



Supervisor Expression of Interest MSCA-IF Marie Skłodowska Curie Action-Individual Fellowship 2020

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Department Name: Research topic: (https://www.polimi.it/en/scientific-research/research-at-the-politecnico/departments/)	ABC Risk prevention and emergency management ICT and smart systems for constructions
MSCA-IF Research Area Panels	<input type="checkbox"/> CHE_Chemistry <input type="checkbox"/> ECO_Economic Sciences <input type="checkbox"/> ENG_Information Science and Engineering <input type="checkbox"/> ENV_Environmental and Geosciences <input type="checkbox"/> LIF_Life Sciences <input type="checkbox"/> MAT_Mathematics <input type="checkbox"/> PHY_Physics <input type="checkbox"/> SOC_Social Sciences and Humanities
Politecnico di Milano Areas:	<input type="checkbox"/> Cultural Heritage X Smart Cities <input type="checkbox"/> Territorial Fragilities <input type="checkbox"/> Health <input type="checkbox"/> Industry 4.0
Brief description of the Department and Research Group (including URL if applicable):	Department ABC Interdisciplinary Research Group (civil structures and geomatics) • Maria Pina Limongelli , SHM and Value of Information analyses • Mattia Previtali , UAVs, Digital Twins • Pier Francesco Giordano , Value of Information analyses • Zehra Irem Turksezer , Risk and Resilience indicators



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**Brief project description:
(max 1 page)**

Digitalization of bridge integrity management

Presently a very large number of European bridges built in the '50s and '60s of the last century are close to the end of their design life or even beyond. Due to increased traffic, deterioration, maintenance backlogs and effects related to climate change, they are operating under conditions substantially deviating from original design assumptions. Understanding their current and future performance is essential to keep Europe's transport infrastructure fully operating. However current best practices in bridge emergency management do not fully and efficiently exploit the **potentialities offered by new digital technologies for data collection, processing, and model to support decisions**. The management of bridge serviceability both in ordinary and in emergency situations - created by extreme events or man-made actions - is often tackled collecting information through visual inspections that are time consuming and strongly subjective. The digital transformation can foster the transition toward real-time monitoring systems based on the use of data automatically collected and processed through bespoke algorithms to support decision making at bridge, network of bridges and at geographic scale enabled by the use of digital twins models and remote monitoring systems.

This project will deliver a **digitalised information-driven decision support tool for integrity management of bridges** based on the joint use of:

- a) **remote sensing devices** installed on drones and able to collect data on a network level;
- b) **local sensing systems** accelerometers, strain gauges, displacement transducers installed to monitor one component of the network (one bridge);
- c) **digital twin models** continuously informed by monitoring data and providing a unique permanently updated data source relevant to the structural performance and enabling frequent updates of prognoses at reasonable effort.

The project will build up the results of survey of the protocols and best practices currently used for integrity management of bridges both in ordinary and in emergency situations.

Evidence-based indicators of the bridge safety and serviceability will be defined to feed the decision-making algorithms, also considering highly relevant aspects related to resilience and sustainability. **Limit states** used to describe the **structural condition** will be defined in terms of such indicators and a **risk-based approach** will be adopted to optimize the monitoring system for different types of hazard and to select an optimal emergency protocol at the network and bridge level. Step-wise risk-based alert protocol providing multi-level alarms based on the type of hazard and of the different measures taken by different types of sensing devices will be investigated based on the **value of information** provided by different monitoring solutions.