Prof. Marco Alfano
Dipartimento di Scienze e Metodi dell'Ingegneria
Università di Modena e Reggio Emilia
Via Giovanni Amendola, 2, Padiglione Morselli
42122 Reggio Emilia (RE), Italia
marco.alfano@unimore.it.

Fracture mechanics of polymers, composites and adhesives

This short course provides a comprehensive overview of the critical aspects of fracture mechanics in polymers, adhesives, and composites, all of which are essential in the realm of mechatronic devices and systems. Topics covered include applied adhesion science, fracture theories, joining techniques, and finite element models. Emphasizing practical applications, the course equips interested PhD students with a strong foundation to address the complex challenges in the development and optimization of mechatronic devices.

Contents (tentative, 3 ECTS, 12 hours[1])

- **Applied Adhesion Science [3h]**. Surface properties and their impact on adhesion. Surface energy and surface tension. Wettability and contact angle. Adhesion theories, mechanisms of adhesion, adhesive bonds.
- **Fracture Mechanics [3h]**. Intro to fracture mechanics. Crack-tip behavior. Fracture mechanics of fiber-reinforced plastics. Joining of composites using adhesives. Mechanical testing and mode of failure.
- **Finite Element Models in Fracture Mechanics [3h]**. Basics of FEA. Cohesive Zone Models (CZM) to simulate fracture/debonding in composites and adhesives. Practical Applications using ABAQUS (Part 1).
- **Finite Element Models in Fracture Mechanics [3h]**. Practical Applications using ABAQUS (Part 2). Special topics: Architected materials and interfaces for fracture control.
- **Final assessment**.

Lecture day, time and location details (may be subjected to changes)

The lectures will be held at DISMI (Classroom M0.1 - [RE 20] - Tecnopolo - Ex Officine Reggiane - Padiglione 15) according to the schedule proposed below.

Detailed schedule
Lecture #1, 2025.02.28, 10:00 - 13:00
Lecture #2, 2025.03.14, 10:00 - 13:00
Lecture #3, 2025.03.28, 10:00 - 13:00
Lecture #4, 2025.04.11, 10:00 - 13:00
Final assessment, 2025.05.16, 10:00 - 12:00

[1]For further information, please contact the Instructor at: marco.alfano@unimore.it