Research Proposal Presentation

DEVELOPEMENT OF NO CONTACT MEASUREMENT TECHNIQUES OF STRESS AND STRAIN ANALYSIS

Scuola di Dottorato in Scienze Tecnologie e Misure Spaziali (STMS) CICLO XXXV
Misure Meccaniche per l'Ingegneria e lo Spazio (MMIS)

PhD Student: Iva Xhimitiku
Matricola: 1229355

Tutor: Prof. Gianluca Rossi

Overview of Presentation

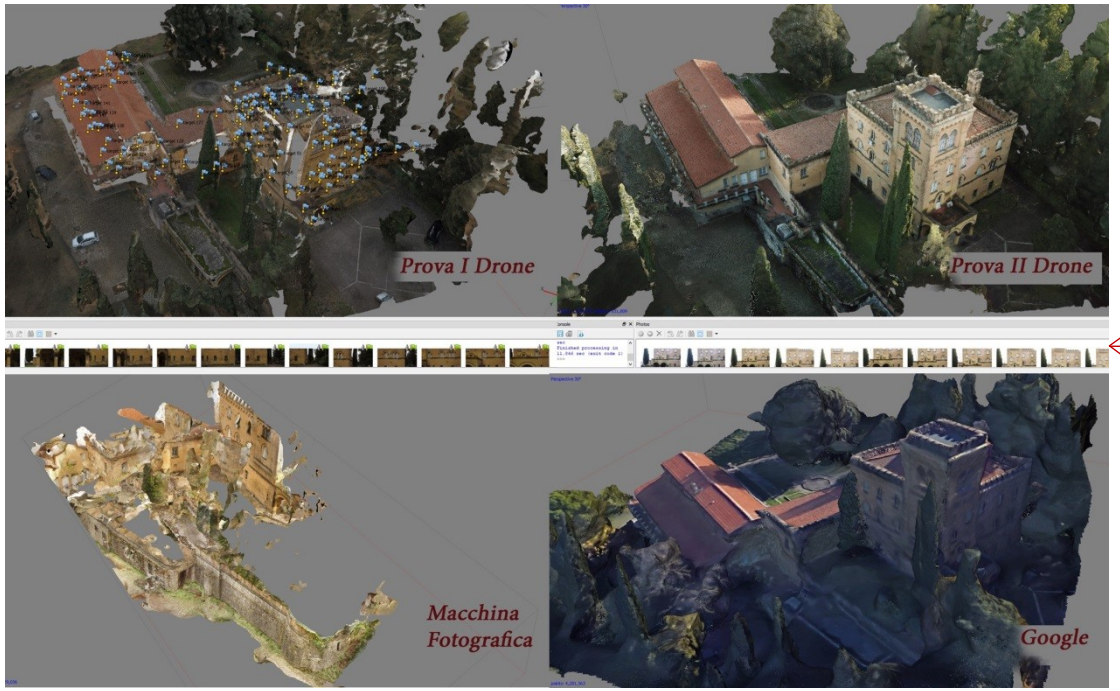
- Illustration of thesis and research work till now
- Standard measumerement methods and development
- Objectives of doctoral research
- Summary of three years doctoral research activity

THESIS WORK

Experimentation of digital techniques for the survey of cultural heritage: the case of Villa Capitini in Perugia

PhD Student: Iva Xhimitiku

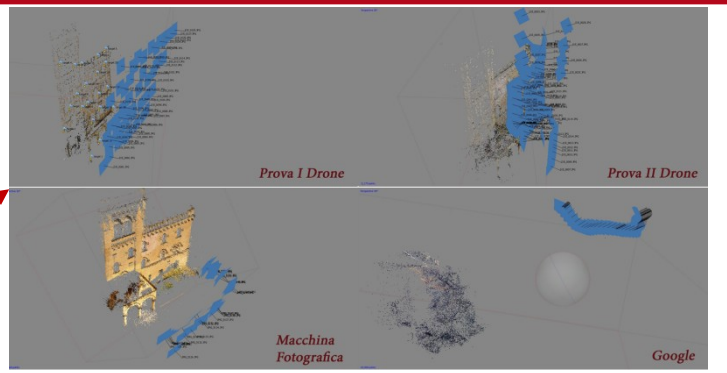
Research Proposal:
Developement of no Contact Measurement Techniques of Stress and Strain Analisys

