Scholarship Summary

Lingkuangyi Jin
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Summary

About Myself:

MSME at USC

Mechanical Design
+ Mechatronics

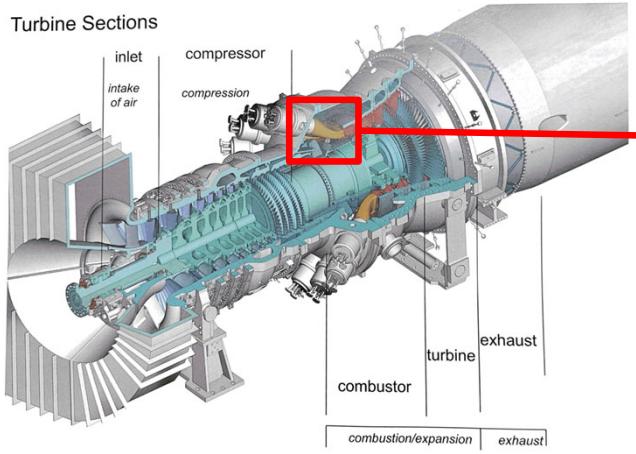
Intern Area:
LGT EN TDA

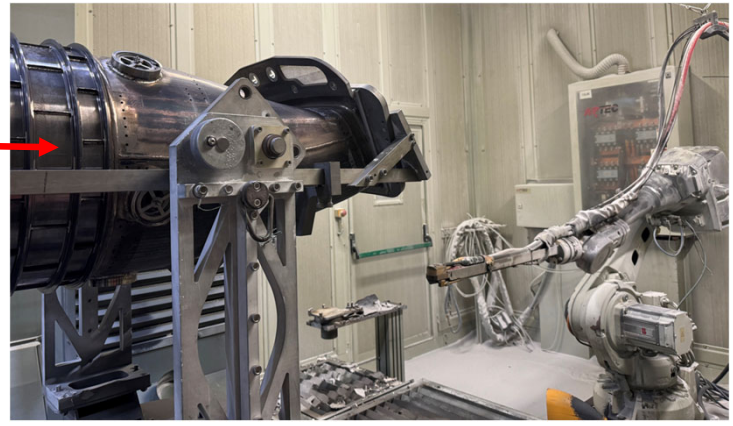
Assigned Challenge:

- Evaluate 1650C coating system for gas turbine transition
- Thermal Barrier Coating (TBC) development and optimization
- Non-Destructive Evaluation

Challenge Description:

- There is a plasma torch melt and attach ceramic particles onto the surface of transition at the end of a robot arm
- The transition has an irregular shape with narrow exit face
- Hard to evaluate the thickness profile and coating quality (due to robot arm movement path) of TBC





Coating Booth

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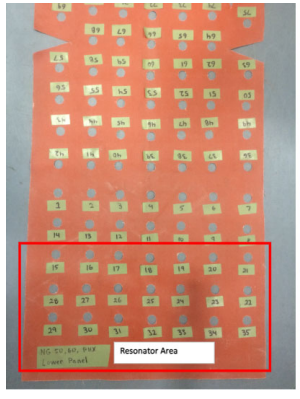
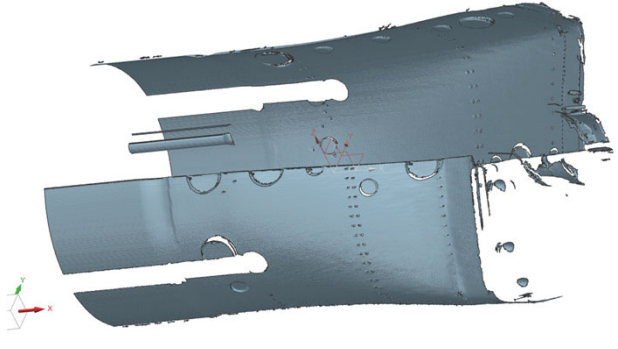
Problem Statement

