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E-LASS SEMINAR
Digital Twin for the Predictive Maintenance of Offshore Wind Platform Structures

Borja Serván, CIMNE
Andrés Pastor, CIMNE-UPM

E-LASS Seminar
Las Palmas, 3/05/2023

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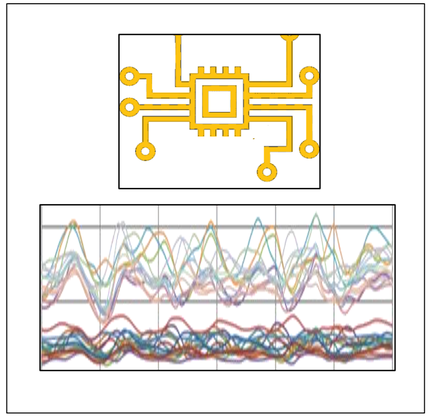
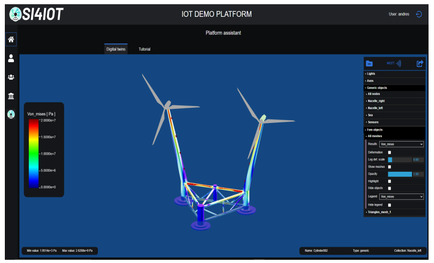
Digital twin (DT) for Predictive Maintenance and Structural Health Monitoring

DIGITAL TWIN

DATA PROCESSING



USER FRIENDLY DIGITAL PLATFORM



DECISION SUPPORT SYSTEM

DECISIONS

Delay maintenance

Schedule inspections

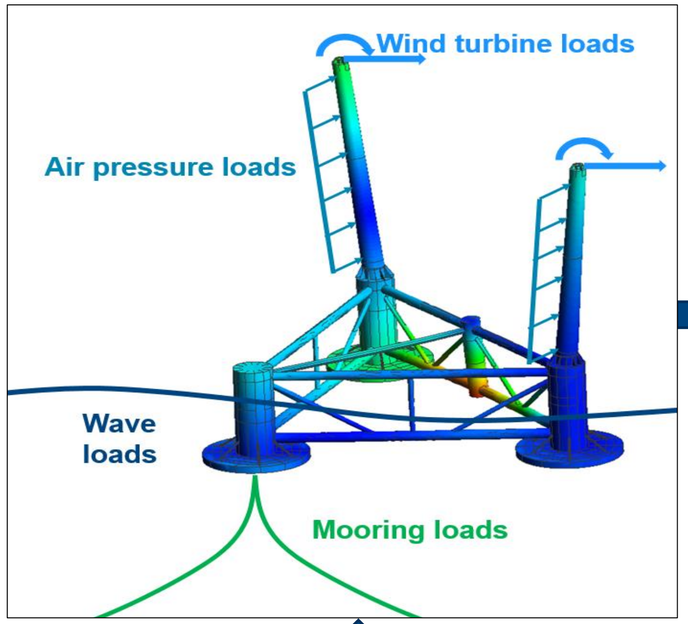
Stop operations & Repair

...

Structural health monitoring strategy developed under H2020 FibreGY & Fribre4YARDS

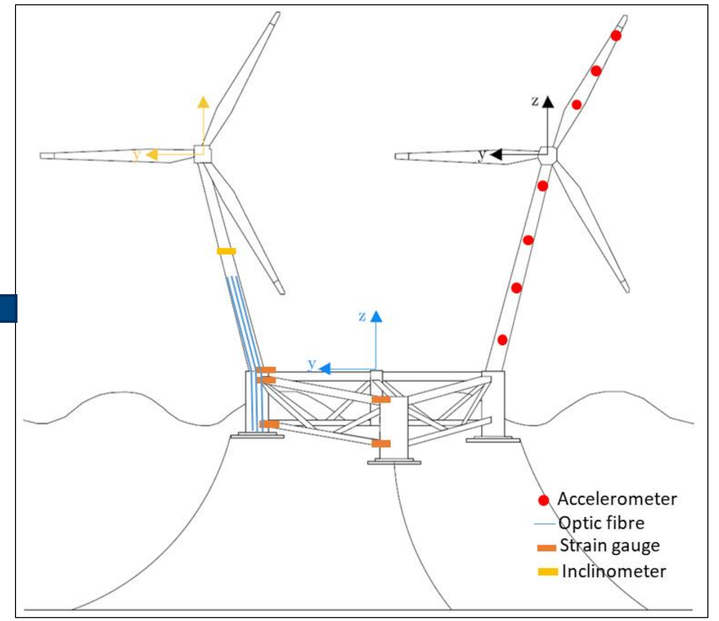
Digital twin (DT) for the Structural Health Monitoring