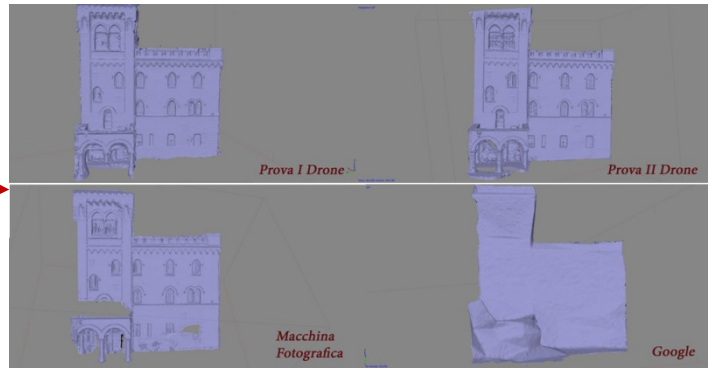


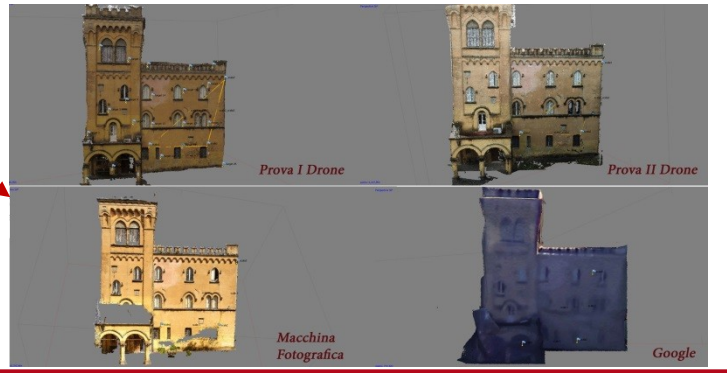
Point Cloud

Mesh

Texture





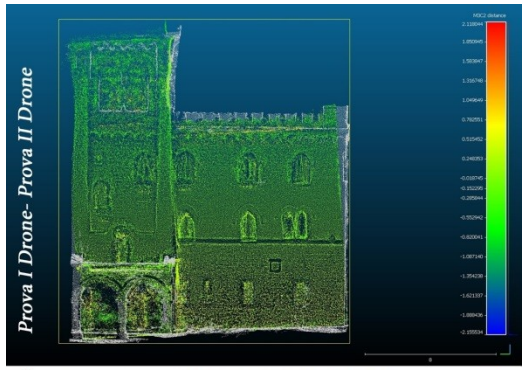


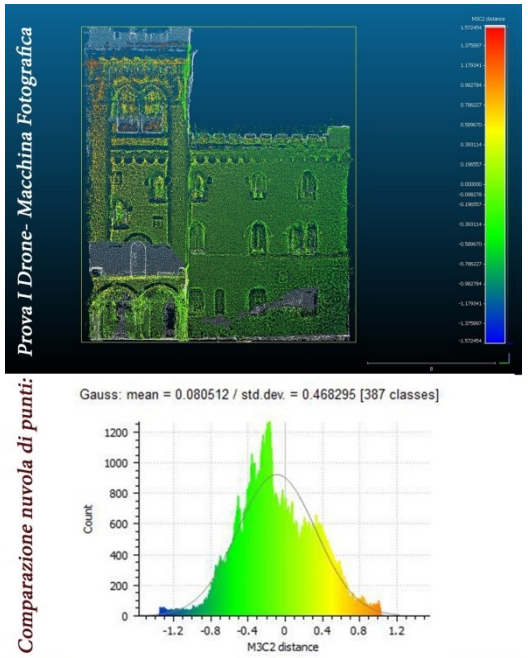
INSTRUMENT TECHNICAL FEATURES AND POINT CLOUD ANALISYS

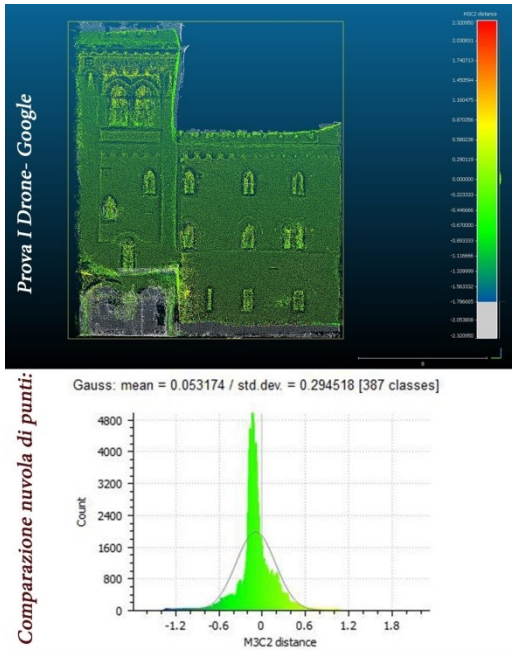
DJI Mavic Pro 2

Canon EOS 7D

Google Satellite





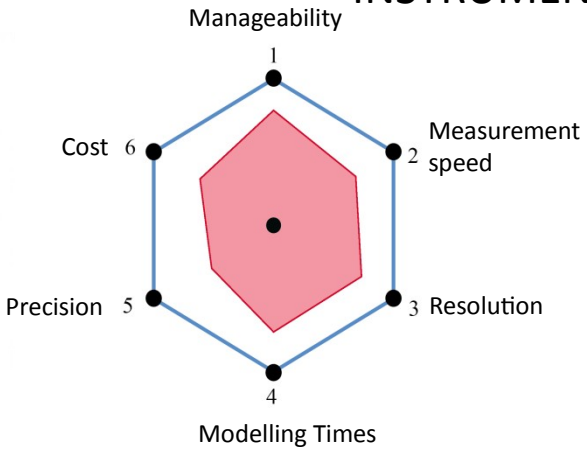


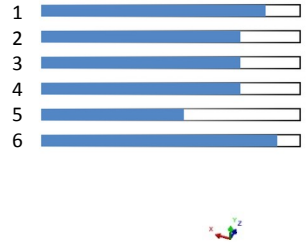
RESEARCH WORK till now

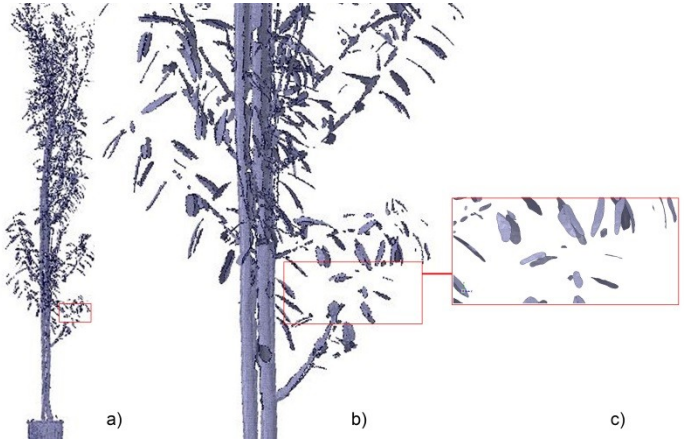
Critical analysis of instruments and measurement techniques of the shape of the trees: Terrestrial Laser Scanner and Structured Light scanner