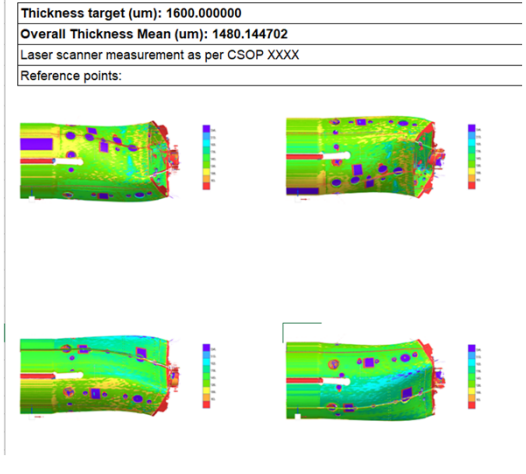
No.	R1	R2	R3	Avg.	No.	R1	R2	R3	Avg.
1	2.27	2.22	2.22	2.24	41	2.45	2.40	2.40	2.42
2	2.61	2.61	2.63	2.62	42	2.25	2.23	2.15	2.21
3	2.60	2.59	2.64	2.61	43	2.05	2.04	2.04	2.04
4	2.93	2.92	2.93	2.93	44	2.63	2.56	2.59	2.59
5	2.56	2.57	2.66	2.60	45	2.89	2.94	2.94	2.92
6	2.68	2.72	2.66	2.69	46	3.01	3.01	2.98	3.00
7	2.85	2.75	2.75	2.78	47	2.80	2.75	2.73	2.76
8	2.51	2.48	2.50	2.50	48	2.98	2.99	3.00	2.99
9	2.87	2.96	3.02	2.95	49	3.05	3.03	3.01	3.03
10	2.76	2.80	2.75	2.77	50	2.72	2.58	2.70	2.67
11	2.64	2.60	2.59	2.61	51	3.30	3.19	3.17	3.22
12	2.82	2.80	2.77	2.80	52	2.66	2.59	2.60	2.62
13	2.42	2.41	2.45	2.43	53	2.90	2.95	2.94	2.93
14	2.37	2.29	2.25	2.30	54	3.06	3.00	3.02	3.03
15	2.31	2.29	2.31	2.30	55	2.78	2.75	2.76	2.76
16	2.45	2.49	2.45	2.46	56	2.34	2.36	2.17	2.29

No.	R1	R2	R3	Avg.	No.	R1	R2	R3	Avg.
81	2.82	2.80	2.88	2.83	121	3.14	3.13	3.16	3.14
82	2.58	2.54	2.52	2.55	122	2.98	3.03	2.89	2.97
83	2.69	2.66	2.61	2.65	123	3.06	3.08	3.24	3.13
84	2.81	2.82	2.87	2.83	124	3.21	3.14	3.25	3.20
85	2.68	2.71	2.72	2.70	125	3.00	3.03	3.00	3.01
86	2.80	3.09	2.92	2.94	126	3.44	3.40	3.57	3.47
87	2.49	2.51	2.54	2.51	127	2.74	2.74	2.74	2.74
88	2.62	2.47	2.52	2.54	128	2.68	2.64	2.63	2.65
89	2.56	2.59	2.59	2.58	129	2.52	2.56	2.53	2.54
90	2.66	2.59	2.61	2.62	130	2.84	2.83	2.82	2.83
91	2.53	2.57	2.51	2.54	131	3.95	4.08	3.72	3.92
92	2.43	2.38	2.39	2.40	132	3.05	3.35	2.97	3.12
93	2.45	2.44	2.47	2.45	133	3.15	3.09	3.00	3.08
94	2.78	2.77	2.76	2.77	134	2.89	2.98	3.04	2.97
95	2.91	2.82	2.80	2.84	135	3.64	3.67	3.55	3.62
96	2.76	2.79	2.75	2.77					



