Proceedings of the Canadian Society for Mechanical Engineering International Congress
32nd Annual Conference of the Computational Fluid Dynamics Society of Canada
Canadian Society of Rheology Symposium
CSME-CFDSC-CSR 2025
May 25–28, 2025, Montréal, Québec, Canada

OPTIMIZATION OF WET EDGE FINISHING OF NATURAL STONES: INFLUENCE OF TOOL GEOMETRY, GRIT SIZE AND CUTTING CONDITIONS

Wael Mateur[1], Victor Songmene[1]*, Jules Kouam[1] and Ali Bahloul[2]
[1]Department of Mechanical Engineering, École de Technologie Supérieure (ÉTS), Montréal, Canada
[2] Institut de recherche Robert-Sauvé en santé et en sécurité du travail (IRSST), Montréal, Canada
Corresponding author: *victor.songmene@etsmtl.ca

Abstract— Edge polishing is a critical process in stones manufacturing and transformation as this process affects both aesthetic quality and manufacturing efficiency. This study investigates the impact of tool geometry, grit size, and cutting conditions on surface quality, tool wear, and process optimization in wet edge polishing of granites. Four tool shapes, eased concave edge, eased chamfered edge, ogee edge, and half-beveled edge, were used, each with three grit sizes (G150, G300, G600). Cutting parameters included spindle speeds of 1500, 2500, and 3500 rpm, along with feed rates of 500, 1000, and 1500 mm/min.

Surface quality was assessed by measuring roughness profiles and arithmetic mean deviation, Ra-values under varying conditions, while tool wear and cutting forces were analyzed to evaluate polishing efficiency. Results indicate that finer grits improve surface finish but increase processing time and tool wear. Higher spindle speeds enhance material removal but generate greater cutting forces, potentially affecting tool longevity. The interaction between edge geometry and process parameters revealed that eased concave and ogee edges require lower energy input and produce superior surface finishes.

Process optimization was performed to identify the best balance between surface quality and efficiency. Statistical analysis demonstrated that an optimal combination of G600 grit, a spindle speed of 2500 rpm, and a feed rate of 1000 mm/min provides a favorable compromise between polishing performance and tool durability. Additionally, cutting forces obtained during the edge finishing of black granite were marginally higher than those obtained for white granite. These findings contribute to improving the granite edge polishing process by optimizing cutting parameters to enhance productivity while maintaining high-quality standards.

Keywords: granite; edge finishing; cutting conditions; tool geometry; cutting forces; surface finish

I. INTRODUCTION

Edge finishing is a critical process in the natural stone industry, particularly for granite, as it directly influences both the aesthetic appeal and functional durability of the final product. In regions like Quebec, Canada, granite holds significant economic and cultural importance, contributing to the provincial economy through job creation and establishing Quebec as a prominent exporter of granite products. Beyond its economic role, granite is integral to Quebec's architectural heritage, frequently utilized in construction and design, where its enduring qualities and visual appeal reflect the region's identity and history [1]. The transformation of granite into finished products for applications such as countertops, landscaping, and urban design involves multiple processes, including sawing, milling, grinding, and edge finishing. Among these, edge finishing is particularly crucial, as it determines the surface quality and edge profile, which are often the most stringent requirements for customer satisfaction.

Surface finish quality in granite edge finishing is influenced by several factors, including the material's mineral composition, abrasive grit size, tool geometry, and cutting conditions. Research has shown that these parameters significantly affect surface roughness, gloss, and overall part quality. For instance, [2] highlighted that surface roughness impacts the aesthetic properties of ornamental granites, such as color and gloss, with an inverse relationship between roughness and gloss observed at low roughness levels. Similarly, [3] found that roughness correlates with lightness and reflectance, influenced by the granite's grain size and quartz content. In edge finishing, tool geometry plays a pivotal role, as different profiles (e.g., chamfered, concave, ogee) distribute cutting forces differently, affecting both surface finish and tool wear. [4] noted that finer abrasives in finishing processes shift material removal from brittle fracture to ductile flow, reducing roughness and enhancing gloss, a finding echoed by [5], who associated ductile flow with lower friction and improved surface quality.

Despite the extensive research on plane surface finishing, edge finishing of natural stones remains underexplored, particularly under varying lubrication conditions. [6] initiated studies on granite edge finishing, emphasizing the role of spindle speed and lubrication in achieving superior surface finishes, with wet conditions significantly reducing roughness. However, the interplay between tool geometry, grit size, and cutting parameters in wet edge finishing across different granite types warrants further investigation. This study aims to address this gap by examining the optimization of wet edge finishing processes for natural stones, focusing on the influence of tool geometry, grit size, and cutting conditions on surface roughness, cutting forces, and tool wear. By providing insights into these factors, this research seeks to enhance edge quality, meeting the exacting standards of the granite industry while contributing to sustainable machining practices.

