WS2 Advanced Hybrid Structural Health Monitoring Advancements

Theo Tsenis CERTH/IMET,
email ttsenis@certh.gr

Advanced Car body shells for railways and light material and innovative doors and train modularity

Project coordinator: Fundació Eurecat
Project start date: 01/12/2019
Project end date: 30/11/2021

"This project has received funding from the Shift2Rail Joint Undertaking (JU) under grant agreement No 881814. The JU receives support from the European Union's Horizon 2020 research and innovation programme and the Shift2Rail JU members other than the Union. The content of this document reflects only the author's view – the Joint Undertaking is not responsible for any use that may be made of the information it contains. The users use the information at their sole risk and liability."

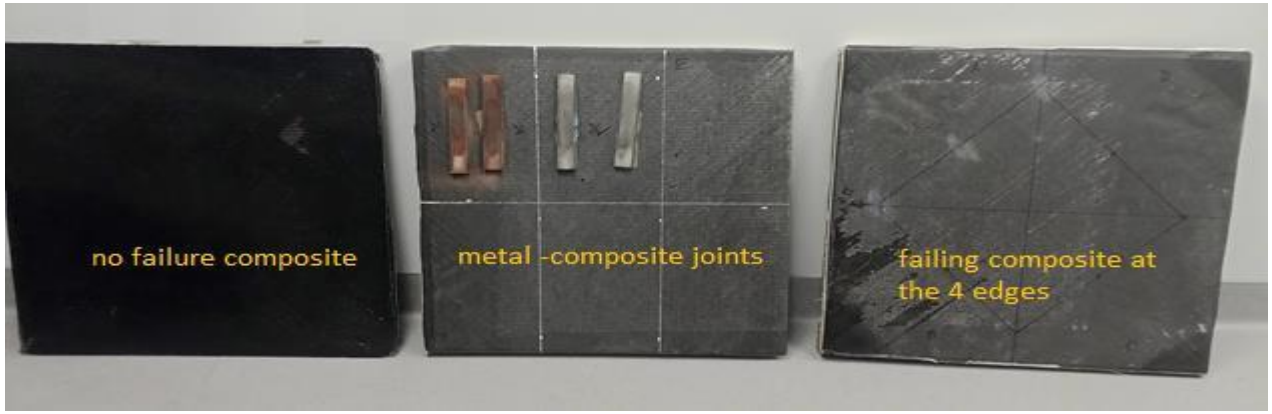
- The hybrid SHM consists of:
  - **Wireless Acoustic Emission (AE)**, constantly searching in a passive mode ailing Acoustic Events either sourced from car-body's skeleton or from crucial metal-composite joints.
  - **Network of Accelerometers and Gyroscopes**, scattered across car-body, and embedded inside the composite boards or beams able to passively capture failures sourced by failing fractured composite boards or mounting rivets or fractured composite beams.
  - **Fibre Optic Sensor (FOS)**, by using sensitive composite embedded Bragg's sensors to measure composite strains and composite temperature aiding, thereby providing additional features in predictive maintenance.

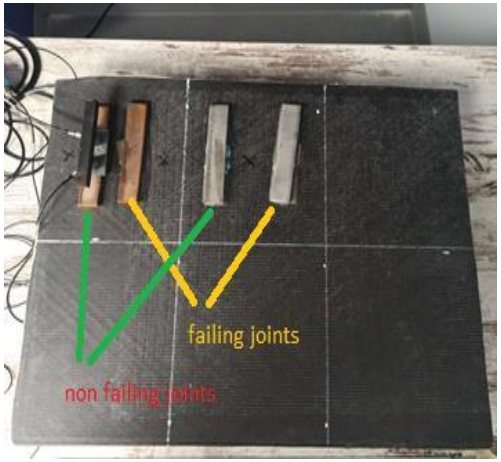
WS2: Exploitation of AE

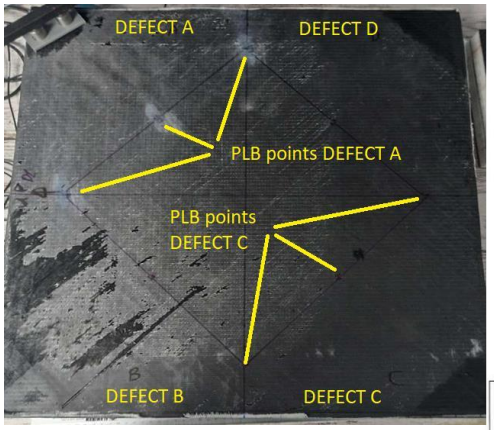
- Easy deployment throughout and across train car-body.
- Sensitivity and wireless connectivity.
- Good robust ML models through 1D or 2D CNN models and usage of LSTM over AE time-series input data.
- Ability for edge inference.

