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Effect of a milling cutter diameter on distortion due to the machining of thin wall thin floor components

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ABSTRACT

Machining of prismatic blocks, removing material up to 85 % on CNC machines to produce thin wall thin floor monolithic components replacing multi part assemblies has become common in aerospace industries. The greatest challenge when machining these components is part distortion. Selecting the right kinds of tools and machining parameters is of utmost importance in minimizing distortion. One of the important parameters is the size (diameter) of the cutter. Generally, within a production scenario, the selecting the size of the cutter is driven by the productivity and geometrical constraints of the component. Experience shows that selecting the wrong size of the cutter can lead to distortion and the selecting of a correct size of the cutter depends on heuristics. In order to understand the effect of cutter diameter on distortion, machining experiments were carried out by using different sizes of milling cutter, at constant feed, speed, depth of cut and volume of material removal rate, on a representative thin wall thin floor aluminium alloy (2014A T651) component, holding the part from the bottom, using a shop made vacuum fixture. Machining simulations were also carried out to understand the machining characteristics with any change in cutter diameter at constant feed, speed, depth of cut, and material removal rate. Experimental results show that the diameter of a milling cutter has an effect on distortion at constant feed, speed, depth of cut, and volume of material removal rate.

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Učinek premera rezkala na deformacijo med obdelavo nizkih tankostenskih komponent

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POVZETEK

Obdelava prizmatičnih obdelovalcev za izdelavo nizkih tankostenskih monolitnih komponent, kjer predstavlja CNC-obdelava z odstranjevanjem materiala do 85 % vseh obdelovalnih postopkov, s pridom nadomešča izdelavo izdelkov, sestavljenih iz več sestavin, še posebej za potrebe letalske industrije. Največji izziv pri obdelavi takšnih izdelkov je njihova deformacija. Za zmanjšanje deformacije sta izbiri ustreznega orodja in obdelovanih parametrov zelo pomembni. Eden izmed pomembnih parametrov je premer rezkala. V splošnem izbiro velikosti rezkala narekujejo želena produktivnost in geometrijske omejitve komponente. Izkušnje kažejo, da izbira napačne velikosti rezkala lahko vodi do deformacij komponente. Da bi razumeli vpliv premera rezkala na deformacije smo izvedli preizkuse z različnimi velikostmi rezkala pri konstantni obdelovalni hitrosti, podajanju, globini reza in volumnu odstranjenega materiala. Tankostenska komponenta je bila iz aluminijeve zlitine (2014A T651), vpeta pa je bila od spodaj s pomočjo vakuumske vpenjalne priprave. Da bi bolje razumeli značilnosti obdelave, smo izvedli tudi simulacije obdelave za vsak premer rezkala pri konstantni obdelovalni hitrosti, podajanju in globini reza. Eksperimentalni rezultati so pokazali, da ima premer rezkala vpliv na deformacije pri konstantni obdelovalni hitrosti, podajanju, globini reza in volumnu odstranjenega materiala.

PODATKI O ČLANKU

Ključne besede:
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