II. EXPERIMENTAL PROCEDURE

The choice of tool shape is determined by customer preferences for edge profiles. According to [7], the most sought-after options include straight, round, full bullnose, half bullnose, ogee, waterfall, beveled or chamfered, and eased edges. In this study, the experiment involved edge finishing through grinding and polishing, focusing on chamfered and concave edges (Fig 1a–1d). The eased chamfered edge (AR30-2) features a 45° chamfer with a 2 mm depth on a 26 mm high edge (Fig 1a). The half-beveled edge (E30-12) has a 20.5° bevel, a 9.5 mm depth, and a 13 mm fillet radius at the bottom (Fig 1b). The eased concave edge (T30-10) includes a 30° concave curve with a 3 mm radius fillet on a 24 mm high edge (Fig 1c). Lastly, the ogee edge (F30) features two 15 mm radius curves (Fig 1d), creating a decorative profile. Each design balances aesthetics and functionality, influencing durability and finishing outcomes in granite processing.

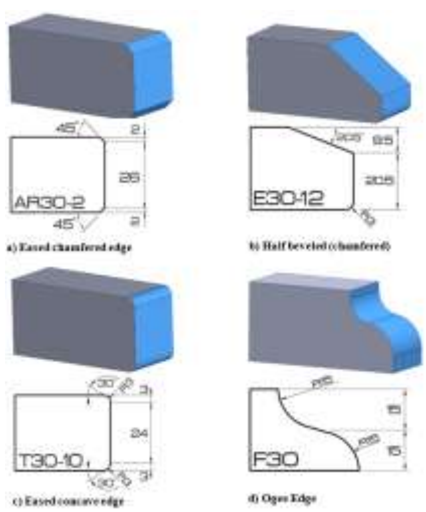

Figure 1. Experimental tool shapes: (a) Esed chamfred edge, (b) Half-beveled edge, (c) Eased concave edge, (d) Ogee edge

To investigate the effects of various process parameters and tool geometry on surface roughness and cutting forces during the machining of natural stones, a comprehensive experimental study was conducted. A full factorial design was employed to systematically plan the experiments. The input factors and their respective levels are presented in Tab 1, while the output responses analyzed are outlined in Tab 2.

TABLE I. INPUT FACTORS AND THEIR LEVELS

Factors	Levels			
Granite type	Black		White	
Tool shape	Eased chamfered	Half-beveled	Eased concave	Ogee edge
Tool grit size	150	300	600	
Spindle speed N(rpm)	1500	2500	3500	
Feed rate V_f(mm/min)	500	1000	1500	

TABLE II. OUTPUT RESPONSES STUDIED.

Responses		Description
Roughness	Ra (µm)	Arithmetic mean deviation of the surface profile
Forces	Fx (N)	Cutting forces follow the x-axis
	Fy (N)	Cutting forces follow the y-axis
	Fz (N)	Cutting forces follow the z-axis

The abrasive tools utilized in this study are presented in Fig 2. These tools, each with distinct grain sizes suited to specific edge shapes, were used in the edge-finishing process. All abrasive tools were sourced from GranQuartz Canada Inc., located in Stanstead, QC, Canada.

Figure 2. Experimental used abrasive tools: (a) Esed chamfred edge tool, (b) Half-beveled edge tool, (c) Eased concave edge tool , (d) Ogee edge tool

The experimental design yielded to a total of 216 tests, as calculated using (1). To ensure the reliability and robustness of the analyses, each test was replicated twice, resulting in a total of 432 tests.

$$\prod (\text{Number of levels})^{(\text{number of parameters})} = 2^1 * 4^1 * 3^3 = 216 \text{ tests.} \quad (1)$$

The granite workpiece samples used in this study were provided by A. Lacroix Granit (Saint-Sébastien-de-Frontenac, QC, Canada) as part of their support for the granite transformation research project. These samples, measuring 200 × 200 × 30 mm³, consisted of white and black granite varieties.

The material compositions of these workpieces are detailed in Tab 3.

The white granite comprises 41% quartz, 33% plagioclase, and 23% K-feldspar, with minor accessory minerals accounting for the remainder. Its grain size ranges from 0.5 to 7.0 mm, and it has an average density of approximately 2.7 g/cm³, as reported by [6].

The black granite, identified as a Canadian anorthosite with coarse grains, is predominantly composed of plagioclase (approximately 83%), with no quartz present. Its grain size varies from 0.2 to 17.0 mm, significantly larger than that of the white granite, according to mineralogical analysis by [8]. The average density of the black granite is higher, at about 3.1 g/cm³, as noted by [6].

