



Development of a multisensory arm for process monitoring in Robot Assisted Polishing

Pilny, Lukas; Dalla Costa, Giuseppe; Bissacco, Giuliano; De Chiffre, Leonardo

Publication date:
2015

Document Version
Publisher's PDF, also known as Version of record

[Link back to DTU Orbit](#)

Citation (APA):

Pilny, L., Dalla Costa, G., Bissacco, G., & De Chiffre, L. (2015). Development of a multisensory arm for process monitoring in Robot Assisted Polishing. Poster session presented at 15th International Conference of the European Society for Precision Engineering and Nanotechnology, Leuven, Belgium.

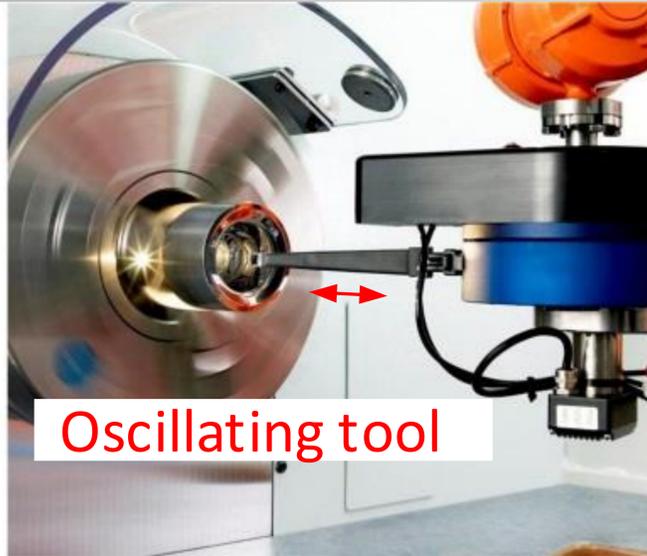
General rights

Copyright and moral rights for the publications made accessible in the public portal are retained by the authors and/or other copyright owners and it is a condition of accessing publications that users recognise and abide by the legal requirements associated with these rights.

- Users may download and print one copy of any publication from the public portal for the purpose of private study or research.
- You may not further distribute the material or use it for any profit-making activity or commercial gain
- You may freely distribute the URL identifying the publication in the public portal

If you believe that this document breaches copyright please contact us providing details, and we will remove access to the work immediately and investigate your claim.

Lukáš Pilný, Giuseppe Dalla Costa, Giuliano Bissaco, Leonardo De Chiffre
Technical University of Denmark, Department of Mechanical Engineering, Denmark

