University of Zagreb
Faculty of Mechanical Engineering and Naval Architecture

Project Laboratory for Numerical Modelling of Damage in Aeronautical Structures

Objectives

The Laboratory, **AeroDamageLab**, was established in 2009 at the Faculty of Mechanical Engineering and Naval Architecture (FMENA), University of Zagreb, within the framework of the Technology Project TP-07/0120-30 "Numerical Modelling of Damage in Aeronautical Structures". One of the objectives is to continue cooperation with flag carrier airline "Croatia Airlines" in the development of technology aimed at determining foreign object damage (e.g. due to bird impact) in the composite, sandwich as well as metallic aeronautical structures.

The methodology is based on explicit integration methods used within finite element program Abaqus/Explicit, along with the corresponding failure criteria at impact on aluminium, sandwich or composite structures. Special attention was given to the modelling of impactor/bird (using EOS, ALE) in order to be able to compare numerical results with the available references.

Furthermore, the Laboratory is the focal point for development of numerical methods in the mechanics of composites structures.

Activities

- development of new numerical methods and constitutive laws in the field of damage mechanics, applied in the composites engineering
- stress analysis of composite and metallic structures, primarily in the aeronautics, as well as in the other areas of application
- expertise and creation of technical reports in the area of aeronautical composites engineering and other fields of aeronautics
- collaboration in FP7 and other international scientific projects in the field of aeronautical engineering and composite structures with particular aim at application of numerical methods
- collaboration in engineering / scientific projects (such as national Technology Projects, national Scientific Projects, EUREKA projects etc.) in the fields of composites engineering and aeronautical engineering in general sense
- consultancy in the field of aeronautical engineering

Infrastructure

- 2 Workstations with 2 x 4 core processors
- **Abaqus/Standard/Explicit** FEM software and other CAD software available at FMENA (e.g. through FMENA CAD/CAE Referral Centre)
- other supporting computational equipment (notebooks, printers, scanners, overhead projectors etc.)

Education

Lectures in Subjects :

- **Airplane Structures, part 1** (Undergraduate Study)
- **Composite Aircraft Structures** (Graduate)
- **Economics of Aircraft Structures** (Graduate)
- **Introduction to Aeronautics** (Undergraduate)
- **Mechanics of Composite Materials** (Graduate)
- **Mechanics of Composite Structures** (Postgraduate)
- **Strength of Composite Aircraft Structures** (Graduate)
- Rocket Technology (Undegraduate)

Cooperation

Within activities of the Laboratory, cooperation has been established with:

- **NASA Glenn**
- **ILSB - Vienna Institute of Technology**
- **Cranfield University**
- **University of Patras**
- **Technical University of Munich**
- **Airbus**

and other institutions (through preparation and work on joint projects, invited lectures or presentation of research results).

