EMPIR Call 2018 – Research Potential

JRP r02 ProbeTrace - Traceability for contact probes and stylus instruments measurements.

The EMPIR initiative is co-funded by the European Union's Horizon 2020 research and innovation programme and the EMPIR Participating States

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Presented by Dr. Tanfer YANDAYAN (TUBITAK) in EMPIR Review Conference
8 November 2018, Monaco. (E-mail: tanfer.yandayan@tubitak.gov.tr)

Overall objective: To develop traceable and cost effective measurement capabilities for the calibration of form and surface roughness standards with uncertainties in the range of 10 nm – 100 nm.

JRP Start date (estimated) and duration : 1 June 2019, 36 months

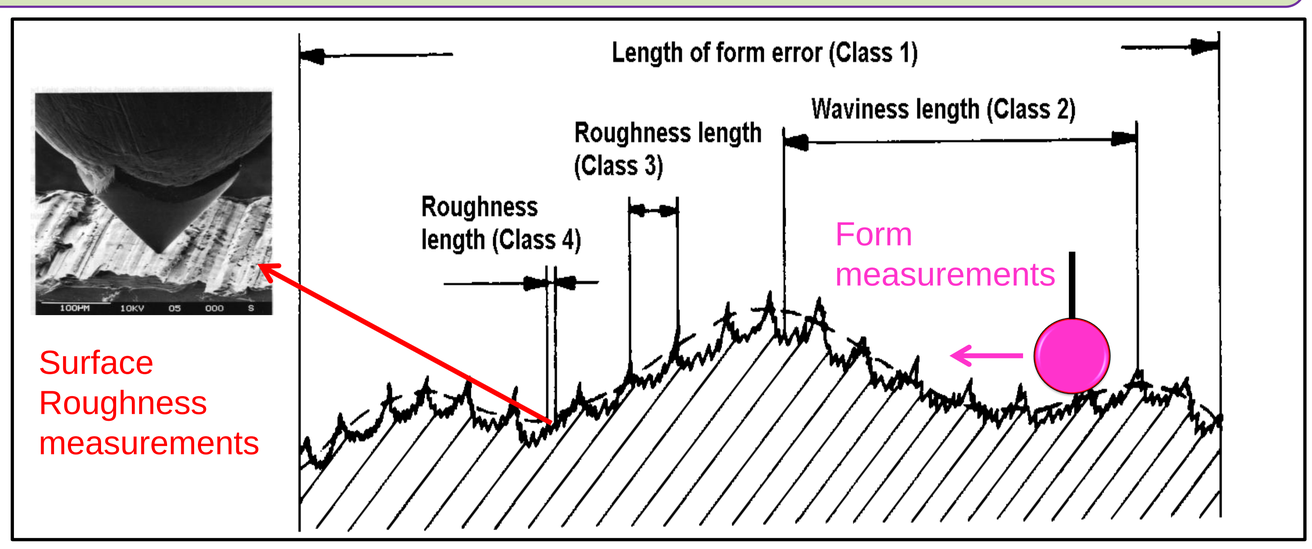
REQUIREMENTS & BACKGROUND

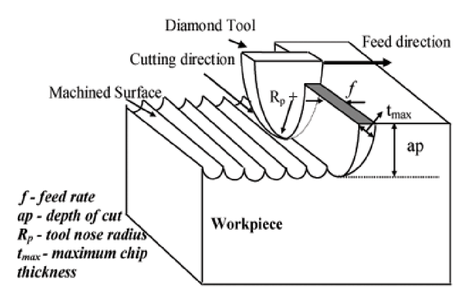
Surface finish and form of the products are important features to be examined for engineering and scientific purposes. Such characteristics of surface include ;

- *wear resistance*,
- *bearing, sliding and lubricating properties*,
- *fatigue and corrosion resistance*,
- *gloss, paintability*
- *functionality etc.*