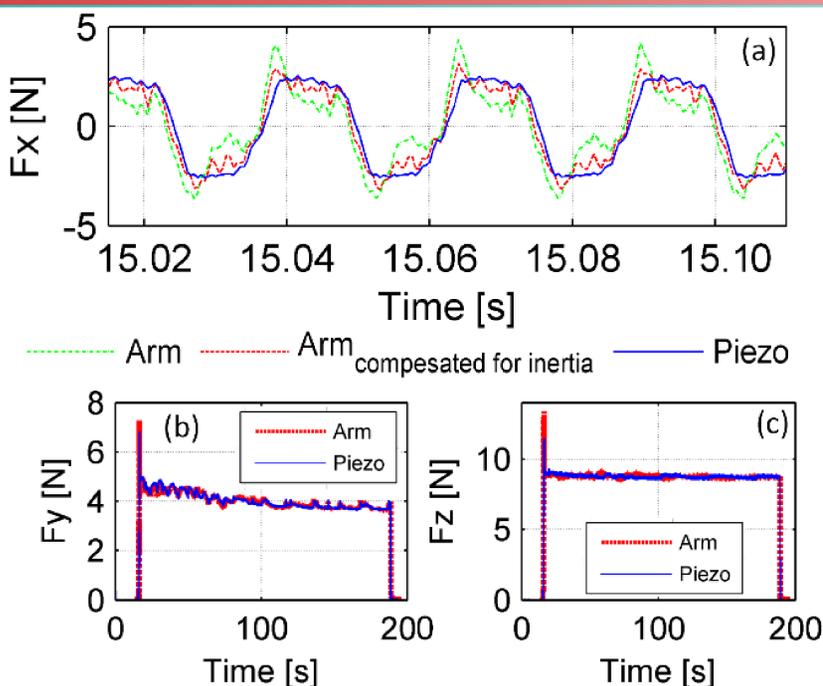
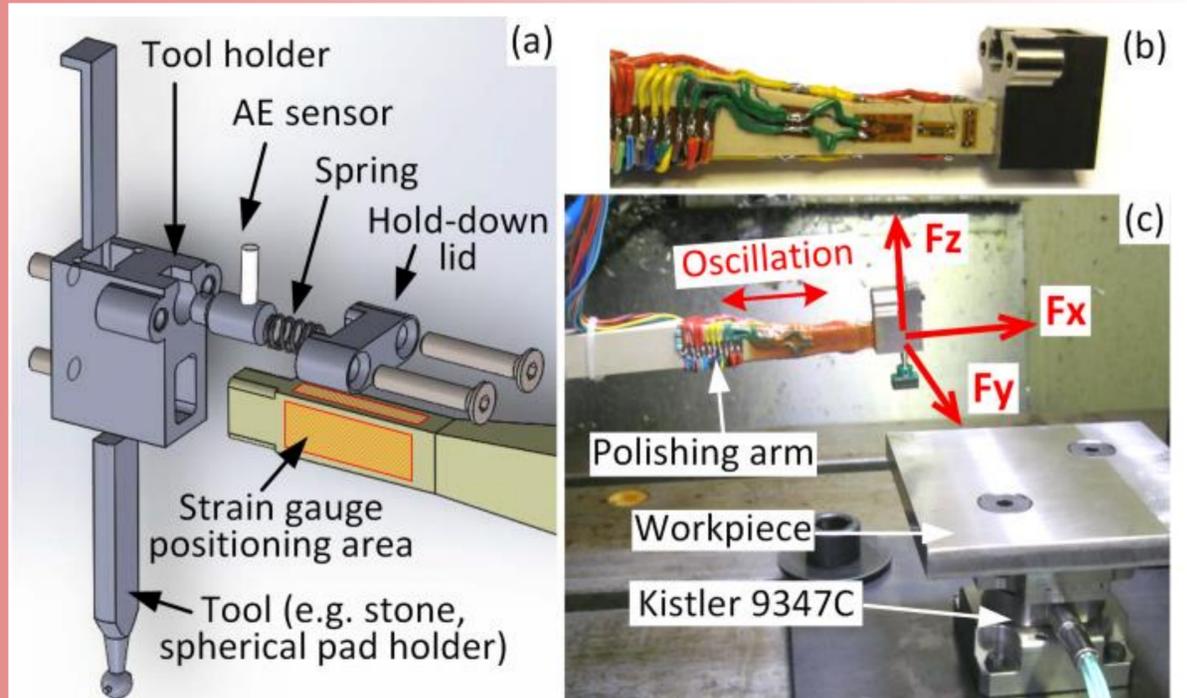


Robot Assisted Polishing (RAP) process is capable of achieving surface roughness down to S_a 10 nm on industrial components. In RAP, a robot arm carries a polishing module with controlled contact force utilizing oscillating or rotating tools.

In this work a multisensory polishing arm with integrated Acoustic Emission (AE), accelerometer and force sensors was developed and the reliability of force measurements for process monitoring in RAP was verified.

The developed and optimized arm design with three axial force sensor (F_x , F_y , F_z) consists of semiconductor and metallic strain gauges, miniature AE sensor and an accelerometer (a).

The manufactured force sensor (b) was calibrated by means of static application of defined loads. The sensor performance in a dynamic application was subsequently verified in a number of tests by comparison of the measured interaction forces with a reference calibrated piezoelectric dynamometer from KISTLER (c).



At high oscillation frequencies of the arm, F_x force is affected by the inertia due to the mass of the oscillating arm (a - green dashed). Such measurement bias can be effectively corrected by measurement of acceleration, calculation and subtraction of the inertial force component from the measurements (a - red dashed), in comparison to the reference piezoelectric force measurement (a - blue solid). An average measurement error of 1 % in paste polishing and 4 % in stone polishing was observed for the investigated process settings.

The results have demonstrated reliable trends in the signals measured by the arm (a, b, c) fundamental for the intended process control to be based on the relative change in friction forces, presumably reflecting the change in surface topography during polishing.

The research leading to these results has received funding from the European Union Seventh Framework Programme (FP7/2007-2013) under grant agreement n° [285489]