INSTRUMENT TECHNICAL FEATURES AND MESH ANALISYS

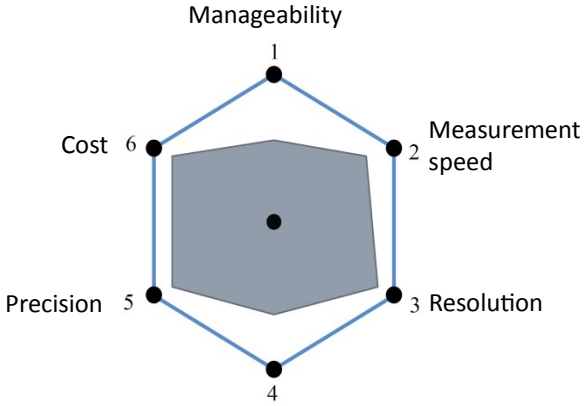
Structured Light Scanner
Go! Scan50

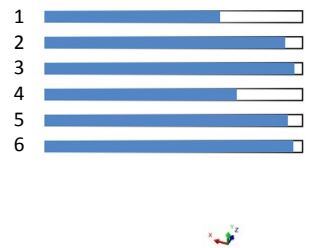


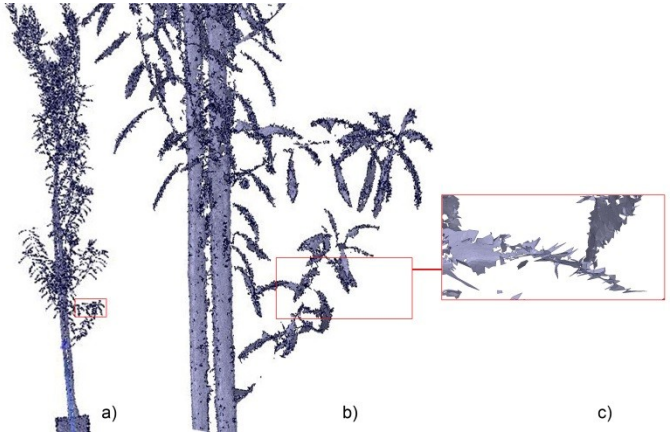




Phase Difference Scanner
Z+F IMMAGER 5010X



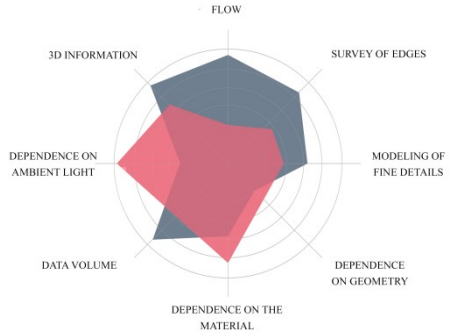




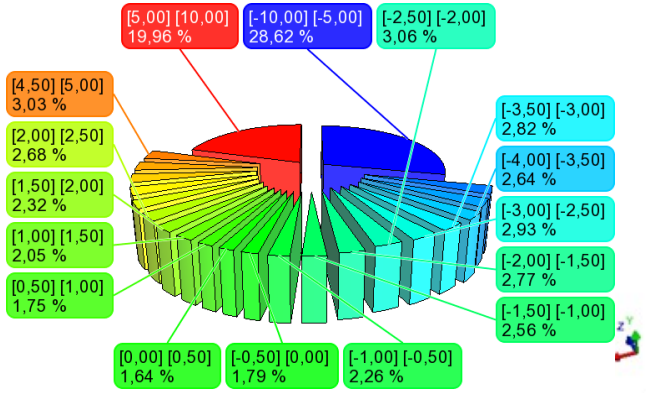
RESULTS

UNIT	MILLIMETER
DATA ALLIGNEMENT	BEST FIT 1
MAX. DISTANCE	20
MAX ANGLE	20
TOL. SUP.	0.5
TOL. INF.	-0.5
DIRECTION	THE SHORTEST (MEASURE TO THE LIMIT)
N. POINT	649922
DEV. AVERAGE	-1.693
DEV. STANDARD	11
PTI IN +/-(STDDEV 1')	392876 (60.450%)
PTI IN +/-(STDDEV 2')	649922 (100.000%)
PTI IN +/-(STDDEV 3')	649922 (100.000%)
PTI IN +/-(STDDEV 4')	649922 (100.000%)
PTI IN +/-(STDDEV 5')	649922 (100.000%)
PTI IN +/-(STDDEV 6')	649922 (100.000%)
SURFICE OUT TOLLERANCE	96.736%

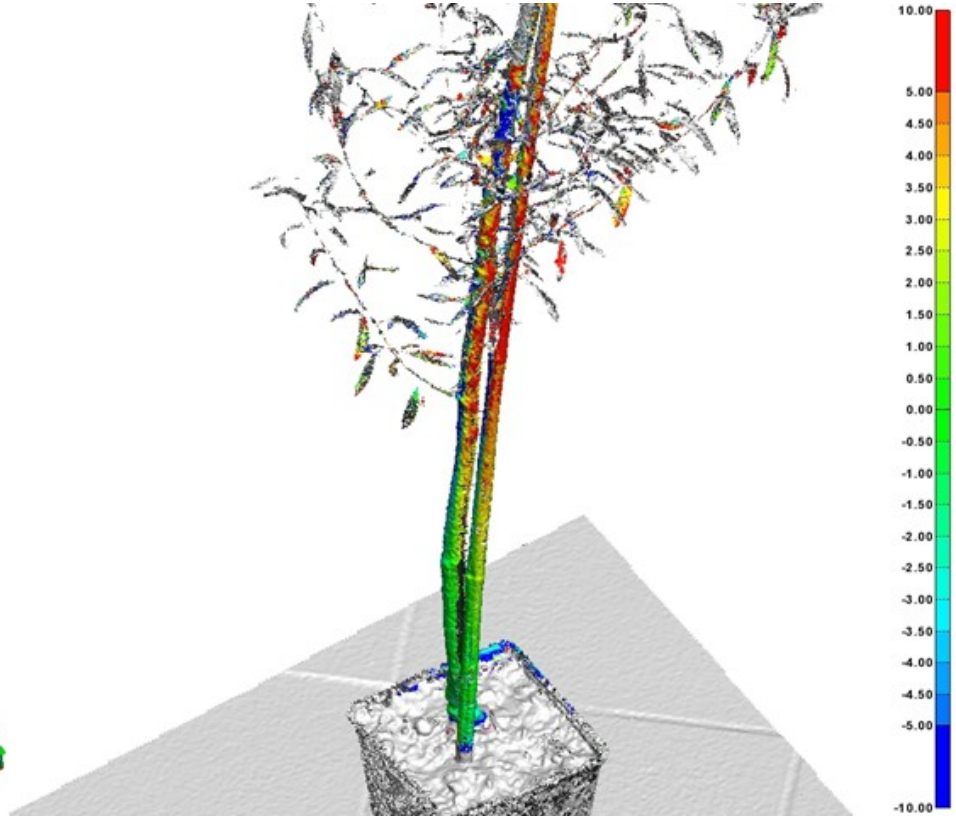
Total deviation between the model extracted from the overlap of the scan performed with Go! Scan 50 and Z+F IMAGER05010X obtained through Poliworks



