Pengembangan metode dan strategi pemesinan milling peripheral 5-axis pada permukaan berkontur berbasis model faset = Development of method and strategy 5-axis peripheral milling sculptured surface based on faceted models

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Abstrak

Untuk mencapai proses efisiensi milling, salah satunya dengan menggunakan strategi pemesinan peripheral milling karena material removal rate (mrr) yang besar terutama bila diaplikasi pada permukaan planar. Peripheral milling menemukan banyak kendala saat mengerjakan jenis permukaan sculptured dan memerlukan bentuk tool khusus yang menyesuaikan bentuk permukaan. Selain itu upaya efisiensi dapat dilakukan dengan mengurangi setup tool pada setiap tahapan proses (single setup tool) dengan menggunakan parameter tool yang sama misalnya silindrical cutter. Namun peripheral milling menggunakan tool silinder pada permukaan sculptured memerlukan metode dan strategi khusus, karena akan menemukan banyak interference antara tool dengan permukaan tergantung pada parameter tool dan initial tool orientation-nya. Sehingga problem dalam menentukan metode dan strategi pemesinan peripheral milling pada sculptured surface menggunakan tool silinder menjadi menarik untuk diteliti lebih lanjut dan menjadi keterbaharuan dalam penelitian ini. Posisi tool pada setiap cc-point mengandung nilai Normal vector (N), Feed direction vector (F) dan Tool Vector (T). Penetilian ini menghasilkan mengembangkan metode inisial orientasi tool peripheral, metode pendeteksian dan penghindaran interference peripheral, metode inisialisasi area non-machinable peripheral, dan pengembangan strategi diantaranya startegi tool orientasi alternative peripheral, strategi penghindaran intereference, startegi milling area non-machinable peripheral, strategi efektifitas terhadap arah pemakanan, strategi end milling sebagai solusi milling area non-machinable dan terakhir startegi hybrid milling (gabungan peripheral dengan end milling) menggunakan single parameter tool. Hasil pengembangan metode dan strategi kemudian divalidasi dengan simulasi milling pada model uji sculptured surface. Setelah diaplikasi pada beberapa model uji sculptured
surface berbasis model faset, membuktikan metode dan strategi pemesinan yang dikembangkan telah berhasil disimulasikan pada seluruh area sculptured surface.
Hasilnya dipresentasikan dalam prosentase kemampuan peripheral milling dan hasil akhir berupa toolpath simulasi hybrid milling. Hasil pengembangannya pada metode dan startegi peripheral milling ini dapat dijadikan sebagai acuan pengembangan strategi milling 5-axis selanjutnya
.....To achieve the milling efficiency process, one of them is by using a peripheral milling machining strategy because high of the material removal rate (mrr), especially when applied to a planar surface. Peripheral milling encountered many obstacles when working on sculptured surface types and required a special form of tool to adjust the surface shape. In addition, efficiency efforts can be made by reducing the setup tool at each stage of the process (single setup tool) by using the same tool parameters such as a cylindrical cutter. However, peripheral milling using the tool cylinder on the sculptured surface requires a special method and strategy, because it will find a lot of interference between the tool and the surface depending on the tool parameters and the initial tool orientation. So that the problem in
determining the method and strategy of peripheral milling machining on sculptured surfaces using tool

cylinders becomes interesting for further research and becomes a novelty in this study. Tool position at each cc-point contains Normal vector (N), Feed direction vector (F) and Tool Vector (T) values. This research resulted in
developing initial peripheral tool orientation methods, detection and avoidance methods for peripheral interference, methods for identification non-machinable peripheral areas, and developing strategies including alternative orientation tool peripheral strategies, interference avoidance strategies, non-machinable peripheral area milling strategies, effectiveness strategies for feed direction, end milling strategy as a solution for milling non-machinable areas and finally hybrid milling strategy (combination of peripherals and end milling) using a single parameter tool. The results of developing methods and strategies were then validated by simulating milling on the sculptured surface test model. After being applied to several sculptured surface test models based on the faceted model, it was proven that the developed machining methods and strategies has been simulated successfully on the entire sculptured surface area. The results are presented in the percentage of peripheral milling capabilities and the final result is a hybrid milling simulation toolpath. The results of its development on this peripheral milling method and strategy can be used as a reference for the development of the next 5-axis milling strategy.