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Torque Analysis on Rolled and Machining Threads Processes

D. Rodrigues[1]
F. O. Neves[2]

[1] *Universidade Federal de São João Del Rei-MG, São João Del Rei-MG, Brazil. E-mail: rodriguesdg@hotmail.com*
[2] *Universidade Federal de São João Del Rei-MG, Department of Mechanical Engineering, São João Del Rei-MG, Brazil. fred@ufsj.edu.br*

Abstract. *Threading is the process to formation of the fillet of a thread which is very used in industry to assembly mechanical parts. Thread are develop considering the type of mechanical component to be produced and, also, to be adequate to quality and insurance specifications, observing the cost and productivity of the fabrication process. As described in the literature, rolled threads present best surface quality and highest mechanical strength. This research studied the threading by rolling and machining, comparing the torsion moment necessary to produce it between the processes. Experimental tests using a factorial design randomized by levels with three factors: production process (machining and rolling), process speed in three levels (17.5, 30.0 e 39.5 m/min) and lubricants concentration in three levels (5%, 10% and 13% of synthetic oil in water) were done. The material used was an AISI 1035 steel and thread specification was a M14x1.5. An analysis of variance was done to evaluate the results. The principal conclusion is that a higher torque is necessary to produce thread by rolling than machining process.*

Keywords: *Torsion moment, machined thread, rolled thread*

1. INTRODUCTION

Threading is production process that can be done by machining or rolling

This research aims at analyzing the torque moment behavior in the internal thread formation, comparing the machining and mechanical forming processes in the steel AISI 1035. For the thread formation, scales were established for the parameters of cutting speed and percentage of lubricating fluid to verify its influence on the results of torque.

2. EXPERIMENTAL PROCEDURE

Test specimens on AISI 1035 were used. First, test specimens were drilled with twist drills of diameters of 12.5 mm and 13.3 mm. In sequence, threads were done with die thread and thread rolling die, both M14x1.5. Three concentration of semi-synthetic oil in wate was used as lubrication: 5%, 10% and 13%. Both process, machining and rolling was conducted under three levels of speed: 17.5, 30.0 and 39.5 m/min. Three replicas were done at each level of process speed and oil concentration, totaling 27 experiments.

3. RESULTS AND DISCUSSION

As can be seen in Fig. 1, the torsion moment media in machining thread using 5% of semi-synthetic oil concentration was higher than the others concentrations.

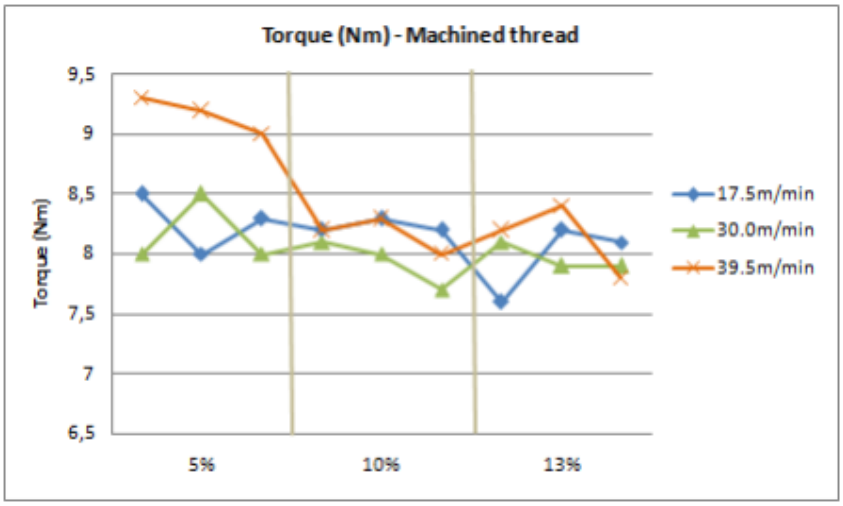

Figure 1 – Torque (Nm) in machining thread versus oil concentration

The torsion moment in rolling thread versus speed rolling is presented in Fig. 2 was presented. As can be seen, the torque is higher in presence of 5% of oil concentration than the others oils concentrations.