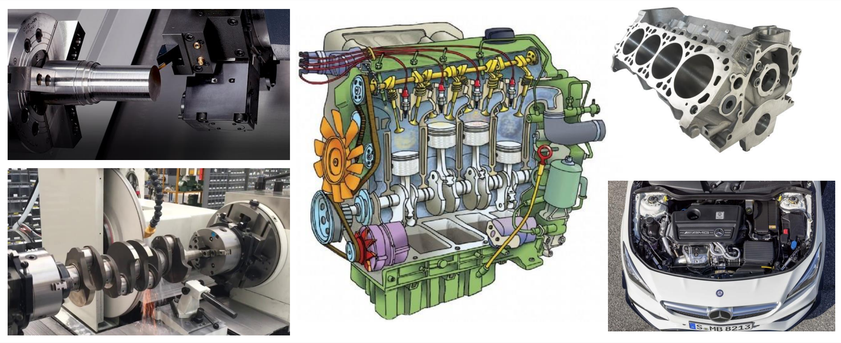
Knee implant – surface measurements in TUBITAK

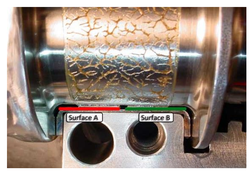
These are important parameters for the industries. Form and surface measurement devices with contact probes and stylus are used to characterise engineering surfaces.

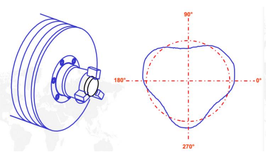


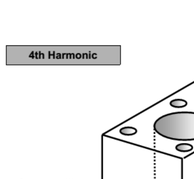


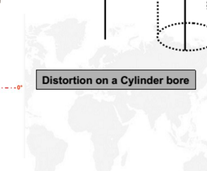
Machining geometry with round nose tool











4th Harmonic

Distortion on a Cylinder bore

Surface Roughness Device

Form Measuring Device

Form Measurements

Flat glass
Hemisphere
Flick / M.Wavelength
cylinder

Measurement standards for form parameters defined in ISO 1101, ISO 12181, ISO 12780 ISO 12781

Uncalibrated

Sometimes through line scales

Traceability through wave length λ

LASER

or

Traceability through gauge blocks calibrated by wave length λ

+

Error separation methods

Form instrument in "industry"

"Reference" Form instrument in NMIs

Calibrated

Standards and guides (VDI/VDI 2631, DAkkS-DKD-R 4-4) are available for calibration of form instruments in "industry" – dedicated to secondary level labs. No guides exist for calibration of reference form instruments (e.g. Primary calibration of Flick and multiwavelength stds.)

EXCELLENCE

New route
Traceable displacement generator (portable)

Calibrated

Calibration by LASER (Λ)

Surface Roughness Measurements

roughness parameters nach ISO 4287 — Pt, D

specimen types nach ISO 5436-1 — A

Wt — flat glass
Ra, Rz, Rsm, ... — C
Ra, Rz, Rq, ... — D1, D2

Industrial manufactured standards

Uncalibrated

Limited range
Complicated
Cross check

traceability of wavelength λ

reference measuring instrument, e.g. interference microscope

Calibration of depth standards

Calibrated

"Reference" Stylus instrument in NMIs

Stylus instrument in "industry"

Calibration of stylus instruments and standards DKD-R 4-2, ISO 12179 (for secondary level labs)

Source: VDI/VDE 2655

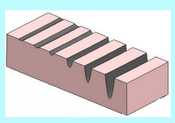
Interference microscope and confocal microscope in "industry"

Calibration of interference microscopes, confocal microscopes and depth setting standards VDI/VDE 2655

IMPLEMENTATION

Objectives

1. To investigate "portable displacement generators" to calibrate stylus instruments - static /dynamic
2. To develop noise reduction methods
3. To develop novel methods for investigations of measurement probes and stylus instruments.
4. To develop an individual strategy for the long-term operation of the capacity developed.



