Course modules

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| --- | --- | --- | --- | --- |
|  | Day 1 | Day 2 | Day 3 | Day 4 |
| 9:00 | Strain-rate sensitivity and testing equipment | Instrumentation and sensors | Advanced data elaboration | Tension tests realization (large machine) |
| 10.30 |
|  | Coffee break | Coffee break | Coffee break | Coffee break |
| 11.00 | Hopkinson bar facilities | Simplified data elaboration | Tension tests realization (large machine) | Round table |
| 12.30 |
|  | Lunch | Lunch | Lunch |  |
| 14.00 | Unit presentation and ELSA labs tour | Compression tests realization (small machine) | Compression tests realization (large machine) |  |
| 15.30 |
|  | Coffee break | Coffee break | Coffee break |  |
| 16.00 | Hopkinson bar typical structure | Design of Hopkinson experiments | Test Examples |  |
| 17.30 |

# Strain-rate sensitivity and testing equipment (with focus on metals and geomaterials)

1. Strain-rate sensitivity of structural materials
2. Material models
3. Testing equipment for strain-rate sensitivity investigation

# Hopkinson bar facilities

1. Hopkinson technique basics
2. Gas guns VS pre-tensioning method (wave length, calibration, pulse shaping, etc.)
3. Hopkinson bar configurations (compression, tension, torsion, tension-torsion, etc.)

# Unit presentation and ELSA labs tour (Reaction Wall and Hoplab)

1. JRC and unit presentation
2. Reaction Wall tour
3. Hoplab tour

# Hopkinson bar typical structure

1. Base frame
2. Gas-gun
3. Pre-tensioning and quick release system
4. Bars and bushings

# Instrumentation and sensors

1. Strain-gages (ohmic, semiconductors)
2. Signal conditioning and acquisition
3. High speed cameras
4. Other sensors (accelerometers, lasers, etc.)

# Simplified data elaboration

1. 1D wave propagation theory
2. Hopkinson formulae
3. Equilibrium check

# Compression tests realization (small machine)

1. Test on metal specimen and elaboration with a conventional Hopkinson bar
2. Test on metal specimen (pulse shaping) and elaboration
3. Test on brittle specimen

# Design of Hopkinson experiments

1. Design parameters of a Hopkinson test (bars material and diameter, specimen size, input wave length and amplitude)
2. Input wave amplitude prediction (gas gun and pre-tensioning)
3. Hopkinson experiment design tool

# Advanced data elaboration

1. 3D wave propagation theory (dispersion)
2. Deconvolution algorithms
3. Data elaboration in non-standard conditions (short bars, bar of different materials and sizes)
4. Integration of DIC measurements

# Tension tests realization (small machine)

1. Tests on metal specimen with a modified Hopkinson bar and data elaboration (low/high strain-rate)

# Compression tests realization (large machine)

1. Test on concrete specimen with a large Hopkinson bar and data elaboration
2. Test on concrete specimen (pulse shaping) and data elaboration

# Test Examples

1. Collection of different case studies and data collection of JRC experiments
2. Presentations of past Open Access projects at Hoplab

# Tension tests realization (large machine)

1. Test on metal specimen with a large Hopkinson bar and data elaboration

# Round table

1. Questions and answers