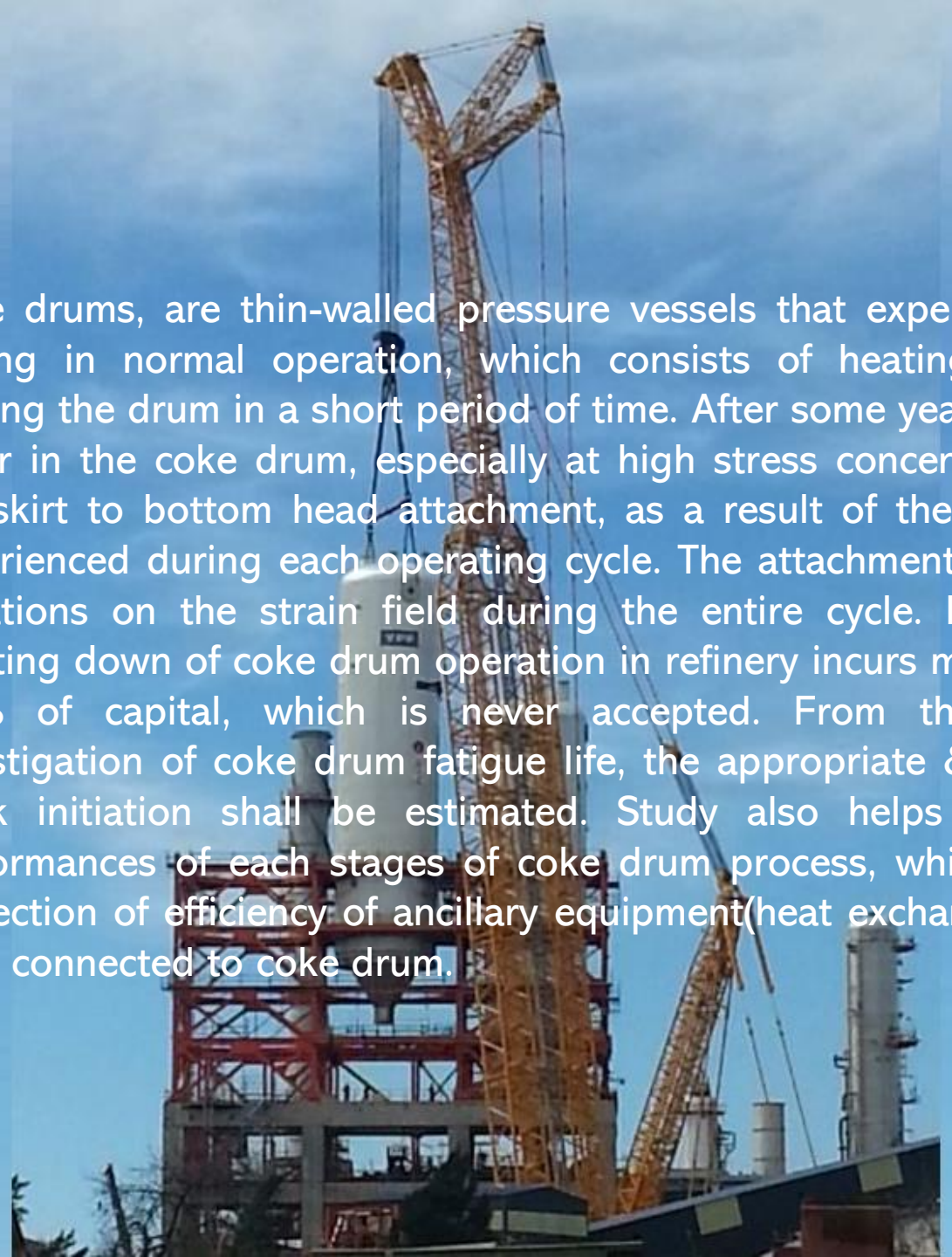
Interim Project Presentation

DSL 810 : Project Proposal

Real Time Thermocouple Data Driven Fatigue Life Evaluation of Coke Drum

Ayush Kumar - 2019DDS6004
Balaji Srinivasan - DDZ208073

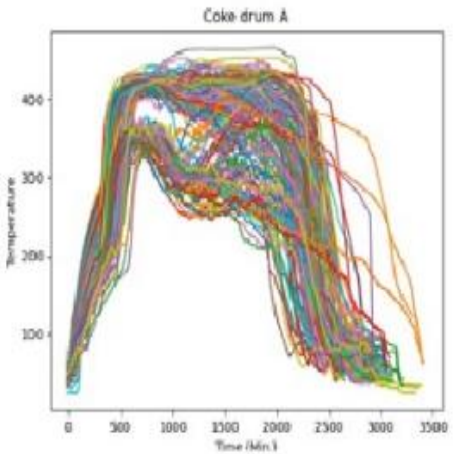
Introduction



Coke drums, are thin-walled pressure vessels that experience severe thermal cycling in normal operation, which consists of heating, filling and rapidly cooling the drum in a short period of time. After some years of operation cracks occur in the coke drum, especially at high stress concentration areas such as the skirt to bottom head attachment, as a result of thermo-mechanical loads experienced during each operating cycle. The attachment is subjected to large variations on the strain field during the entire cycle. In case of unplanned shutting down of coke drum operation in refinery incurs major loss of up to 30-40% of capital, which is never accepted. From the actual data-based investigation of coke drum fatigue life, the appropriate & in-line prediction of crack initiation shall be estimated. Study also helps in investigating the performances of each stages of coke drum process, which indirectly leads to inspection of efficiency of ancillary equipment(heat exchanger, columns, pumps etc..) connected to coke drum.

