

Qualitative indicators of progress and success

General progress was received in the areas:

- numerical modelling of delamination between core and skins in sandwich plates with ABAQUS
- experimental testing of cracks propagation in two phase: ceramic and concrete composites with ARAMIS
- micromechanical model for deformation in two phase ceramics
- micromechanically based numerical model for damage growth in plywood
- modelling of crack propagation under thermal shock in layered composites
- fatigue of polymer matrix composites in high temperature
- numerical modelling of WC/Co composite under compression
- control of regular and chaotic vibrations of a system with pendulum using magnetorheological damping
- analysis of the nonlinear model of the composite beam excited in horizontal and vertical directions
- analysis of experimental tests of composites cutting process
- analysis of nonlinear normal modes to the mechanical non-autonomous systems around resonance regions
- experimental modal analysis of the composite plates
- modelling, numerical analysis of the natural frequencies of a composite beam under axial load
- optimisation procedure to composite plates
- modelling and analysis of cable dynamics.

The following milestones were reached:

1. Development of new areas of competence:

- experimental testing of cracks in composites using ARAMIS
- application of ABAQUS for modelling of gradual degradation in composites
- micromechanical modelling of two-phase ceramics up to the final failure
- experimental testing and modelling of foams
- fatigue testing in polymer matrix composites at high temperature
- chaos control of the pendulum-like-systems with magnetorheological dampers
- analysis of dynamics of heavy suspended cables
- control using active elements: Shape Memory Alloys and piezoactuators
- control techniques applied to nonlinear cantilever beams.
- recurrence plots to the milling process of composites

2. Reinforcement of the research potential by:

- preparation of the new experimental stand for: a) impact testing of ceramic and foam materials, b) fatigue testing with influence of the temperature
- purchase of SECOTOM-10 for cutting of different types and shapes specimens, also introduction of notches for cracks propagation tests

- increase of knowledge on: a) control by application a magnethorheological damping of the structure with an attached pendulum, b) nonlinear beams theory and effectiveness of different control techniques.
- established a research consortium with helicopter factory PZL Świdnik SA. to develop Composite Laboratory

3. Increased linkage with international scientific community

- participation of co-ordinator in ALCAS workshop (Bristol, 25-26. 01. 2009) to present the achievements of this project. Discussion with ALCAS (greatest FP6 project) leader about cooperation within newly prepared project CEMCAST,
- initiation of co-operation with: prof. G.Maier (Politecnico di Milano, CISM, Italy), prof. B.Karihaloo (Cardiff University)

4. Common papers submitted to international journals:

- Prof. Sadowski group - papers with researchers from: Germany, Romania, Italy, Egypt
- Prof. Litak group - papers with researchers from: UK, USA, Germany

5. Participation in international conferences:

LUT staff involved in the project participated in 15 international conferences (Bremen, Gdansk, Kharkov, Lodz, Kazimierz Dolny, Erice, Adelaide, Delft, Beijing, Algier, Timisoara, Brno, Bristol-Filton, Venice, Metz,).

6. Scientific community recognition:

- Prof. Warminski was organiser of 498 EUROMECH COLLOQUIUM (21 - 24.05.08, Kazimierz Dolny, Poland)
- Prof. Sadowski gave an "invited lecture" at the international conference SML-85 (21-22.11.08, Timisoara, Romania)
- Prof. Sadowski was a member of Scientific Committees in international conferences: EUROMECH 498 – Kazimierz Dolny (Poland), IWCM'18 – Beijing (China), SML-85 – Timisoara (Romania)