TABLE III. THE COMPOSITION OF TESTED WORKPIECE MATERIALS

	Materials and composition	
Minerals	***Black Granite (Canadian anorthosite)***	***White Granite***
Quartz	0 %	41.4%
Plagioclase	83.6%	32.4%
K-feldspar	-	23 %
Orthopyroxene	6.85%	-
Biotite	2.83%	1.14 %
Oxydes	5.2%	2 %

Fig 3 depicts the configuration of the experimental setup, showing the granite workpiece mounted on a Kistler 9255B dynamometric table and profiling tools attached to the spindle of a K2X10 3-axis CNC milling machine. The setup was designed to investigate the generation of four distinct tool shapes on granite samples during edge-finishing processes.

The edge-finishing experiments were performed on a K2X10 3-axis CNC milling machine, manufactured by Huron Graffenstaden SAS (Eschau, France). This machine features a maximum spindle speed of 28,000 rpm, a torque of 50 Nm, and a power output of 40 kW. The primary objective was to study the creation of four tool shapes, eased chamfered edge, half-beveled, eased concave edge, and ogee edge, on granite samples.

The workpiece was securely mounted on a dynamometric table, while the profiling tools were attached to the CNC spindle. For wet edge-finishing, a lubricant was delivered through two nozzles at a flow rate of 30 L/min and a pressure of 3 bars to reduce heat and wear during machining.

Cutting forces along the x, y, and z axes (Fx, Fy, Fz) were measured using a Kistler 9255B dynamometric table (Kistler Instrument Corporation, New York, NY, USA), equipped with five sensors for precise and comprehensive force acquisition. This setup ensured accurate monitoring of the forces generated during the edge-finishing process for each tool shape.

Surface roughness was evaluated using a Mitutoyo Surftest SJ-201 profilometer (Mitutoyo America Corporation, Aurora, IL, USA), which employs a probing system to scan the surface and calculate key parameters, including the arithmetic mean deviation (Ra) the profile. To ensure measurement accuracy, the SJ-201 was validated at multiple stages using a Mitutoyo Surftest SJ-410. Prior to testing, both devices were calibrated with a roughness standard (Ra = 2.95 µm) to guarantee precision and reliability.

Roughness measurements were conducted three times at three distinct positions on the lateral face processed by each tool shape, using a custom positioning jig designed in the ÉTS workshop. The Surftest SJ-410, with enhanced sample manipulation capabilities, was also employed to ensure optimal positioning and full contact of the detector with the granite surface during roughness assessments.

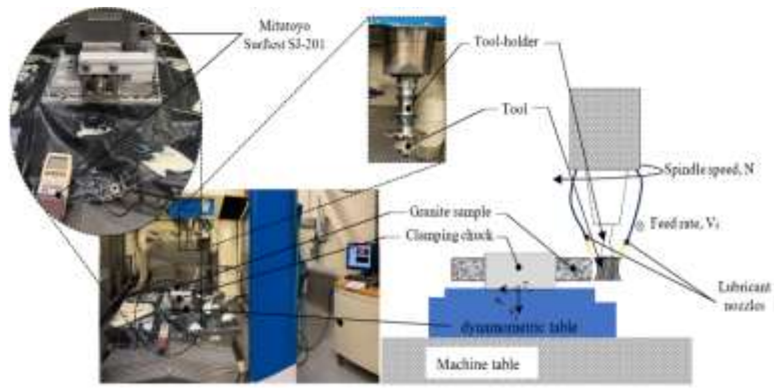

Figure 3. Experimental cutting tests setup

III. RESULTS AND DISCUSSION

A. *Impact of Abrasive Grit Size and Workpiece Material on Component Quality*

The roughness of processed granite samples, quantified by the arithmetic mean deviation (Ra), is depicted for white and black granite in Fig 4a and Figure 4b, respectively. These figures illustrate the variation in Ra values across abrasive grit sizes (45, 150, 300, and 600) for two tool shapes, half-beveled and Ogee edge, highlighting the influence of grit size on surface finish quality. A clear trend emerges as grit size increases from 45 to 600, Ra values decrease significantly for both granite types, indicating improved surface smoothness.

This reduction in roughness is attributed to the finer abrasive particles associated with larger grit sizes, which remove smaller material fragments, thereby minimizing surface irregularities and producing a smoother finish. This trend is critical for achieving the stringent smoothness requirements in granite industries, where lower Ra values signify higher surface quality. Notably, the Ogee edge tool consistently outperforms the half-beveled tool, achieving lower Ra values across all grit sizes in both white and black granite.