Qualitative comparition between the instrument: Z+F Imager 5010X and Go! Scan50



Graph of the distances between the point cloud given by instruments(Deviation) obtained through Poliworks.



DOCTORAL RESEARCH

Developement of no contact measurement techniques of stress and strain analysis

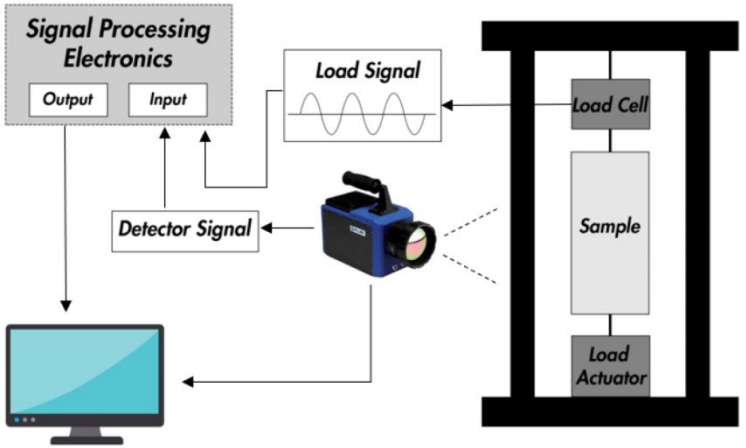
TERMOELASTIC STRESS ANALISYS

Hypothesis:

- Isotropic, homogeneous and linear elastic behavior
- Adiabatic and reversible tranformation

$$\Delta T = \frac{-\alpha T}{\rho C_p}(\Delta\sigma_{xx} + \Delta\sigma_{yy})$$

- α = Thermal expansion coefficient
- C_p = Specific heat
- ρ = Density
- T = Absolute Temperature
- $\Delta\sigma$ = Variation of surface tension in two orthogonal directions lying on the surface



