

Thematic Symposium

Durability of structural joints: experimental, theoretical and numerical approaches

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Lightweight, safe, and cost-effective mechanical structures are vital in a wide range of industries, including automotive, railway, and construction machinery. These industries constantly seek innovative solutions to enhance performance, reduce energy consumption, and lower operational costs while ensuring the highest standards of safety and environmental sustainability. In alignment with the European Union's Horizon 2020 (H2020) initiative on "smart, green, and integrated transport," there has been a significant tightening of emission regulations and safety requirements. To comply with these evolving and increasingly stringent regulations, industries are exploring various advanced materials joining technologies. These technologies are essential for assembling components made of both similar and dissimilar materials, which are often used to optimize weight, strength, and durability. However, existing standards and guidelines frequently fail to adequately address the complexities involved in ensuring the structural integrity of such joints under real-world operating conditions. Issues such as thermal expansion mismatches, fatigue resistance, and load-bearing capacity require further investigation and innovative solutions.

In this framework, this Thematic Symposium aims to bring together contributions focused on:

- **welding joints:** covering processes involving similar and dissimilar materials, with attention to microstructural effects, residual stresses and mechanical performance;
- **bonded joints:** exploring adhesive technologies, surface preparation methods, and their applications;
- **bolted joints:** addressing design considerations, stress distributions and failure mechanisms;
- **hybrid joints (bonded/bolted):** combining the benefits of both methods to achieve improved structural performance.

The symposium aims to bridge theoretical developments with practical applications and to innovative solutions that address current challenges in materials joining technologies, by mainly emphasizing three key areas: theoretical modeling, experimental characterization, and integration with modern computational analysis.

The thematic symposium is co-organised by Raffaele Sepe (University of Salerno) in the framework of the project PRIN 2022, Prot. n. 2022EY5JAL, entitled "*Design for structural strength and durability of hybrid joints between dissimilar metal materials: experimental characterisation, theoretical modeling and computationally efficient structural analyses*". . Public notice n. 104/2022 of 02/02/2022. CUP D53D23003510006.

The objectives of the project are aligned with *Piano Nazionale di Ripresa e Resilienza (PNRR) - Mission 4: Istruzione e ricerca, Componente 2: Dalla ricerca all'impresa, Investimento 1.1: Fondo per il Programma Nazionale della Ricerca (PNR) and Progetti di Ricerca di Rilevante Interesse Nazionale (PRIN)*, Funded by the European Union – NextGenerationEU.

The symposium is going to showcase the outcomes of the project, along with other independent contributions in the fields of Durability of structural joints.