For instance, in white granite (Fig 4a), the Ogee edge maintains Ra values below 1.5 µm at a grit size of 600, compared to the half-beveled tool's Ra of approximately 2 µm. Similarly, in black granite (Fig 4b), the Ogee edge achieves Ra values as low as 0.5 µm at 600 grit size, underscoring its superior performance.

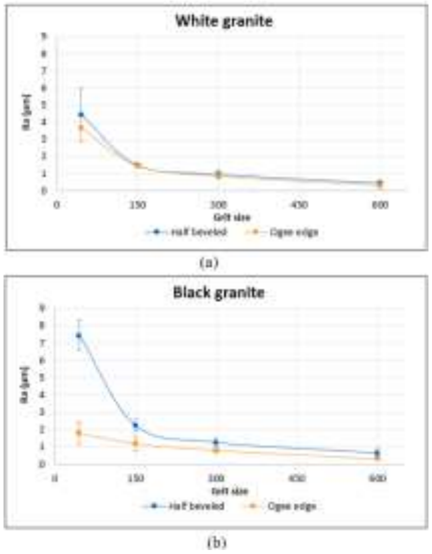

Figure 4. Curves of arithmetic average roughness Ra as a function of grit size for the half-beveled and ogee edge shapes with fixed spindle speed (N = 2500 rpm) and fixed feed rate (Vf = 1000 mm/min): (a) black granite, (b) white granite.

Fig 5a–b illustrates the variation of axial forces (Fz) on black and white granites.

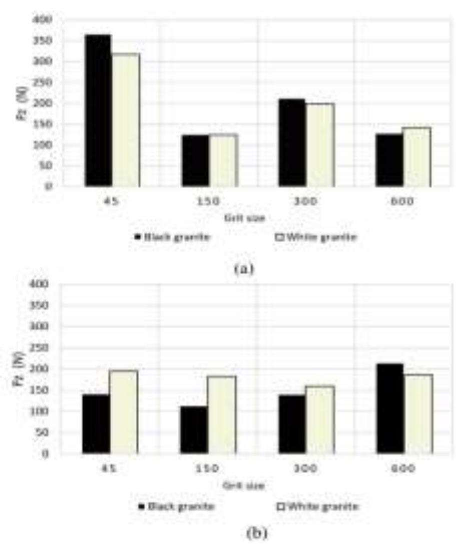

Figure 5. Variation of the Fz forces as a function of grits for white and black granite with fixed spindle speed (N = 2500 rpm) and fixed feed rate (Vf = 1000 mm/min): (a) Ogee edge, (b) Half-beveled

For both edge profiles, black granite consistently experiences higher Fz forces compared to white granite across all grit sizes, with the most significant difference observed at grit size 45, where Fz reaches approximately 350 N for black granite versus 300 N for white granite in the ogee edge setup. This disparity can be attributed to the inherent material properties, as black granite's higher hardness and density likely result in greater resistance to material removal, increasing the cutting forces and potentially leading to more pronounced surface stresses [9]. Conversely, white granite, with its relatively lower hardness, allows for easier material removal, reducing the forces exerted on the tool and workpiece, which may contribute to a more consistent edge quality with less risk of surface damage. These findings highlight the significant influence of workpiece material on cutting dynamics and the resulting component quality during edge finishing processes.

B. Influence of Tool Shape on Cutting Forces and Surface Finish Quality

Fig 6 and Fig 7 present the cutting force profiles (Fxy and Fz) for four edge-finishing tools applied at a spindle speed of 2500 rpm and a feed rate of 1000 mm/min.

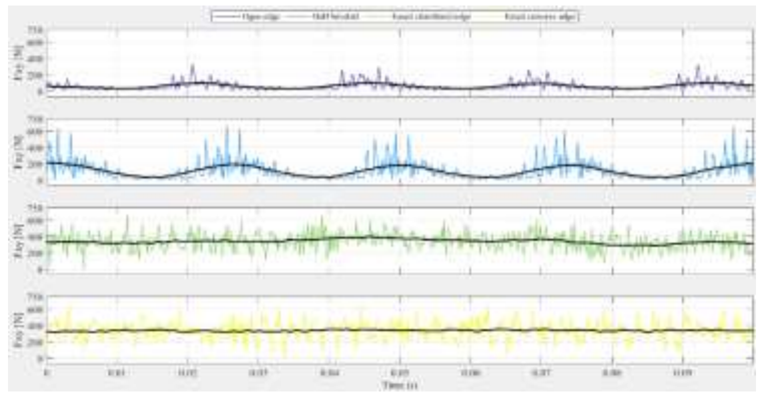

Figure 6. Cutting force profiles Fxy for the four edge-finishing tools applied at a spindle speed of 2500 rpm and a feed rate of 1000 mm/min.

