Self-Learning Control of Tool Temperature in Cutting Processes

Results in Brief

Machine tools that automatically adjust temperature

Temperature is a much-neglected yet important parameter in process control. Scientists developed a self-learning temperature sensor and actuator linked to a self-cooling tool for automatic adjustments of tool temperature.

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European manufacturers are pressed to reduce the time and cost of production while increasing product quality. Conventional process monitoring systems evaluate forces, vibration and acoustic emissions. They typically neglect tool temperature, which can significantly affect workpiece quality and tool wear.

in particular, manufacturing new high-temperature alloys and composites imposes high thermal strain on machine tools. Controlling over-heating while avoiding cooling lubricant would save money and protect the environment as well. The EU-funded 'Self-learning control of tool temperature in cutting processes' (Contemp) project was initiated to develop a self-learning temperature monitoring system linked to a tool with self-cooling capability. Integration into existing machines was an important objective.

the self-learning platform for adaptive process control continuously monitors the

temperature of the cutting tool, creating a database of optimal process parameters. Monitoring and comparison to previous conditions enables accurate estimation of appropriate process conditions for the current piece. Such capability makes the system particularly useful for small and medium batches in which time-consuming optimisation can end up being a significant percentage of total production time.

A sensor is integrated in the closed internal micro-cooling device. The self-cooling tool system senses temperature data and controls tool temperature based on parameters from the self-learning platform. Its closed nature protects against contamination from the environment, from cooling fluid leaks and from the fluid of dust.

the final design for internal cooling enabled a decrease in tool wear of 25 % compared to wet machining, and more than 230 % when compared to dry machining with coolant temperatures of 20 degrees Celsius. As such, Contemp temperature control technology promises to increase tool lifetime and accuracy while reducing costs and production times. And, better yet, the system can easily be retrofitted to existing machines.

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CONTEMP

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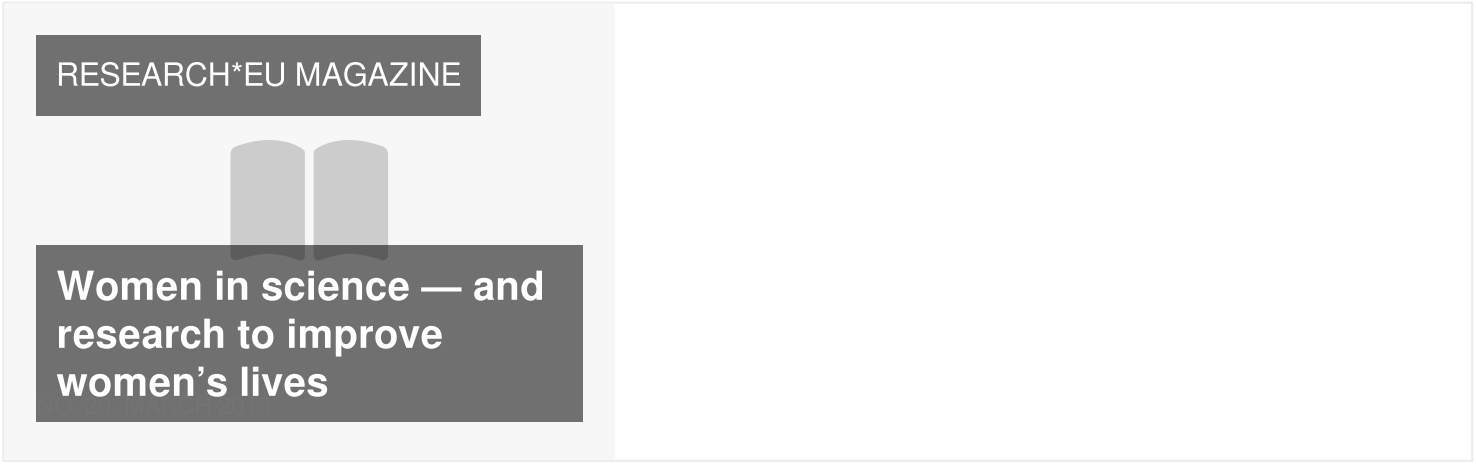

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