DIGITAL IMAGE CORRELATION

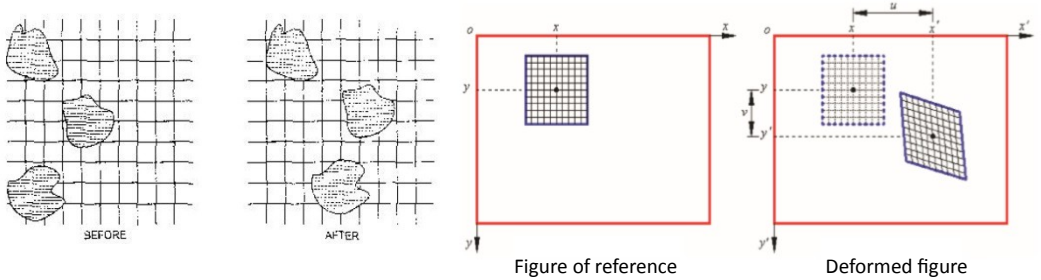


Figure of reference

Deformed figure

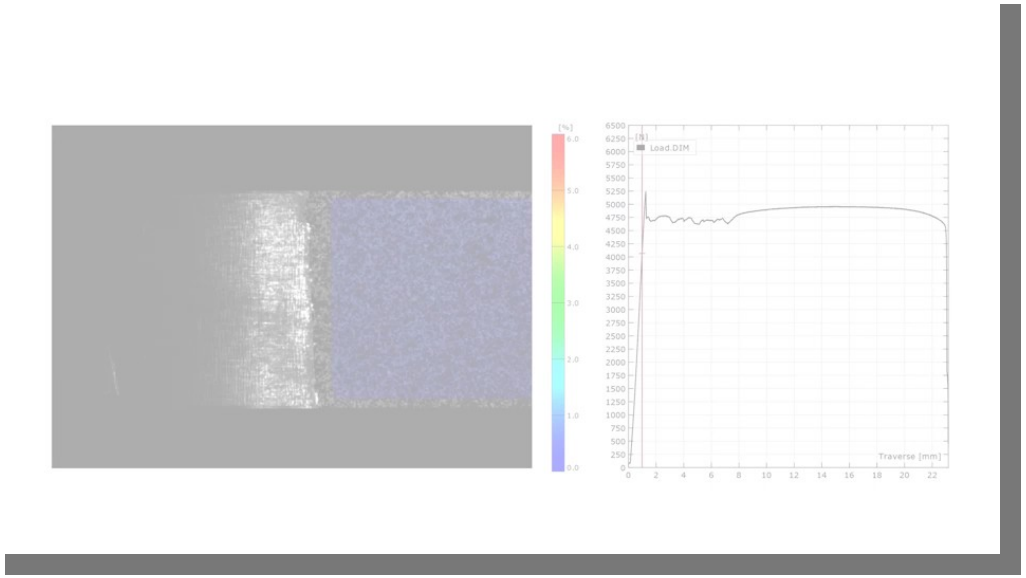
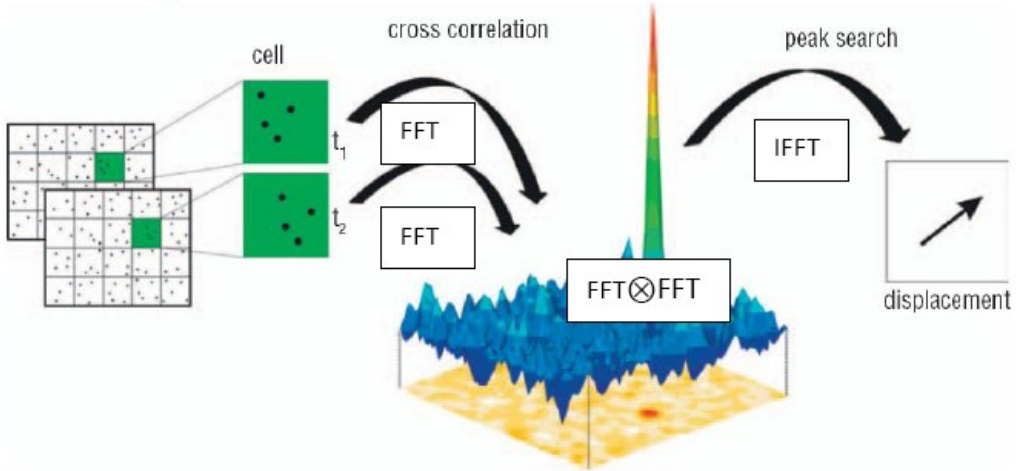
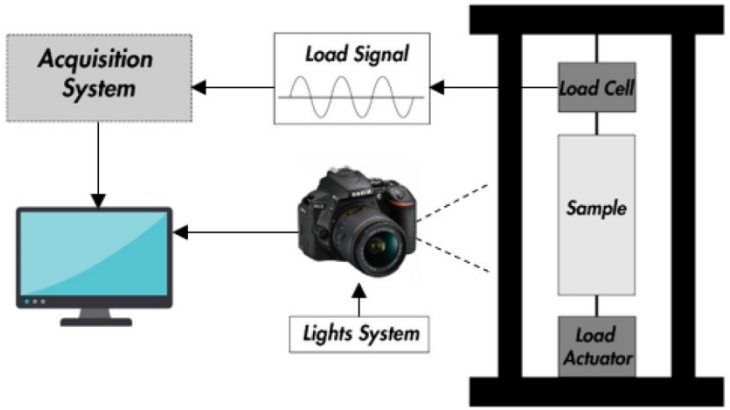