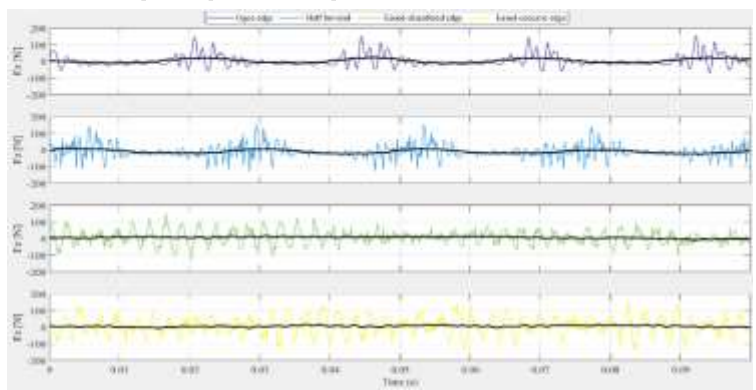

Figure 7. Cutting force profiles Fz for the four edge-finishing tools applied at a spindle speed of 2500 rpm and a feed rate of 1000 mm/min.

The black lines represent the moving average trends, which fluctuate around 150 N for the axial force (Fz) and about 200 N for the plane force (Fxy) across all the tools.

The ogee edge (purple) exhibits the highest variability in cutting forces, with Fz peaking near 300 N, likely due to its intricate geometry increasing contact points with the workpiece, which may accelerate tool wear through heightened friction and stress concentration Fig 8b. In contrast, the eased concave edge (yellow) demonstrates the most stable force profile, with minimal fluctuations and lower peak forces, suggesting reduced tool-workpiece interaction intensity and potentially slower tool wear rates Fig 8a. The half-beveled (blue) and eased chamfer edge (green) profiles show moderate oscillations, indicating a balanced but still notable impact on tool wear due to intermittent force spikes. Interestingly, despite the ogee edge's higher cutting forces, Fig 4b reveals that it achieves a superior surface finish, with Ra values decreasing from approximately 2 µm at grit size 45 to 0.5 µm at grit size 600, consistently lower than the half-beveled edge, which ranges from 7 µm to 1 µm. This improved Ra can be attributed to the ogee edge's complex, curved geometry, which facilitates more uniform material removal across the edge profile through multiple contact points, effectively smoothing surface irregularities, particularly at higher grit sizes where finer abrasives enhance the polishing effect.

These findings highlight a trade-off between surface quality and tool longevity, where the ogee edge's design enhances edge finish but at the cost of increased tool wear, as evidenced by the pronounced force spikes that could exacerbate material fatigue and wear on the tool's cutting surface over time.

Figure 8. Comparison of the tool wear : (a) Eased concave shape reduced tool wear, (b) Ogee edge shape increased tool wear

Fig 9a-d illustrates the edge finishing outcomes on black granite using different edge profiles, with a particular focus on the eased chamfered edge and its impact on surface quality.

Fig 9a shows eased concave edge with no visible damage, serving as a reference for comparison. In contrast, Fig 9b highlights the eased chamfered edge, where significant surface damage is evident, as indicated by the inset magnifying the affected area, which reveals chipping and material removal along the edge.

This damage likely stems from the chamfered edge's geometry, which concentrates contact pressure at specific points on the granite surface, leading to localized stress and subsequent surface degradation [10]. Fig 9c and Fig 9d, representing half-beveled and ogee edge profiles, exhibit smoother finishes with no apparent damage, suggesting more evenly distributed contact pressure during the finishing process.

The eased chamfered edge's tendency to focus pressure at the edge likely exacerbates material removal, increasing the risk of chipping, as observed, while the other profiles appear to mitigate such risks through broader contact areas, resulting in a more controlled and uniform material removal process.

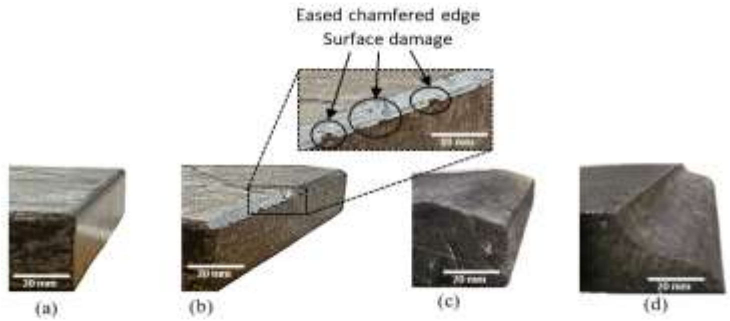

Figure 9. Edge finishing outcomes on black granite: (a) Eased concave, (b) Eased chamfered, (c) Half-beveled (d) Ogee edge

C. Influence of Spindle Speed and Feed Rate on Surface Finish Quality

In the 3D plots below (Fig 10a-b and Fig 11a-b), the color gradient represents the variation in Ra, with blue indicating lower roughness values (smoother surfaces) and red indicating higher roughness values (rougher surfaces).