Interference Microscopes

Depth setting standards (ISO 5436)

Discrete calibration

Gauge Blocks

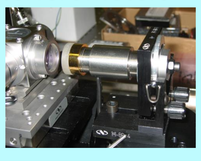
Gauge Block Interferometers

Precise spheres

Continuous calibration

SI Unit metre: Stabilised lasers

Displacement Interferometers



WP1 Stylus Instruments for surface roughness

WP2 Form measurement probes

Flick Stds.

WP3 Portable displacement generators

WP4 Numerical tools

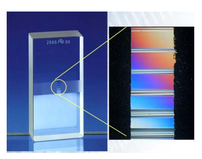
WP5 Impact

Webportal, articles & presentations in trade fairs/conferences/seminars (around 5 technical papers), 2 good practice guides for EURAMET, workshops, Stakeholder Committee, Proposals to international organisations and committees, trainings, new calibration services.

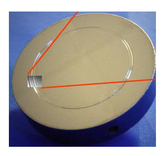
WP6 Management

investigate all but concentrate on continuous route with numerical tools

Depth setting stds. for surface roughness



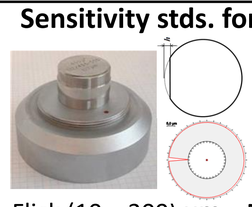
(0.02 – 10) µm



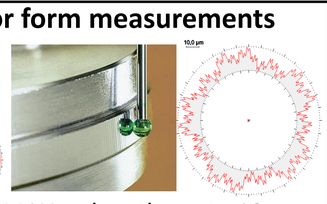
(0.24 – 75) µm

(1 – 1000) µm

Sensitivity stds. for form measurements



Flick (10 – 300) µm



M.Wavelength up to 10 µm

EXCELLENCE & IMPACT

The project will use the latest knowledge obtained in previous projects of ERA-NET PLUS, EMRP, EMPIR and EURAMET with experience of the NMIs and industry to provide practical solutions

NANOTRACE (INRiM) | Subnano (PTB) | SIB58 Angles (TUBITAK) | EURAMET Project 866 (INRiM)

Latest developments in PZTs | Needs from EUCom (INRiM) | Needs from industry

ProbeTrace project

Standards , Technical Committees, Working groups and other EMPIR Projects, Conferences, papers, Good practice guides, Articles in popular press, website, Stakeholder Committee

CCL and RMOs
EURAMET, COOMET, GULFMET, APMP etc.
CCL-DG8 (Surface Texture)

N11 - EUCoM
Normative EMPIR project
Standards for the evaluation of uncertainty Of CMMs in industry.

Papers : Macroscale 2020, Metromeet, Euspen, IMEKO, SPIE
"EURAMET Guides"

Improved services of NMIs will lead to improvements in industry: This will strengthen the competitiveness of the European industry (e.g. automotive and supply) well spread in emerging economies e.g. Turkey, Spain, Poland, Portugal, Bulgaria, Croatia, Egypt (FIAT, Renault), S. Arabia (plan for R. Rover): Better services for manufactured parts-reduction of fuel consumptions, energy consumptions, compliance on emission standards, extend of Europe's competence in the region, facilitating more efficient production (e.g. better medical parts for health issues).

Consortium: 10 NMIs: TUBITAK (Turkey), INRiM (Italy), CEM (Spain), GUM (Poland), IPQ (Portugal), DMDM (Serbia), FSB (Croatia), BIM (Bulgaria), NIS (Egypt), SASO-NMCC (Saudi Arabia).

CONSORTIUM

Funded partners: TÜBİTAK UME; CEM Centro Español de Metrología; INRiM Istituto Nazionale di Ricerca Metrologica; Central Office of Measures; FSB / bmi Nacionalni laboratorij za duljinu / National Laboratory for Length; Republic of Serbia Ministry of Economy, Directorate of Measures and Precious Metals; Bulgarian Institute of Metrology; IPQ Instituto Português da Qualidade

External Partner: National Institute for Standards NIS

Unfunded partner: SASO; NMCC المركز الوطني للقياس والمعايرة National Measurement & Calibration Center