Currently Used Method 1: Eddy Current NDE





Currently Used Method 2: 3D Scan Data Comparison

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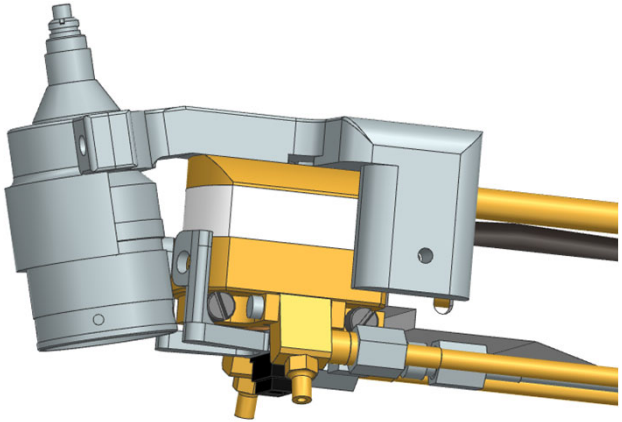
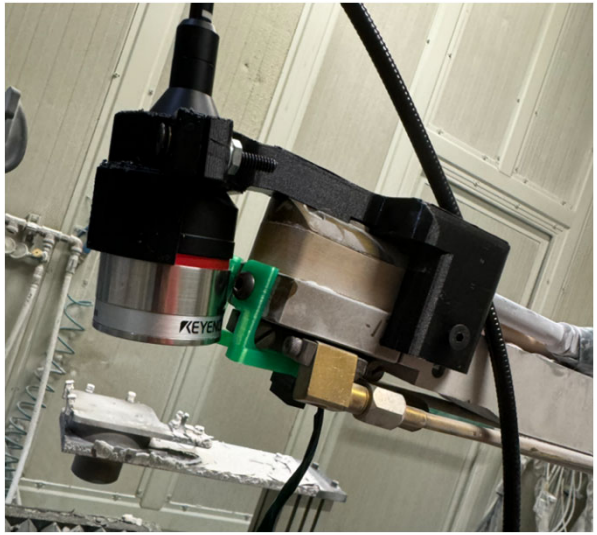
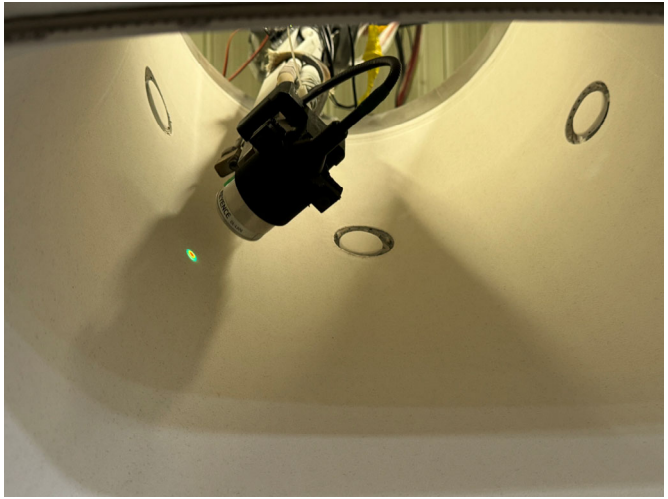
Key Contributions







Dual Sensor System

- Measures the distance from torch face to transition surface
- Taking measurements as the robot arm moving along the coating program
- Calibrate each other as a reference
- One measures precise but small region, one measure coarse but boarder region
- Export csv files, easy to visualize with timestamp
- Easy to setup with 5 minute and detach
- Write step by step instruction documentation

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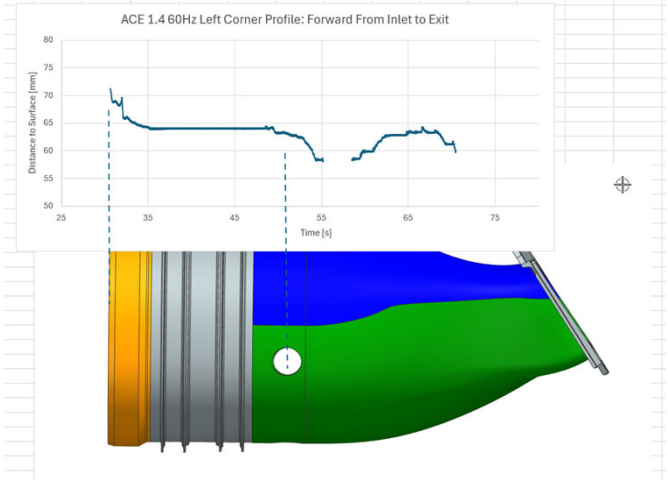
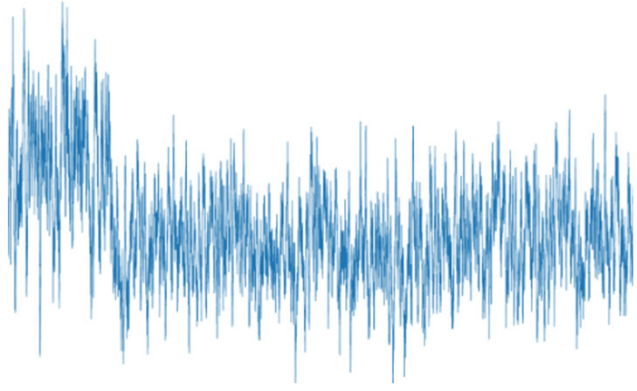
Hurdles met



Out of measuring range: lost data



Noise and offset of cheap sensor

A LOT OF iterations and adjustments (as always)

