force or position control.
Materials: Must be able to produce a micro-pattern in a range of diamond machinable materials including copper, aluminum, brass, germanium and infrared transparent (chalcogenide glass).
Temperature Control: The device will be designed to operate in a laboratory with ±0.1 C temperature control.

Micro-patterning Performance: At a minimum the device must be able to produce a linear grating on a flat optical quality surface in copper with 1 micrometer pitch and 1 micrometer height over an area of 50 square millimeters and produce the grating with an uncertainty in the grating pitch and depth of ±0.1 micrometers. Ideally, the device would be able to produce patterns down to a fraction of the scale of the wavelengths of visible light (400 nm – 700 nm) and be able to generate these patterns on freeform surfaces with minimum radii of curvature down to 10 millimeters.

Expected Deliverables/Results:

The deliverable is a working micro-ruling/patterning device for use on the Moore Nanotechnology 350 FG machine. The device performance shall be proven out with a test component that consists

of an optical quality flat with a 1 micrometer linear grating as described above.

List here any specific skills or knowledge needed or suggested (If none please state none):
None