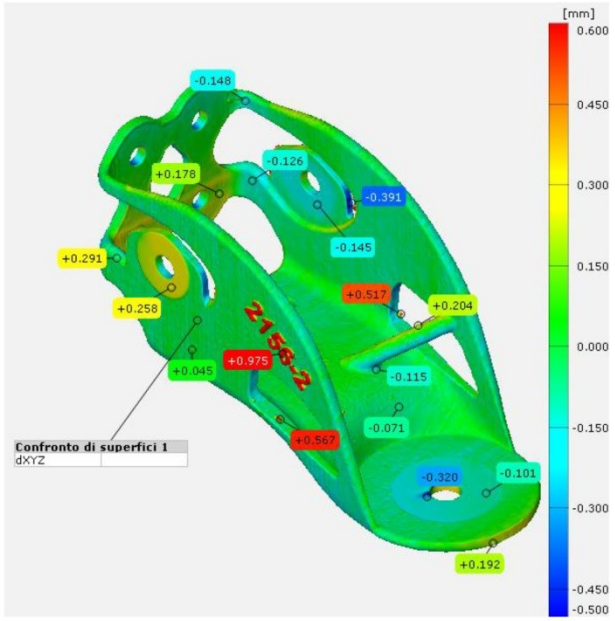
Image Correlation trought Fast Fourier Transform