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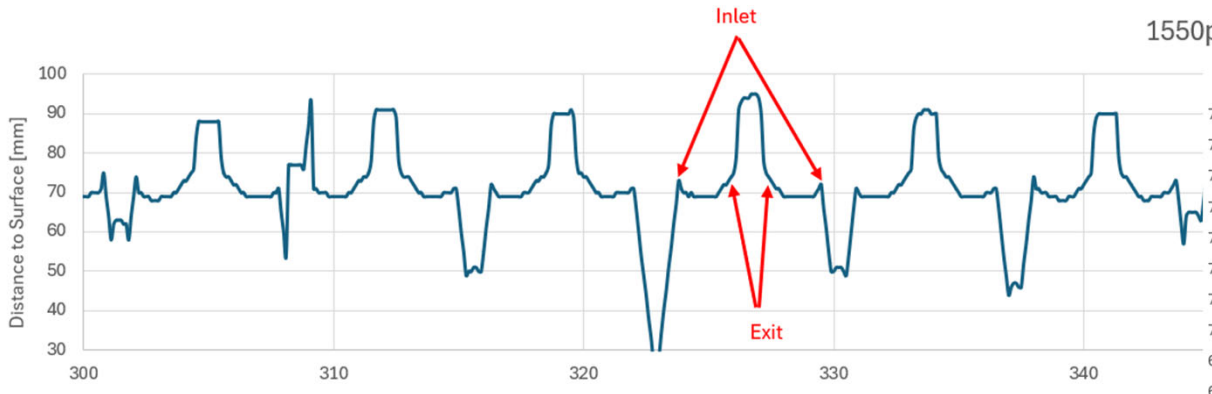
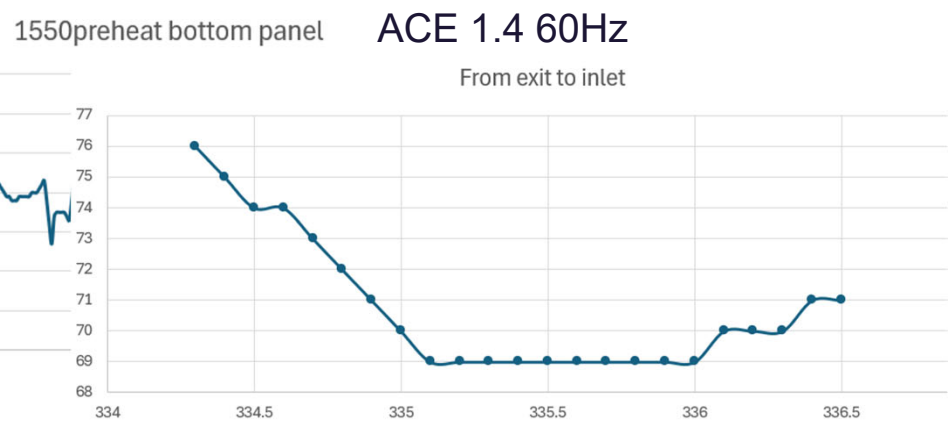
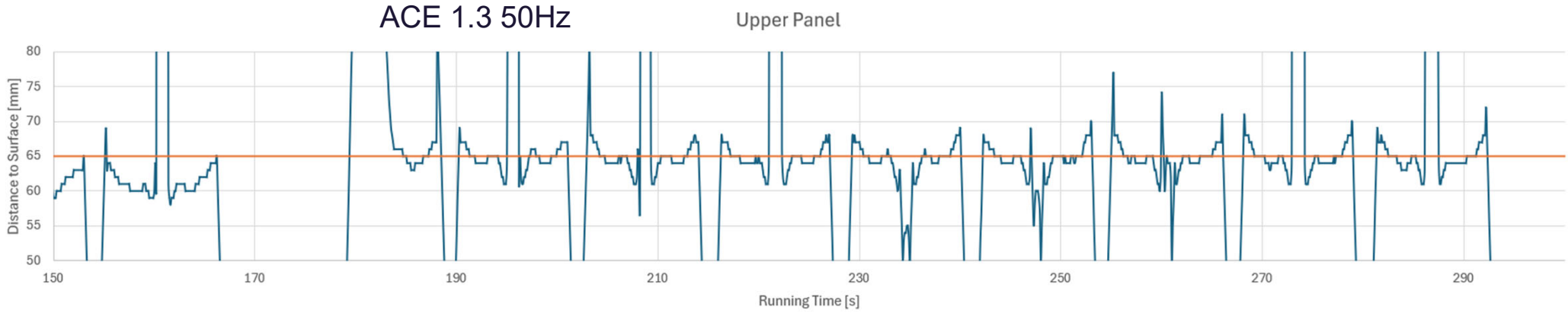
Data Acquired Sample







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Key Learnings

Used:

Use NX, surface roughness measure device, eddy current surface thickness measure device

New Used:

Robot arm movement path analysis, torch head adjustment, efficiency plate calculation and operation, knowledge of heat-resistant materials

Key Take away:

Tight time project collaboration, fast-paced manufacturing experience, and valuable new product development experience

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