

Stage I. Concepts and theories regarding the mechanism of internal stresses decrease and methods for determining the internal stresses in cast, forged, welded steel structures

For carrying out the Stage I, the following activities have been performed:

Activity I.1

Concepts and theories related to the mechanism of reducing the internal stresses by thermal stress relief

Activity I.2

Concepts and theories related to the mechanism of reducing the internal stresses by stress relieving with controlled mechanical vibrations generated by:

- stress relief equipment using controlled mechanical vibrations, DC motor actuator etc.
- vibrators carried out with magnetic materials with high magnetostriction
- electromagnetic vibrators
- electrodynamic vibrators

Activity I.3

Numeric simulations for determining and decreasing the internal stresses

Activity I.4

Destructive methods for determining the internal stress level. Modern methods of structural analysis

Activity I.5

Non-destructive methods for determining the internal stresses (X rays, ultrasounds, electro-resistive tensiometers, by using the photo-elastic foils and reflection polariscope, magneto-elastic).

The following have participated in carrying out the activities of this stage:

- ICMET Craiova – Project leader (P1):
 - has coordinated the activity, setting for each partner the tasks allotted according to the plan for project carrying out and to the expertise they have;
 - has drawn up the activity report taking into account activity reports of the partners involved in this stage;
 - has drawn up the report of internal approval, the payment request, the general post calculation estimate, the general sheet of planned and actual costs, the account card, the post-calculation estimate, the summary of wage costs, the summary of material costs and inventory objects, the summary of endowment costs .
- “Politehnica” University - Bucharest-P2:
 - has approached mainly the activity I.5. “Non-destructive methods for determining the internal stresses”

It is possible to assess the residual stresses by determining the remanent magnetism. It is done by means of a tester generating local magnetization using a coil, measuring after that the magnetic remanence, by the same coil.

By using some experimental techniques for analyzing the stress condition, a practically non-destructive new method was developed, which uses photo-elastic foils.

- University from Craiova-Partner 3:

It has performed tests within the framework of the activities AI.1; AI.3; AI.5.

Within AI.1, a comprehensive study of internal stress appearance and the mechanism of reducing the internal stresses are presented.

Within the activity AI.3, numerical simulations for determining and reducing the internal stresses, a new method for measuring the residual stresses is the contour method, the voltages

being measured by using a finite element method. For determining the residual stresses, one proposes the following:

a) Mechanical methods

Voltages are calculated based on the deformations produced when the body is cut off (Borner and Heyn method), drilling method – Sacks model.

b) Geometric methods

- Trenting-Read method
- Arrow method
- X ray diffraction method.

As non-destructive control methods, the ultrasound analysis is presented.

- Politehnica University - Timisoara-P4

It has contributions especially to the activity AI2 - Concepts and theories related to the mechanism of reducing the internal stresses by stress relieving with controlled mechanical vibrations. The research team of P4 presents in its report a classification of the procedure of stabilizing by vibrations the internal stresses. There are also presented some conclusions resulted from the experimental researches performed on international level, regarding the vibrational stabilization of stress and remanent deformations

Further on, the electromagnetic and electrodynamic vibration generators are described:

- Technical University - Cluj – P5 emphasizes the advantages of vibrational stress relief (energy saving, lack of pollution) as compared to thermal stress relief, describes the VSR systems developed up to the present:

- resonant VSR systems
- sub-harmonic VSR systems
- IVD-287 VSR system – Romanian patent no. 82449/1982.

One should notice the description of the vibrational stress relief using high power transducers (actuators) based on magnetostrictive materials type GMM.

Such installations are produced in China.

The results got during this stage allow passing to the next stage “Execution documentation for functional models”

- Equipment for stress relief by controlled mechanical vibrations using AC motors;
- Equipment for stress relief by controlled mechanical vibrations using electrodynamic vibrators
- ISIM Timisoara – P6 presents modern methods of structural analysis for determining the internal stresses.