COMPUTATIONAL MODEL



DIGITAL TWIN

DATA FROM SENSORS



METOCEAN DATA: WIND & WAVES

Digital Twin developed under H2020 FibreGY

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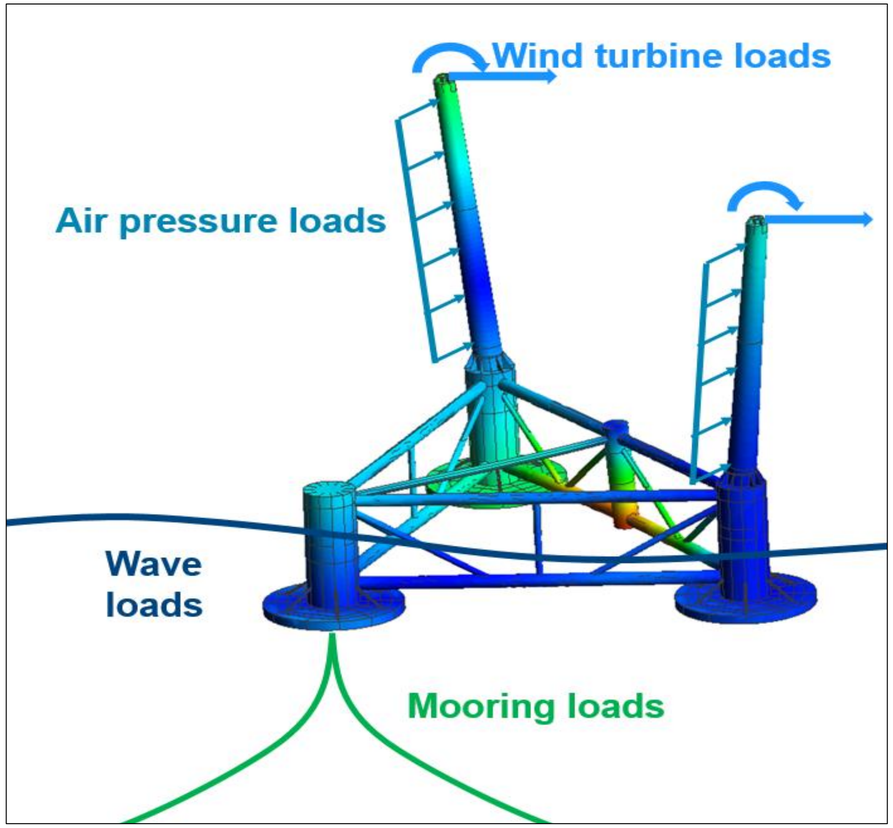
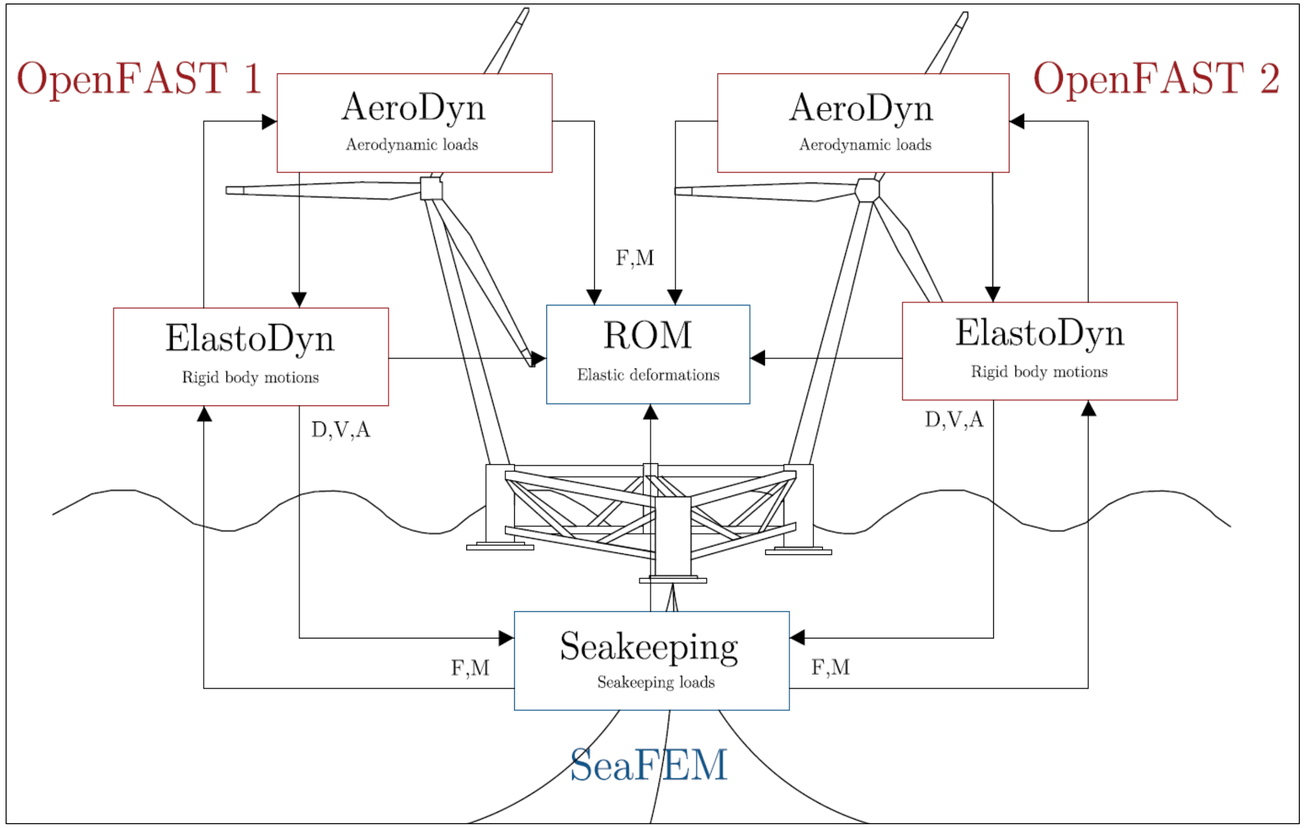
AERO-SERVO-HYDRO-ELASTIC COMPUTATIONAL MODEL





