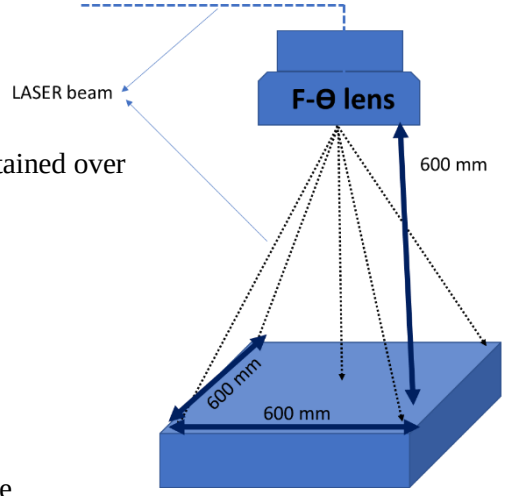
Problem 1: Design F-theta lens system for large area laser beam 2D scanning system



- Laser wavelength of 500nm, 1.067 µm and 10.5 µm.
- Input beam diameter is 1500 µm.
- Expected beam diameter at 600 mm is 100 µm
- Laser beam of circularity(100 µm circular beam) to be maintained over 600X600 mm scanning area at 600mm working distance.

Expected outcome:

- Design with CAD representation of optics system needs to be presented with appropriate mathematical calculation.
- Identification Lens materials needs to be used for the above mentioned wavelength.
- Identification of lens system manufacturing method, integration and testing method needs to identified.
- Lens system should take care of optical errors such as pincushion, astigmatism and other errors.

Problem 2: Effect of spherical metal powder flowability at high temperature

Powder bed additive manufacturing is widely used process in AM industry. When the powder is spread layer by layer, the powder flowability gets affected for different process condition. How the flowability of powder gets affected at high temperature needs to be understood well with appropriate model.

Parameter used in the process:

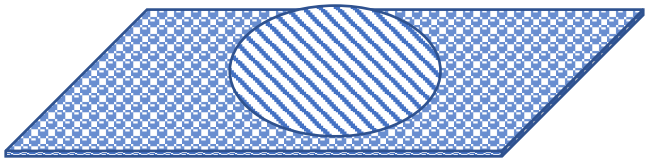
- Powder particle size distribution 45-100 µm
- Temperature during the spreading or re-coating process is 600^{o}C – 1200^{o}C
- Re-coating or blade velocity – 10- 200mm / minute.
- Materials to be considered copper and Titanium Aluminide.

Outcome:

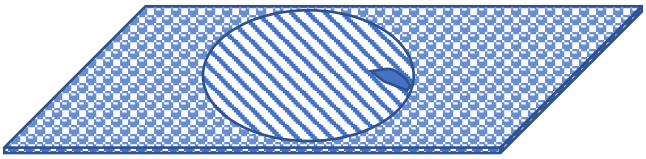
- Powder agglomeration behavior with respect re-coating speed, process temperature and the materials system.
- Threshold temperature at which powder starts giving poor flowability during the re-coating.
- Effect of re-coating density at different temperatures.

Problem 3: In-situ and Ex-situ defect identification methods using imaging methods in Additive manufacturing.

Powder bed additive manufacturing is widely used in AM industry. Layer by layer gets printed or melted with laser beam as per the layer geometrical information in laser powder bed Additive Manufacturing. During the printing or melting process the process has tendency of developing defects in the printed layer. One of the important needs is capturing of image of each printed layer and comparing them with ideal layer information. Any deviation in the printed layer information with respect to ideal layer information needs to verified. The decision on further re-printing or notifying to the process log data needs to developed with image process methods.



Ideal layer information to be printed



Printed layer with a defect.

Outcome:

- Methodology to be developed for image of capturing and comparing
- The method should be able to identify defects more than 50 µm
- Required instrumentation methodology needs to identified with