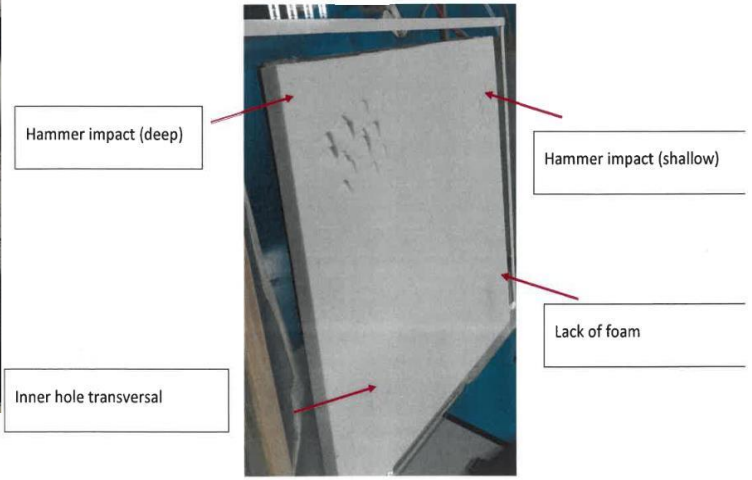
Shift2Rail
Grant agreement No 881814

WS2: AE experimentation description





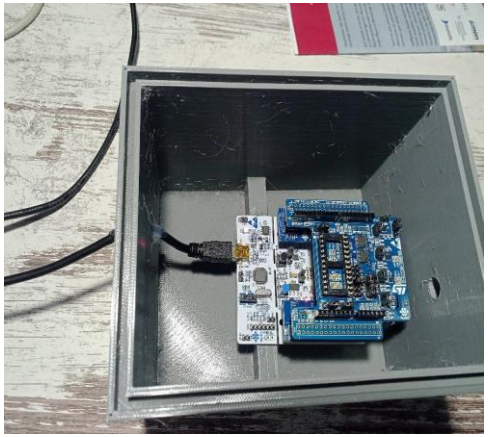




Grant agreement No 881814

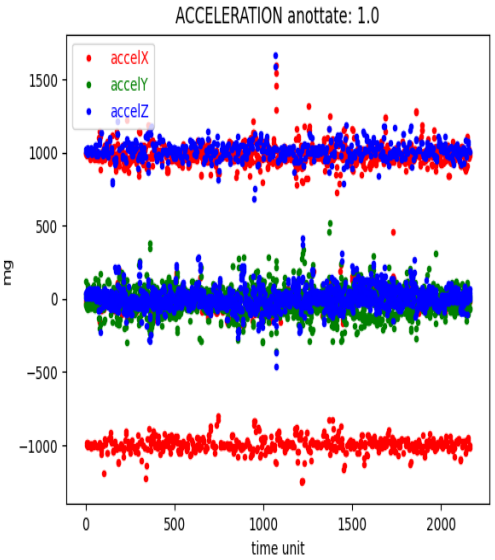
WS2: Exploitation of Accelerometers

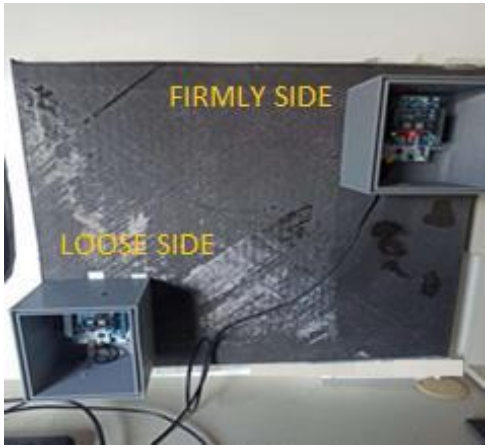
- Easy deploy, low cost, low consumption.
- Embedded inside composites
- Wireless connectivity



- LSTM training with data as time-series or segmentation of input data into data image 1D frame for 1D CNN model learning. Usage of PCA and ICA.