Aero-Servo-Hydro-Elastic model developed under H2020 FibreGY

HYDRO-ELASTIC COMPUTATIONAL MODEL

Modal Equation:

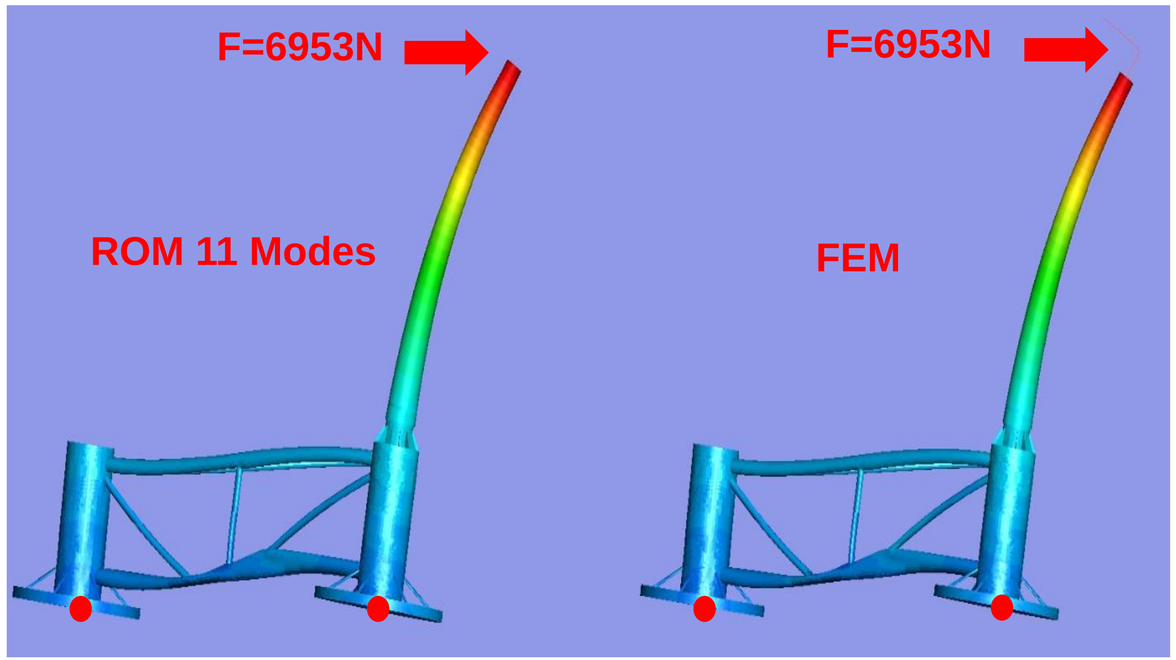
$$\ddot{\lambda}_i(t) + \omega_i^2 \dot{\lambda}_i(t) = \psi_i F$$

