

Non-liquid alternative coolants in Robotic Machining

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Abstract. Robotic machining is starting to feature in the industry thanks to its high flexibility, adaptability, large workspace and low cost. In fact, many studies have already confirmed that robotic machining can be a real cost saving and flexible alternative to large scale conventional CNC machines, due to the aforesaid advantages. However, robotic machining operations are usually carried out in open environments in industrial companies, making conventional cooling systems (flood coolants such as neat oils or water-soluble oils) not directly applicable to them. Thus, the aim of this paper is to evaluate the possible implementation of different non-liquid alternative coolants such as gaseous nitrogen (N₂), air, carbon dioxide (CO₂) or argon (Ar) into robotic machining with the purpose of improving the current capability of this technology. To that end, different round turning tests were conducted on the 34CrNiMo6 alloyed steel several cooling conditions were applied: cryogenic nitrogen gas, compressed air, cold compressed air and flood cooling. Results were compared against dry machining. Thereby, the study proved the analysed non-liquid alternative coolants to be a great option for robotic machining, since they were able to improve both the machining performance and productivity of dry machining. On the other hand, compressed air showed to be the most cost-effective solution among the alternative coolants, due to the high purchase price of the nitrogen (N₂).