

Comparison of cooling simulations of injection moulding tools created with cutting machining and additive manufacturing

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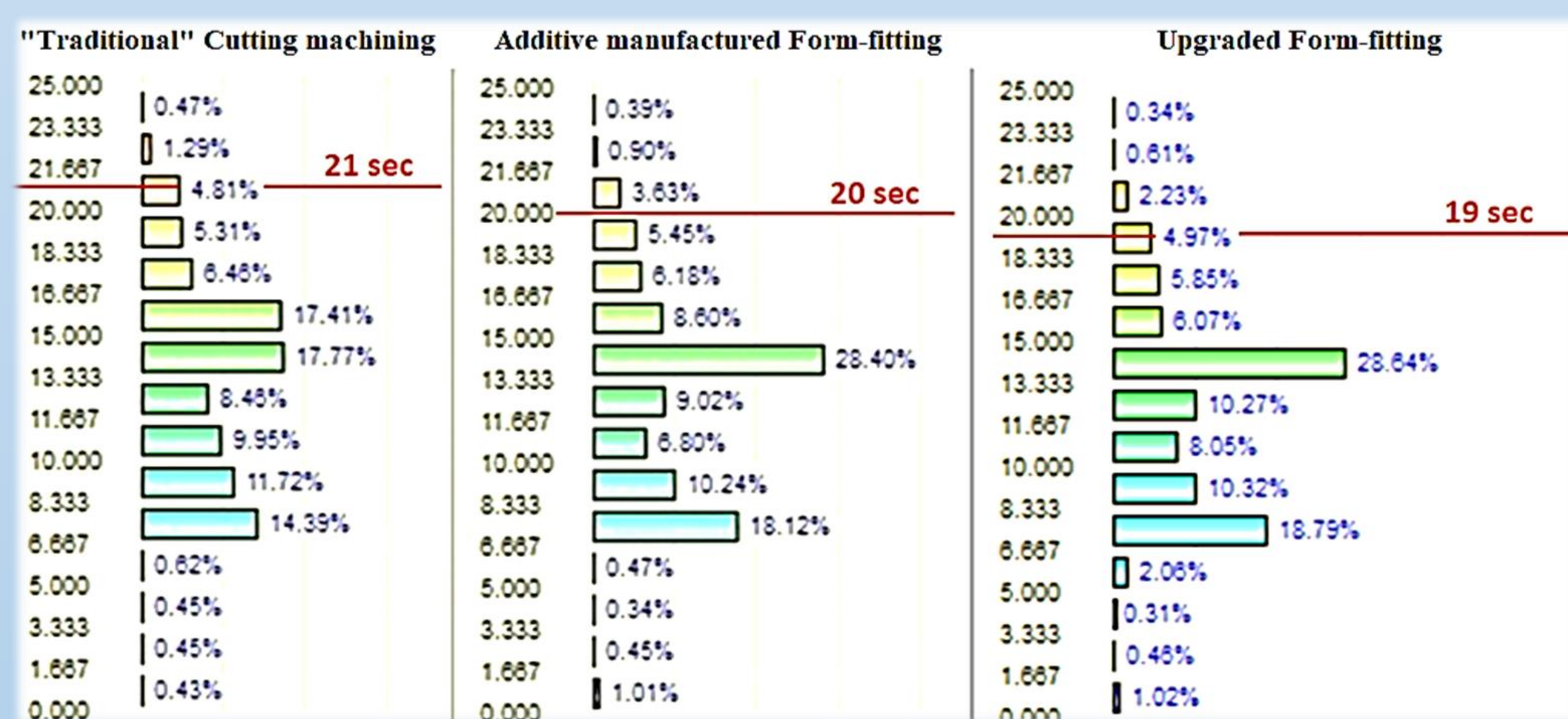