$\psi_i(\mathbf{x})$ Eigenmode
ω_i Modal frequency
$\lambda_i(t)$ Modal amplitude

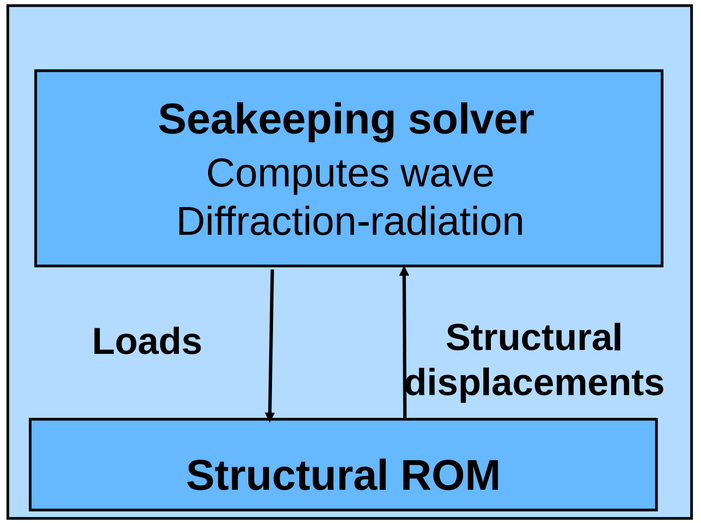
Approximated solution (ROM)

$$u(\mathbf{x}, t) \approx \lambda_1(t)\psi_1(\mathbf{x}) + \lambda_2(t)\psi_2(\mathbf{x}) + \cdots + \lambda_k(t)\psi_k(\mathbf{x})$$