Actual Problem

REAL COKEDRUM



Random Operating Process
Temperature Cycle

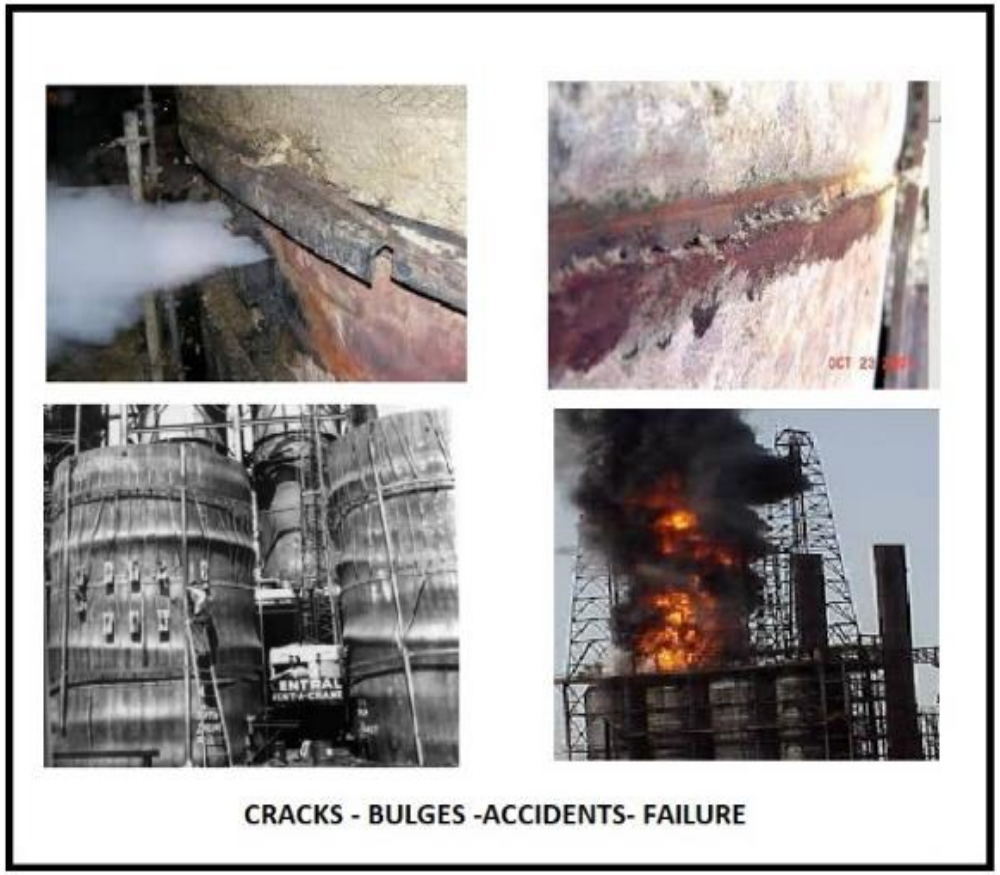
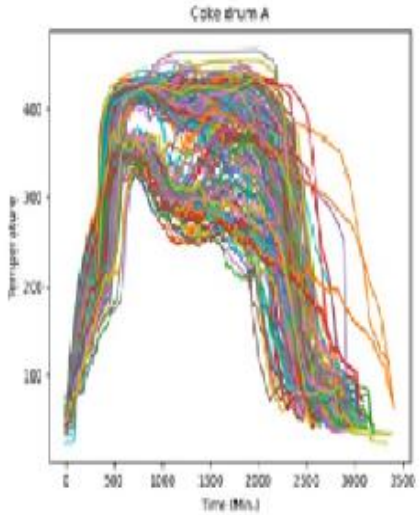
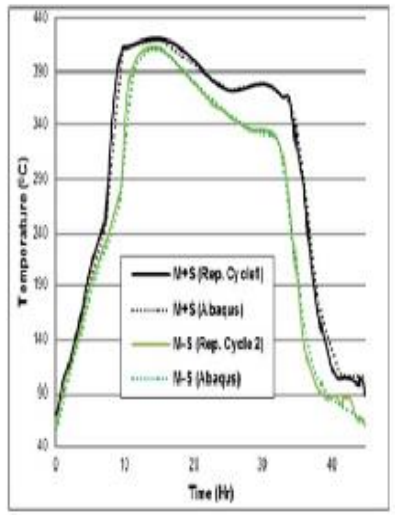