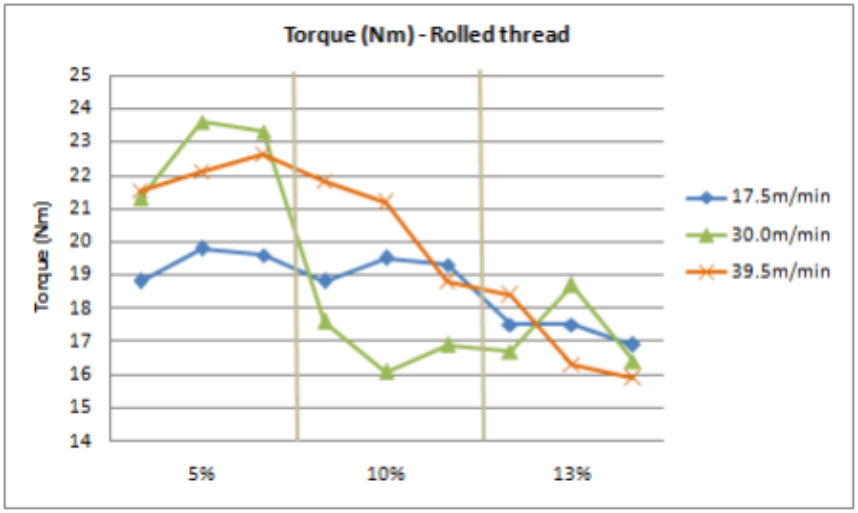

Figure 2 – Torque (Nm) in thread rolling.

The Analyses of Variance (ANOVA) shows that there is significant difference on torsion moment required to produce thread using machining or rolling process. In the same way, there is significant difference between the torsion moment required to produce threads in presence of oil concentration in the levels used. In the order hand, there is no significant difference in the torsion moment required between the three levels o process speeds used here. And finally, there is no interactions between the influence variables studied, as showed in the resume of ANOVA presented in Tab. 1. In Tab. 1, A, B and C are the influence variables. A is the process, B is the lubricant concentration and C is the process speed. AB, AC BC and ABC are the interactions between the influence variables.

Factors		G.L.	MSS	Fcalc	Fo	
SST	1755,288	53				
SSA	1610,263	1	1610,26	670,72	4,113	INFLUENCE
SSB	52,07453	2	26,0373	10,8453	3,259	INFLUENCE
SSC	6,521811	2	3,26091	1,35826	3,259	NO INFLUENCE
SSAB	31,56561	2	15,7828	6,57398	3,259	INFLUENCE
SSAC	1,703137	2	0,85157	0,3547	3,259	NO INFLUENCE
SSBC	17,71199	4	4,428	1,84438	2,634	NO INFLUENCE
SSABC	17,03369	4	4,25842	1,77375	2,634	NO INFLUENCE
SSERR	86,42876	36	2,4008			

Table 1 – Analyses of Variance of the torsion moment

In order to determine the minimum torsion moment required to produces thread in studied conditions, an orthogonal contrast was done, which is presented in Tab. 2. Combined interpretation of Tab. 2 with the Fig. 1 and 2, It can be concluded that machining thread requires less torque than rolled threads.

Factors	SSC	Fcalc	ftab	
Machining 10% / Machining 13%	0,0288	0,012	4,11317	no differ
Machining 5% / Machining 13%	1,190939	0,49606	4,11317	no differ
Machining 13% / Rolled 5%	374,4672	155,976	4,11317	differ

Table 2 – Orthogonal contrast test

4. CONCLUSION

This research investigated the torsion moment required to produce threads, comparing the machining and rolling processes, varying the oil lubricant concertation and the process speed. It can be concluded that there is significant difference between both process, as well as oil concentration. Lesser torsion moment is required when threads are done by machining process in 55 of lubricant oil concentration.

5. REFERENCES

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6. RESPONSABILITY NOTICE

The authors D.G. Rodrigues and F.O. Neves are the only responsible for the printed material included in this paper.

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