STRUCTURAL REDUCE ORDER MODEL

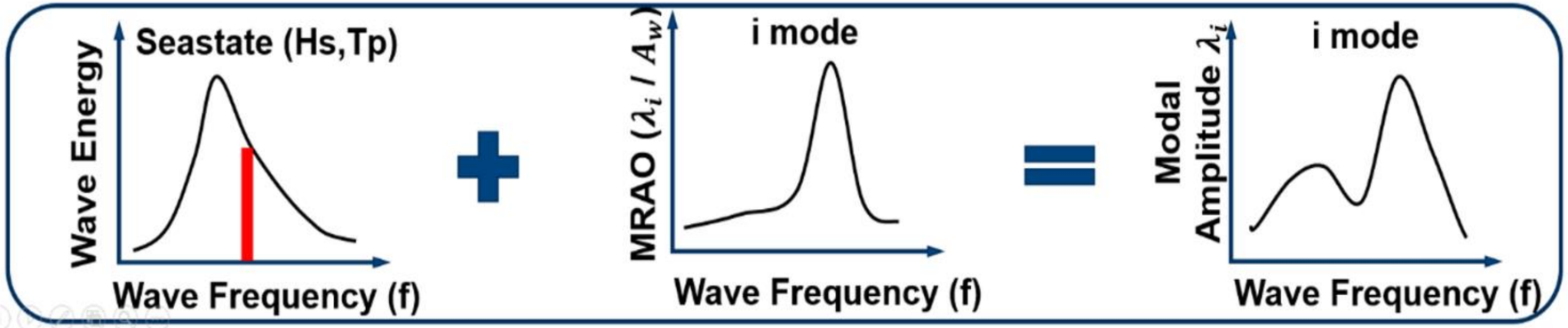


HYDROELASTIC SEAFEM



Hydroelastic Model developed under H2020 FibreGY

MODAL RESPONSE AMPLITUDE OPERATORS (MRAOs)



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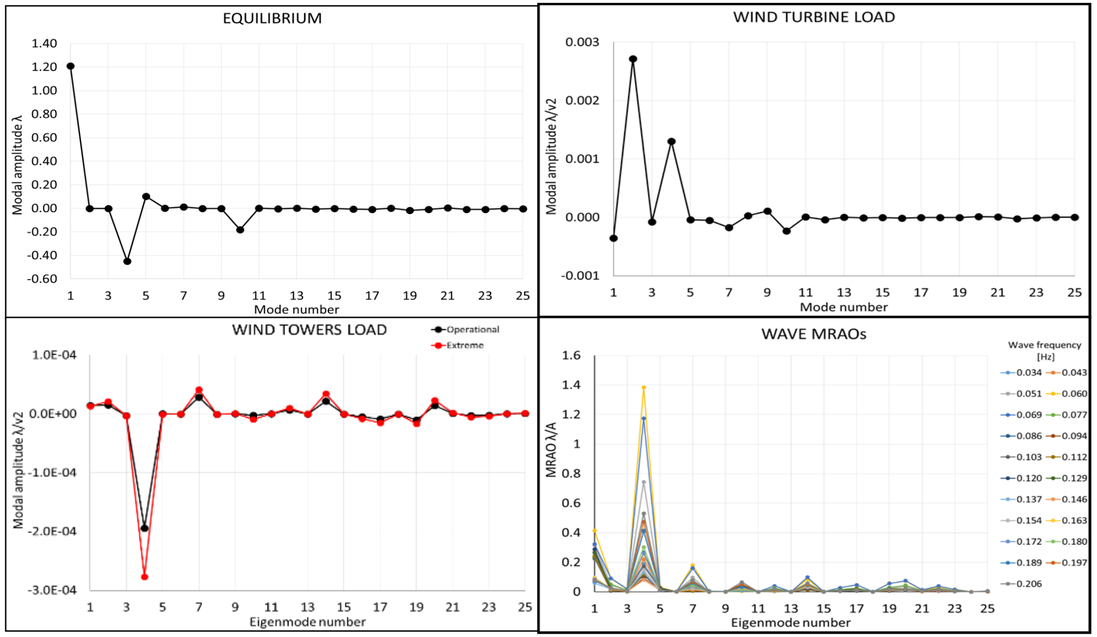

