

Implementing eSHM system for crack detection using WAAM technology: a case study on slab carriers

Context of the master thesis

Slab carriers are used in metal processing industry to transport slabs. These heavily loaded vehicles suffer fatigue damage and are at end-of-life. Repairs become more frequent and downtimes are significant as spare parts are rare, leading to increasing repair costs. The huge investments however still compensate for the higher maintenance costs. The end-user of the slab carrier therefore investigates faster and more efficient repair techniques using Wire Arc Additive Manufacturing (WAAM) techniques. The material affected by fatigue is removed and repaired using additive manufacturing.

The end-user now wants to use the design freedom of additive manufacturing to incorporate a damage detection system to capture fatigue cracks at an earlier stage and thereby avoid unexpected shutdowns and reduce repair costs. Vrije Universiteit Brussel has developed the effective Structural Health Monitoring (eSHM) system comprising of capillaries embedded in the additively manufactured structure. A fatigue crack breaching through the pressurized capillaries leads to a leak flow altering the capillary pressure and therefore signaling the fatigue event.

Tasks:

- 1) Explore the (hybrid) manufacturing capabilities to introduce capillaries using WAAM
- 2) Conduct static and fatigue tests to discover the properties of the new WAAM materials
- 3) Given the case study of the end-user and knowledge of (1) and (2), the thesis student proposes a design guideline for the inclusion of the eSHM capillaries on the repair tasks of the end-user to detect fatigue cracks in an early stage without comprising the component's function.



Figure1: Slab carrier



Figure2: WAAM technology

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Working language

English

Student profile

Engineering (Materials, Mechanical)
Interested in additive manufacturing and structural health monitoring
Highly motivated for a challenging yet industry-relevant thesis topic
Experimental work, materials testing, design & signal processing techniques