

PhD in Civil and Environmental Engineering

Research Title: Mechanics of Structures: SMART ANALYSIS OF INFRASTRUCTURES THROUGH SYSTEM ENGINEERING AND AI

Funded by	Ateneo
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Context of the research activity	<p>In the absence of sound "design for maintenance" strategies, and due to the end-of-life approach, the realm of Italian infrastructures (including bridges, viaducts, tunnels and dams) is now facing severe ageing problems. There is a crucial claim for safety assessment, after a series of minor and major collapses occurred in the last 10 years.</p> <p>The research will start from the determination of the material characteristics (concrete, steel, prestressing cables etc) through innovative statistics and machine learning techniques. The availability of the original design parameters is often missing for old infrastructures and therefore modern diagnostic nondestructive tools like georadar, acoustic emission, diffractionmetry will help to gain adequate knowledge of material characteristics.</p> <p>Then the candidate will look at the structure components, in a framework of "system engineering" (e.g. identifying the basic components of the structure, their interaction and the global behaviour under environmental and traffic loads), leading to the updating of the structural behavior of the structure in its current ageing and degradation state.</p> <p>Finally, the candidate will explore the possibility of adding a permanent and intelligent monitoring system to the bridge (or tunnel) in order to keep day by day control of the</p>
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	<p>evolution of ageing. This will permit to keep constant safety factors and to optimize the maintenance strategies.</p> <p>Several potential industrial collaborations will be established, starting from the partners of the Interdepartmental Center SISCON in the area of rail and road asset managers (like, e.g., ANAS, ASPI, RFI etc). Companies managing hydroelectric facilities and dams, like IREN and ENEL could be also greatly interested in the results of the research.</p>
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Objectives	<p>The aim of the research is to develop innovative methodologies for the safety assessment and the smart maintenance of infrastructures like e.g. bridges, dams and tunnels.</p> <p>Since these manufacts were not designed with regard to optimal maintenance, and due to their age larger than 50 years, the candidate will develop new tools for ageing prediction, efficient maintenance and robust safety assessment by exploiting the capabilities of machine learning and artificial intelligence.</p>
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Skills and competencies for the development of the activity	<p>Master in Civil Engineering - Structural curriculum; Basic knowledge in Artificial Intelligence; Basic knowledge in System Engineering</p>
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