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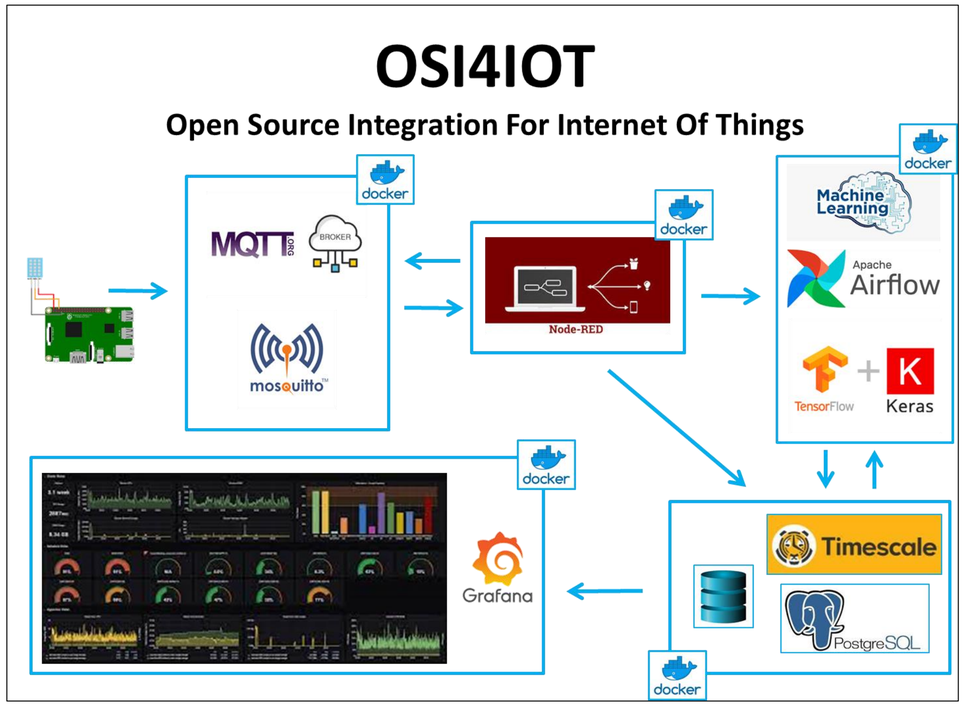
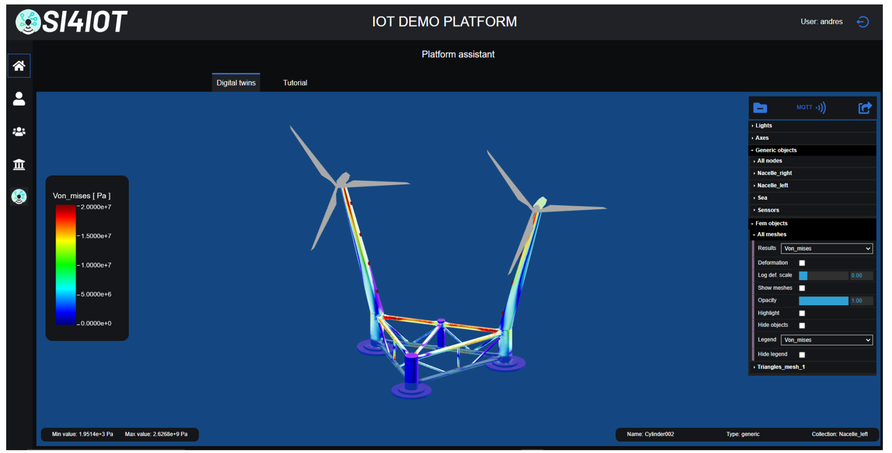
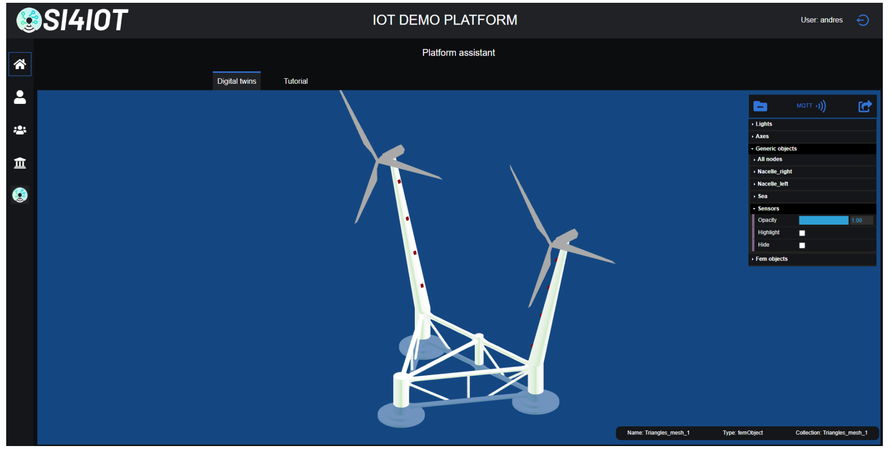
ENVIRONMENT-FRIENDLY VIRTUAL PLATFORM OSI4IOT