Image Courtesy: Coking.com;
refiningcommunity.com; google.com

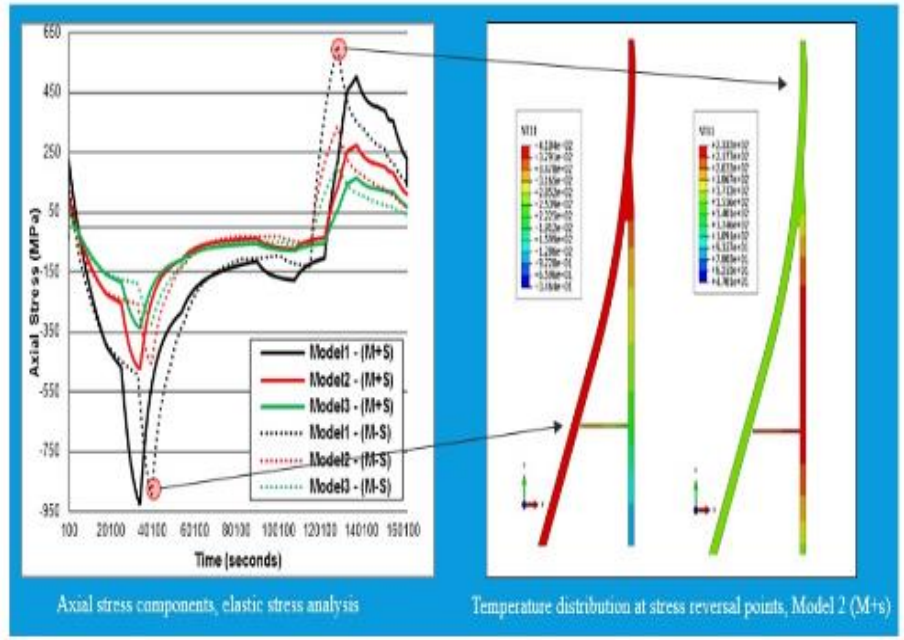
Solution Approach



Random Thermal Cyclic Data



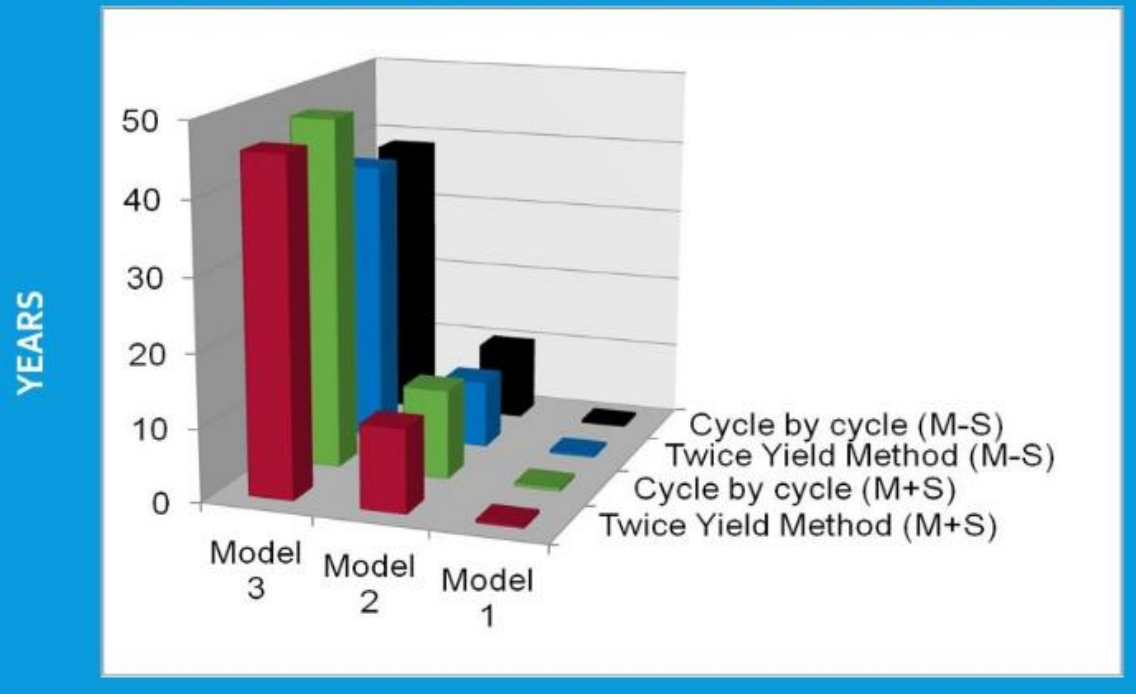
Converted into Meaning Full Data



Fatigue Life Evaluation

Output till now

COMPARISON & ESTIMATION OF REMAINING LIFE



Lowest fatigue life
Mean-Std Dev Curve

Predicted Fatigue life
Mean-Std Dev 20% less than Mean+Std Dev

Mean-Std Dev – Higher Switch temperature
Higher Cooling rate

Highest fatigue Life for Model 3

Model 3-Plastic strain range is almost 0→ Elastic Analysis is Sufficient

By predicting the appropriate fatigue life, the inspection schedules shall be well planned well ahead of failure and appropriate cautionary steps shall be taken to avert unexpected shutdowns and major losses.

Timeline

1st Nov	1st Nov - 30 Nov	1st Dec - 15 Dec	15 Dec - 7 Jan	7 Jan - After
Project Proposal Submission	**1st Spiral** we will take 1 week of data and evaluate the life	**2nd Spiral** 100 days data + visual representation + comparison with actual data	**3rd Spiral** Digital prototype + improvement is visual representation + accuracy	**4th Spiral** Expand the data set