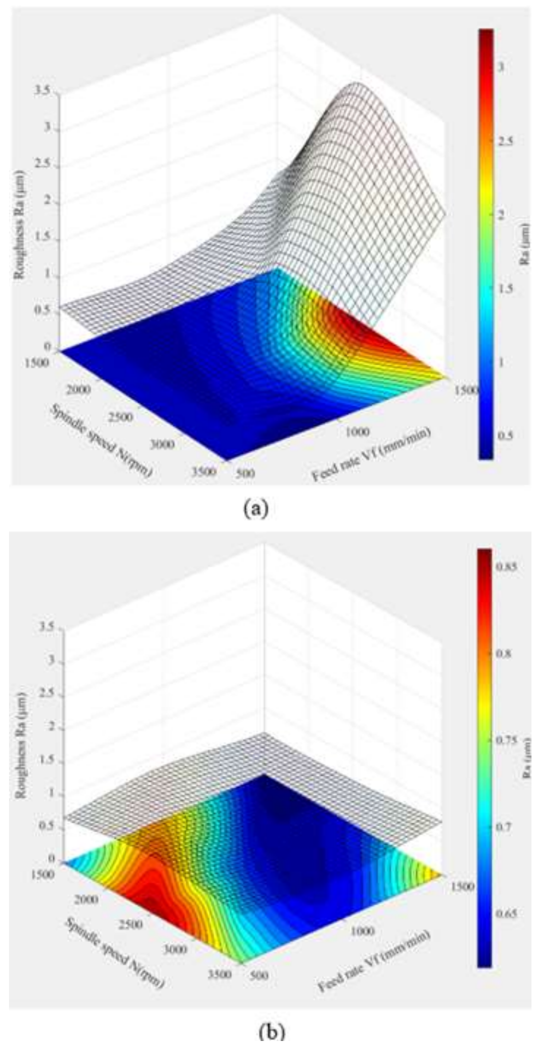

Figure 10. 3D response surface plots of Ra when using a black granite (grit 600): (a) Eased chamfered edge, (b) Half-beveled edge

Across all four subfigures, a consistent trend emerges: lower Ra values are generally associated with higher spindle speeds and lower feed rates. For instance, in Fig 10a, which corresponds to the eased chamfered edge shape tool, the smoothest surfaces (Ra values around 0.5 µm) are observed at spindle speeds above 2500 rpm and feed rates below 1000 mm/min. This trend aligns with the expectation that higher spindle speeds allow for more consistent cutting action, reducing surface irregularities, while lower feed rates provide the tool with sufficient time to engage the material effectively, minimizing uneven cuts.

Similarly, in Fig 10b for the half-beveled edge shape tool, the lowest Ra values (approximately 0.65 µm) are achieved within a spindle speed range of 2000 to 3500 rpm and feed rates below 1000 mm/min. The eased concave edge shape tool (Fig 11a) and ogee edge shape tool (Fig 11b) exhibit comparable behavior, with optimal surface finish (Ra around 0.4 - 0.6 µm) at high spindle speeds (2500 - 3500 rpm) and low feed rates (500 - 1000 mm/min).

However, the ogee edge shape tool in Fig 11b shows a slightly broader region of low roughness, suggesting that this tool geometry may be more forgiving to variations in cutting parameters, potentially due to its curved profile distributing cutting forces more evenly.

The relationship between feed rate and surface roughness is particularly pronounced. As feed rate increases, Ra values rise across all tool types, with red regions (Ra > 1.5 µm) appearing at feed rates above 1500 mm/min, especially at lower spindle speeds (1500 - 2000 rpm). This observation is consistent with the mechanics of material removal: higher feed rates result in faster tool advancement, increasing the material removal rate. If the material is removed too quickly, the tool may not engage the surface uniformly, leading to uneven cutting and higher roughness. This phenomenon is supported by [11], who noted that in abrasive waterjet machining of granite, higher travel speeds reduce the number of cutting particles interacting with a unit area, resulting in fewer cutting edges and thus rougher surfaces.

In contrast, higher spindle speeds generally improve surface finish by increasing the frequency of cutting interactions per unit time, which helps to smooth out surface imperfections. However, there is a limit to this benefit, as excessively high spindle speeds paired with high feed rates can lead to tool vibration or thermal effects, potentially degrading surface quality. This balance is evident in the plots, where the optimal Ra values are not at the maximum spindle speed (3500 rpm) but rather in the 2500 - 3000 rpm range for most tools.