OSI4IOT: Open Source Integration for Internet of Things

https://osi4iot.com/







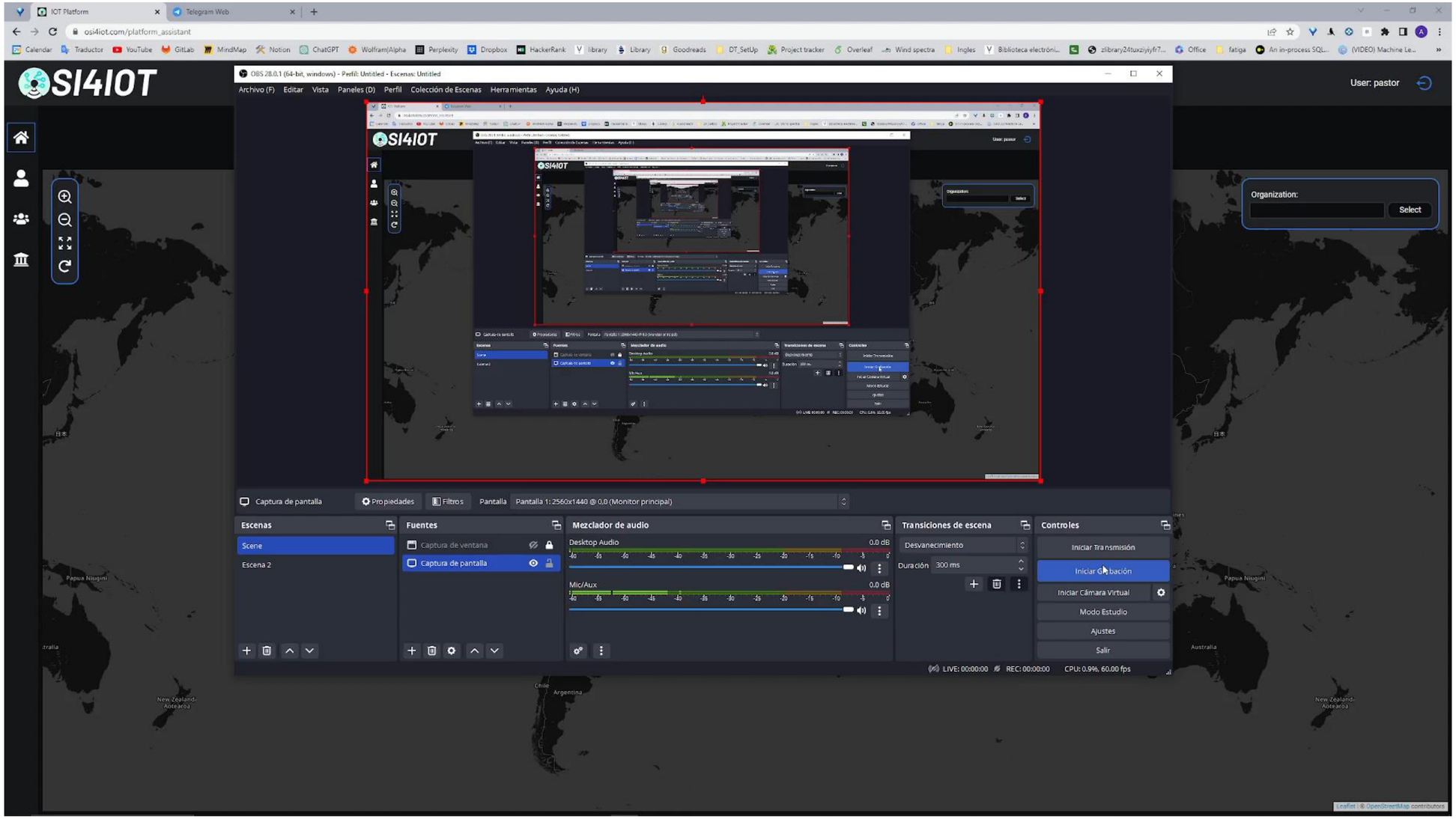
Near real-time displacement and stress fields

Hot-spots monitoring

OSI4IOT: developed under H2020 Fibre4Yards

FIBREGY

ENVIRONMENT-FRIENDLY VIRTUAL PLATFORM OSI4IOT



OSI4IOT: developed under H2020 Fibre4Yards