Recent Publications

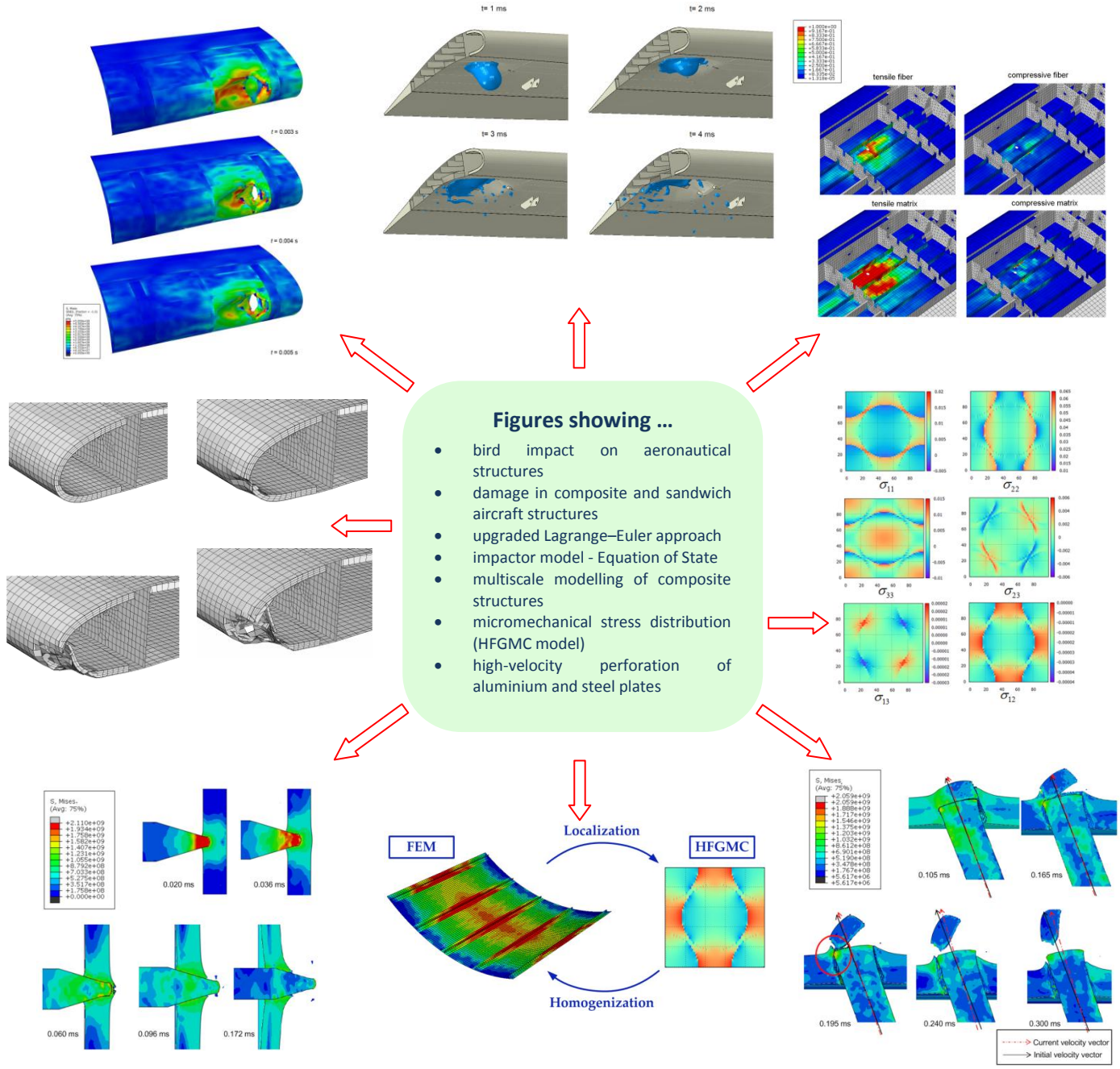
D. Ivančević, I. Smojver, *Explicit Multiscale Modelling of Impact Damage on Laminated Composites – Part I: Validation of the Micromechanical Model,* Composite Structures, **145**, 248-258, 2016

D. Ivančević, I. Smojver, *Explicit Multiscale Modelling of Impact Damage on Laminated Composites – Part II: Multiscale Analyses,* Composite Structures, **145**, 259-268, 2016

D. Ivančević, I. Smojver, *Micromechanical Damage Modelling using a Two-scale Method for Laminated Composite Structures*, Composite Structures, **108**, 223–233, 2014

I. Smojver, D. Ivančević, *Advanced Modelling of Bird Strike on High Lift Devices Using Hybrid Eulerian-Lagrangian Formulation,* Aerospace Science and Technology, **23,** 224-232, 2012

I. Smojver, D. Ivančević, *Bird Strike Damage Analysis in Aircraft Structures Using Abaqus/Explicit and Coupled Eulerian Lagrangian Approach*, Composites Science and Technology, **71**, 489 – 498, 2011



Contact Info

Project Laboratory for Numerical Modelling of Damage in Aeronautical Structures - AeroDamageLab

University of Zagreb, Faculty of Mechanical Engineering and Naval Architecture

Department of Aeronautical Engineering

I. Lučića 5, HR-10000 Zagreb, Croatia

phone: +385 1 6168 267 (Prof. Dr. Sc. Ivica Smojver)

e-mail: ismojver@fsb.hr

aerodamagelab.fsb.hr