The choice of tool geometry also plays a significant role in surface finish outcomes. The eased chamfered edge shape tool (Fig 10a) and half-beveled edge shape tool (Fig 10b) produce slightly higher Ra values compared to the eased concave edge (Fig 11a) and ogee edge (Fig 11b) tools under similar conditions. This difference may be attributed to the sharper cutting edges of chamfered and beveled tools, which, while effective for material removal, might induce micro-damage or surface irregularities on the granite, especially at higher feed rates. The concave and ogee tools, with their more gradual cutting profiles, appear to distribute cutting forces more evenly, resulting in smoother surfaces.

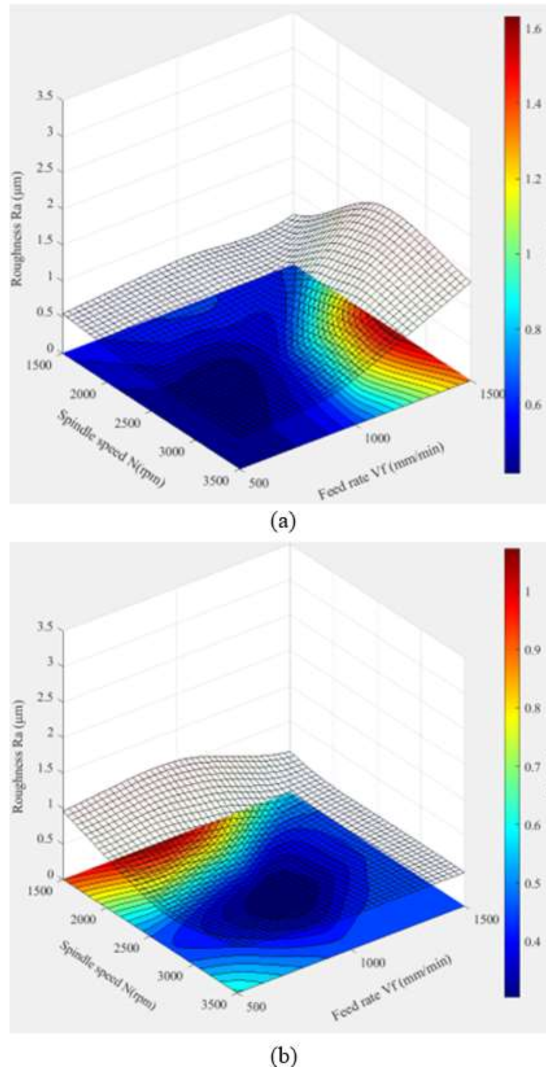

Figure 11. 3D response surface plots of Ra when using a black granite (grit 600): (a) Eased concave edge, (b) Ogee edge

Wet lubrication, used in all experiments, likely contributes to the low Ra values observed in the blue regions of the plots. Lubrication reduces friction and heat generation at the tool-workpiece interface, minimizing thermal damage and tool wear, both of which can degrade surface quality. However, the chamfered tools' tendency to produce higher roughness at elevated feed rates suggests that lubrication alone may not fully mitigate surface damage caused by aggressive cutting conditions, underscoring the importance of optimizing both tool geometry and cutting parameters.

Theses findings align with previous research on surface roughness in machining. [6] observed similar variations in edge finishing, noting that tool geometry significantly affects surface quality, particularly when comparing edge finishing to surface polishing. In contrast, [12] found that higher feed rates could improve surface conditions in plane polishing, a discrepancy that may stem from differences between surface polishing and edge finishing processes. The current study's results, focusing on edge finishing of black granite, suggest that higher feed rates consistently increase roughness, supporting the need for further investigation into how process variations influence surface outcomes.

IV. Conclusion

This study investigated wet edge finishing process for natural stones, focusing on the effects of tool geometry, grit size, and cutting conditions on surface roughness, cutting forces, and tool wear when processing black and white granites. The findings reveal several key insights that advance the understanding of edge finishing optimization:

1. Surface Roughness and Cutting Parameters: Optimal surface quality, with the lowest Ra values (around 0.4–0.6 µm), was achieved at a spindle speed of 2500 rpm and feed rates below 1000 mm/min across all tool shapes. Higher feed rates consistently increased Ra, aligning with the mechanics of material removal where faster tool advancement leads to uneven cutting and rougher surfaces, as supported by [11].