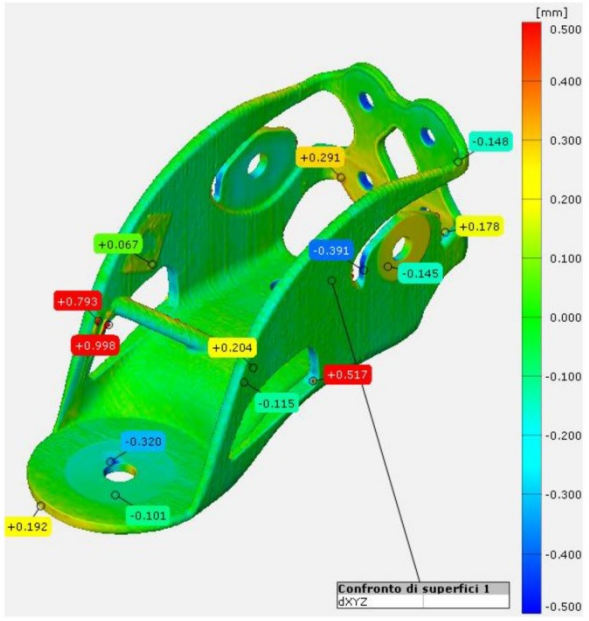


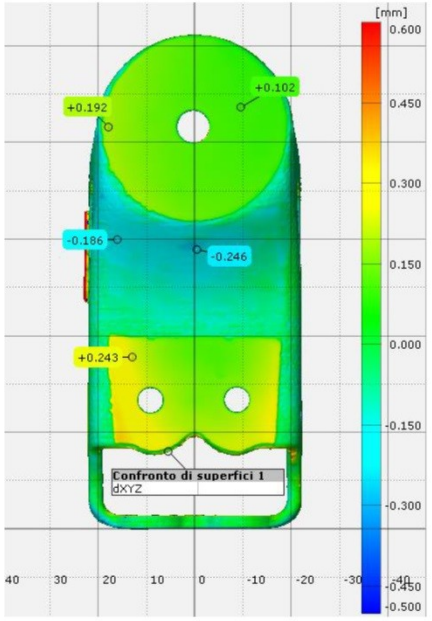


CONFRONTO TRA COMPONENTE NOMINALE (CAD) E COMPONENTE RICOSTRUITO

2. Calcolo delle deviazioni superficiali del modello ricostruito rispetto al CAD



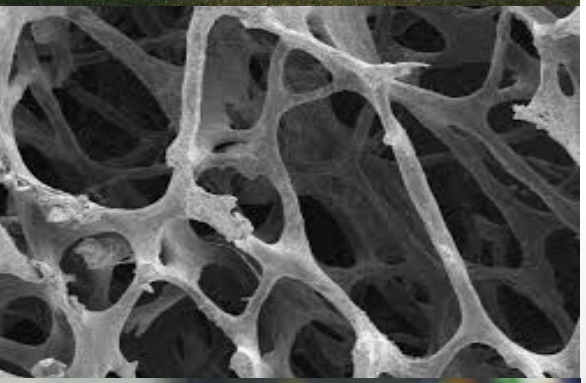




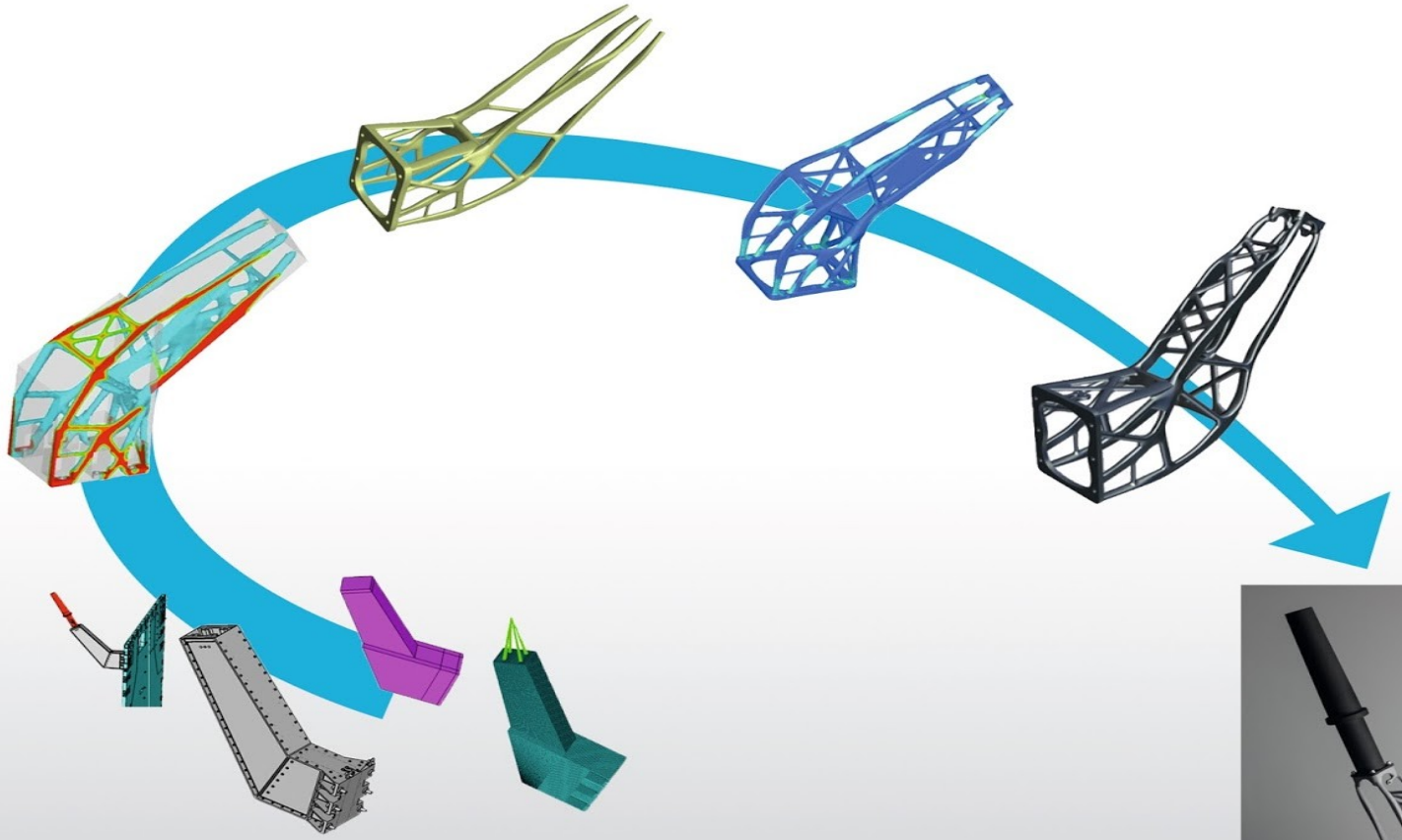
*Scostamento massimo ≈ 0.3 mm**

** Esclusi codice ed estensimetro*

DOCTORAL RESEARCH THESI OF GLORIA ALLEVI:
''FATTIBILITA' DI ANALISI TERMOELASTICA E DI CAMPI DI SPOSTAMENTO SU BRACKET REALIZZATO IN ADDITIVE MANUFACTURING PER USO AEROSPAZIALE''



DEVELOPMENT



The technology symbiosis of topology optimization and additive manufacturing leads to:
half the weight - reduced stress - increased stiffness - minimum design lead time!

DEVELOPMENT

Thermal Camera

Digital Camera

GPS Sensor

Drone

PRELIMINARY STEP

- STUDY OF THEORY
- ANALYSIS OF INSTRUMENTS
- APPLICATION OF STANDARD METHODS

DEVELOPMENT

- EXPERIMENTAL TEST
- DEVELOPEMENT OF MEASUREMENT AND PROCESSING TECHNIQUES
- DATA PROCESSING SOFTWARE DEVELOPEMENT

RESULTS

- EXPERIMENTAL TEST
- DATA ACQUIRED ANALYSIS
- WRITING THESIS


Thank you...