'Snow' better way to clean coordinate-measuring machine probes

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Manufacturers in search of the most effective, fast and green way to keep coordinate-measuring machine probes dirt-free and error-free should use a dry ice technique, known as carbon dioxide 'snow' cleaning.

This advice comes from the Manufacturing Metrology Team at The University of Nottingham which has designed and developed an in-situ snow cleaning method specifically for CMM styli after finding general cleaning solutions available on the market today were unfit for purpose.

A CMM is a mechanical system that measures the dimensions of a manufactured object, using a stylus that makes contact with its surface at various intervals to plot and record coordinates.

CMMs are increasingly used to verify the complex geometry of micro-scale components in the automotive, medical and telecommunications industries.

Measurement error can occur if the highly-sensitive stylus tip, contaminated with tiny debris particles, touches a surface. This can lead to errors that are 10 times greater than the standard error margin expected of the instrument.

In the face of a lack of industry-wide solution, Dr Xiaobing Feng, Dr Simon Lawes and Dr Peter Kinnell (now at Loughborough University) from the Manufacturing Metrology Team in the Department of Mechanical Engineering at The University of Nottingham began

investigating the problem in 2014.

After testing various cleaning systems, they determined that using a high velocity stream of CO2 gas and small dry ice particles, a technique known as snow cleaning, is the best method. The dry ice strikes and cleans the surface, clearing particles and thin layers of organic residue as effectively as solvents, but with the advantage of no chemical reactions or abrasive processes.

Dr Xiaobing Feng explains: "Solid dry ice particles possess greater momentum than air to dislodge and remove any size particles of debris from micro components in precision measuring equipment.

"Snow cleaning is effective and gentle so it doesn't damage the very fragile stylus - which may cost up to around £800 each - and are easily broken. It is also an eco-neutral technique as the CO2 is extracted from air."

The researchers developed the novel technique specifically for on-machine cleaning. As the stylus does not rotate, they used three nozzles, with identical geometry, symmetrically positioned, to clean the entire stylus tip and balance the impact force. The technique also uses short pulses of stream to alleviate a 'snow' build-up on the tip surface, which can obstruct further cleaning.

"A particle just a few micrometres in size can cause significant dimensional measurement errors. Therefore, regular cleaning of the stylus tip is critical in maintaining accuracy and extending life expectancy. As any sacrifice on speed is worth taking as measurements are redundant if inaccurate," adds Dr Feng.

To complement the snow cleaning prototype, the researchers are now working on developing a stylus contamination inspection system for in-

line quality control of μCMM measurements.

Their next steps are to investigate and monitor how quickly probes get dirty and how often they need cleaning in different environments.

Provided by University of Nottingham