2. Tool Geometry and Surface Finish: The ogee edge and eased concave edge tools outperformed the half-beveled edge and eased chamfered edge tools, achieving superior surface finishes (Ra as low as 0.5 µm at 600 grit for black granite). The ogee edge's complex geometry facilitated uniform material removal, while the eased chamfered edge tool's sharper profile led to surface damage, such as chipping, due to concentrated contact pressure.

3. Cutting Forces and Tool Wear: Cutting forces were higher for black granite compared to white granite, reflecting its higher density and friction coefficient. The ogee edge exhibited the highest force variability (Fz peaking near 300 N), contributing to increased tool wear due to heightened friction, as evidenced in Figure 8(b). In contrast, the eased concave edge tool showed stable force profiles and reduced wear, suggesting better longevity.

4. Role of Wet Lubrication: Wet lubrication significantly enhanced surface quality by reducing friction and heat, yielding lower Ra values across all tool shapes. This effect was particularly pronounced for the eased chamfered edge tool, where lubrication mitigated surface damage, highlighting its critical role in achieving high-quality finishes.

These results underscore the importance of tool geometry and lubrication in optimizing edge finishing processes. The ogee edge and eased concave edge tools are recommended for applications prioritizing surface quality, while the eased chamfered edge tool, despite customer demand for its profile, requires careful parameter optimization and lubrication to minimize surface damage. Future research should explore modifications to chamfered tool designs, such as incorporating a connection radius to reduce chipping, and investigating the effects of wet lubrication across a broader range of stone materials to further enhance edge finishing outcomes in the granite industry.

Acknowledgment

The authors sincerely thank A. Lacroix Granit (Saint-Sébastien-de-Frontenac, QC, Canada) for their generous provision of the granite samples crucial to this study.

They also wish to acknowledge the engineers at the Products, Processes, and Systems Engineering Laboratory (Lipps) at ÉTS for their invaluable support throughout the experimental phase.

References

[1] Ministère de l'Énergie et des Ressources Naturelles. "Granite." Géologie Québec. 2022. Available online: https://mern.gouv.qc.ca/territoire/geologie/ressources/granit.jsp (accessed on 10 October 2022)

[2] Sanmartín, P.; Silva, B.; Prieto, B. Effect of surface finish on roughness, color, and gloss of ornamental granites. J. Mater. Civ. Eng. 2011, 23, 1239–1248.

[3] López, A.J.; Pozo-Antonio, J.S.; Ramil, A.; Rivas, T. Influence of the commercial finishes of ornamental granites on roughness, colour and reflectance. Constr. Build. Mater. 2018, 182, 530–540.

[4] Huang, H.; Li, Y.; Shen, J.Y.; Zhu, H.M.; Xu, X.P. Micro-structure detection of a glossy granite sur-face machined by the grinding process. J. Mater. Process. Technol. 2002, 129, 403–407

[5] Saidi, M.N.; Songmene, V.; Kouam, J.; Bahloul, A. Experimental investigation on fine particle emission during granite polishing process. Int. J. Adv. Manuf. Technol. 2015, 81, 2109–2121.

[6] Bahri, H.; Songmene, V.; Kouam, J.; Samuel, A.M.; Samuel, F.H. CNC edge finishing of granite: Effect of machining conditions on part quality, cutting forces, and particle emissions. Materials 2021, 14, 6496.

[7] USA Granite Tools. Available online: https://www.usagranitetools.com/granite-edge-profile-fabrication-best tools/ (accessed on 6 February 2024)

[8] Bahloul, A.; Jorge, V.; Rafael, F.; Djebara, A.; Songmene, V.; Saidi, M.N.; Kouam, J.; Reggio, M.; Villalpando, F. Transformation du granit: Caractérisation et contrôle de la poussière de la silice émise par le polissage. In Rappors Scientifique; Institut de recherche Robert-Sauvé en santé et en sécurité du travail: Montreal, QC, Canada, 2019; Volume R-1054, p. 99.

[9] Preston, F.W. The theory and design of plate glass polishing. Soc. Glass Technol. J. 1927, 11, 214–256.

[10] Mateur, W.; Songmene, V.; Kouam, J. Experimental Investigation on the Effects of Tool Geometry and Cutting Conditions on Machining Behavior during Edge Finishing of Granite Using Concave and Chamfered Profiling Tools. Micromachines 2024, 15, 315.

[11] Aydin, G.; Karakurt, I.; Aydiner, K. An investigation on surface roughness of granite machined by abrasive waterjet. Bull. Mater. Sci. 2011, 34, 985–992

[12] Songmene, V.; Miazza, A.; Hechmi, M.A.; Olufayo, O.A.; Kouam, J. Granite polishing: Effects of polishing parameters and tool paths on part quality and dust emission. Procedia CIRP 2018, 77, 139–142.