WS2: Accelerometer experimentation descritpion



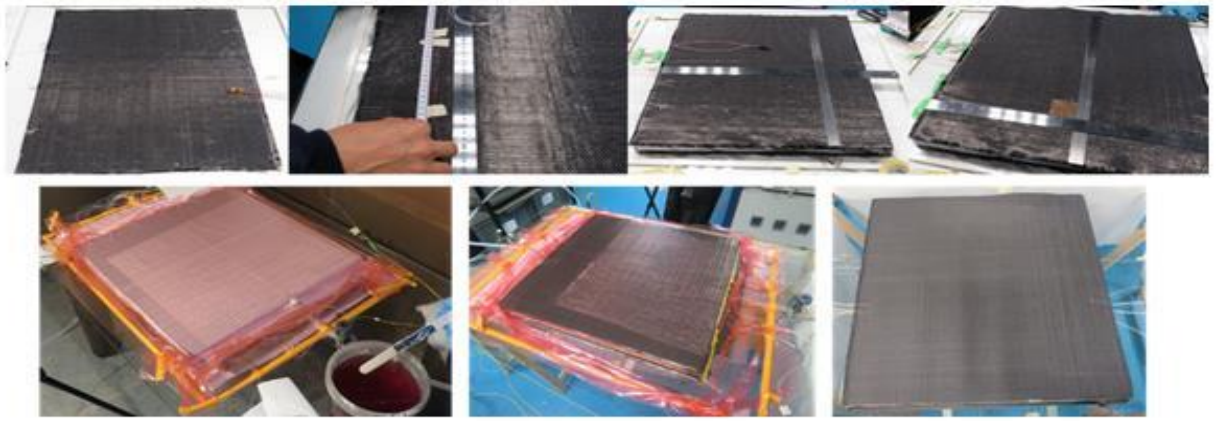


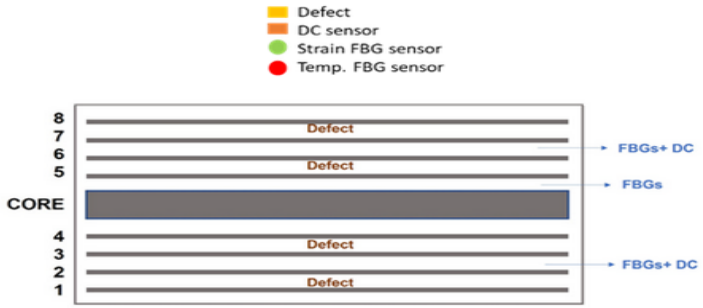
WS2: Exploitation of FOS

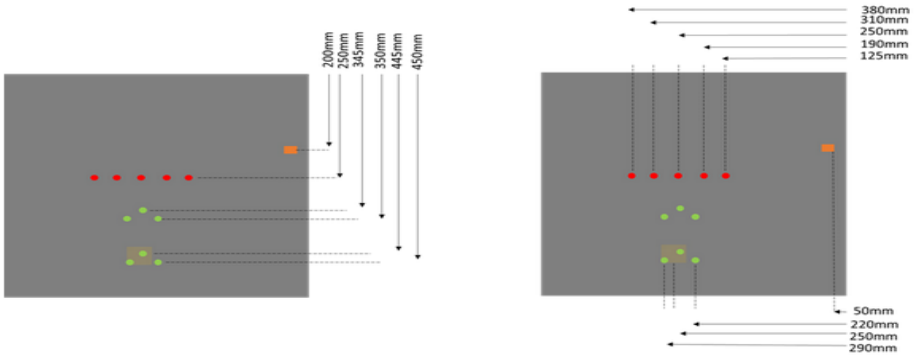
- Sensitive over composite internal residual stresses
- Sensitive in measuring composite temperature
- Embedded inside the composite
- LSTM ML model most suitable.
- Edge Inference.

Shift2Rail
Grant agreement No 881814

WS2: FOS experimentation description







Grant agreement No 881814

Thank you for your attention!

CARBODIN
CAR BODY SHELL, DOORS AND INTERIORS

"This project has received funding from the Shift2Rail Joint Undertaking (JU) under grant agreement No 881814. The JU receives support from the European Union's Horizon 2020 research and innovation programme and the Shift2Rail JU members other than the Union. The content of this document reflects only the author's view – the Joint Undertaking is not responsible for any use that may be made of the information it contains. The users use the information at their sole risk and liability."

Thank you for your attention!

eurecat
Centre Tecnològic de Catalunya

ifs | RWTH AACHEN UNIVERSITY

EURNEX

UIC

aimen
CENTRO TECNOLÓGICO

SAPIENZA
UNIVERSITÀ DI ROMA

DESART

Université Polytechnique
HAUTS-DE-FRANCE

VUZ

CG Rail

SMT

HELLENIC INSTITUTE OF TRANSPORT
CERTH / HIT

masats

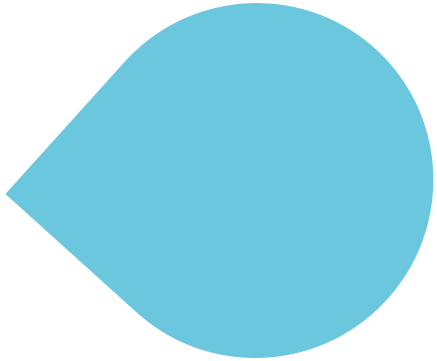
Shift2Rail

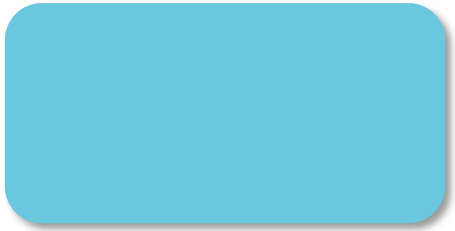
Grant agreement No 881814

Example of elements to use:

Title:
text

Title:
text





Grant agreement No 881814