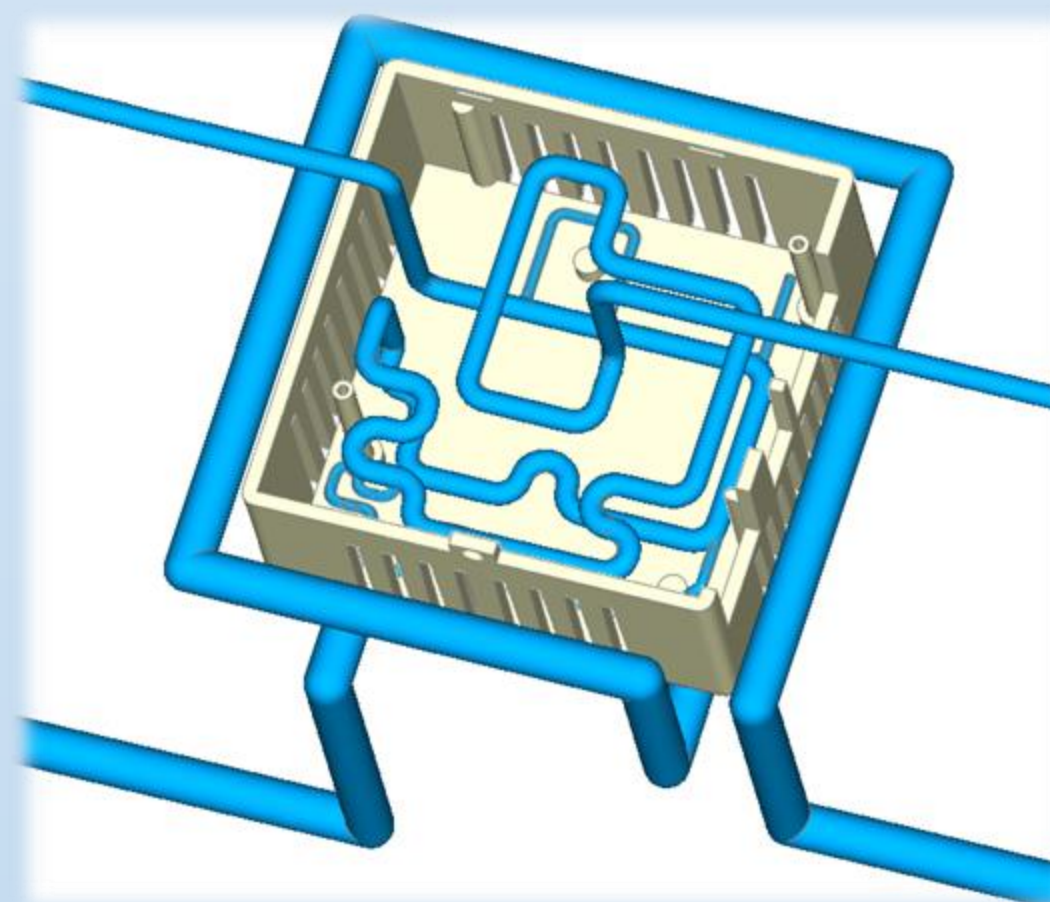
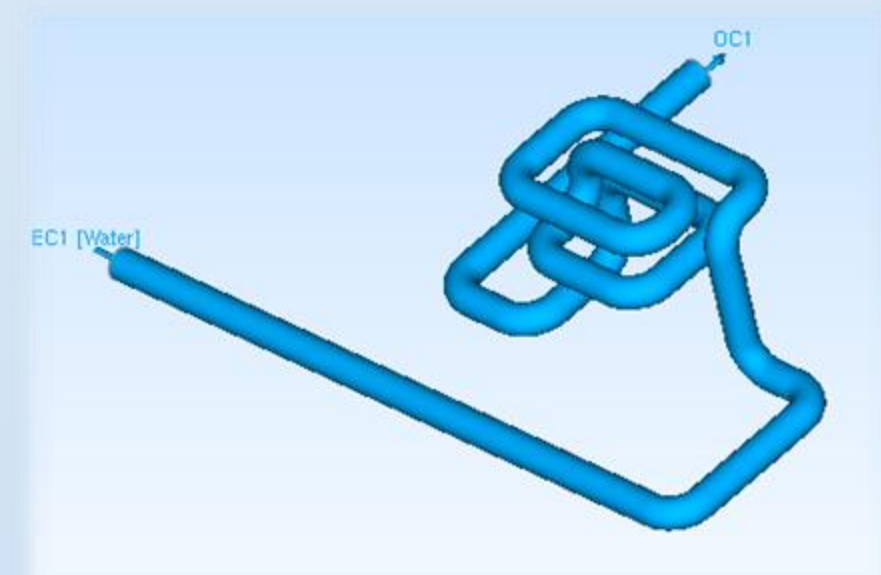
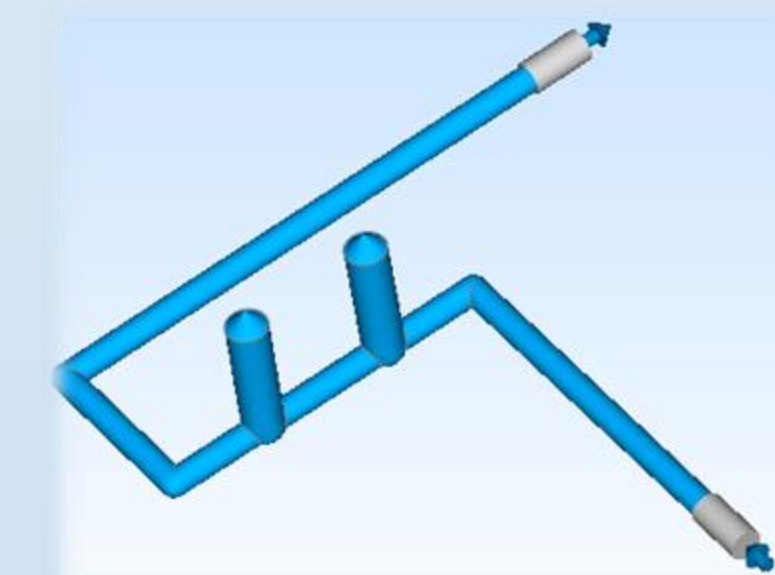
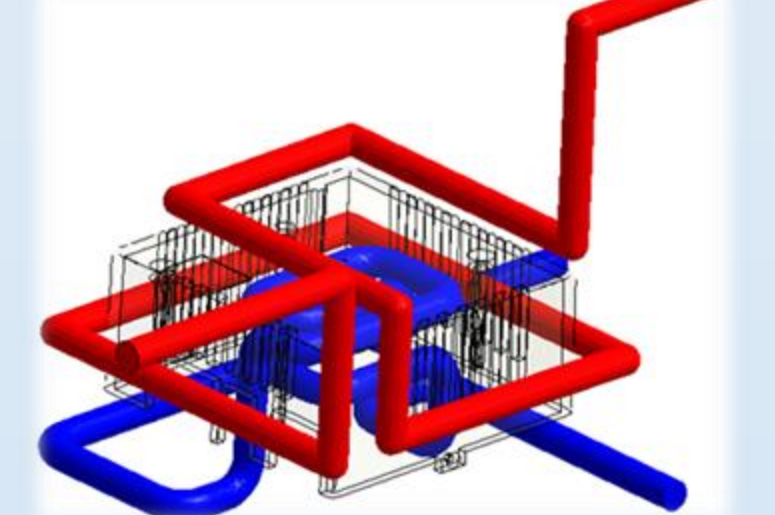
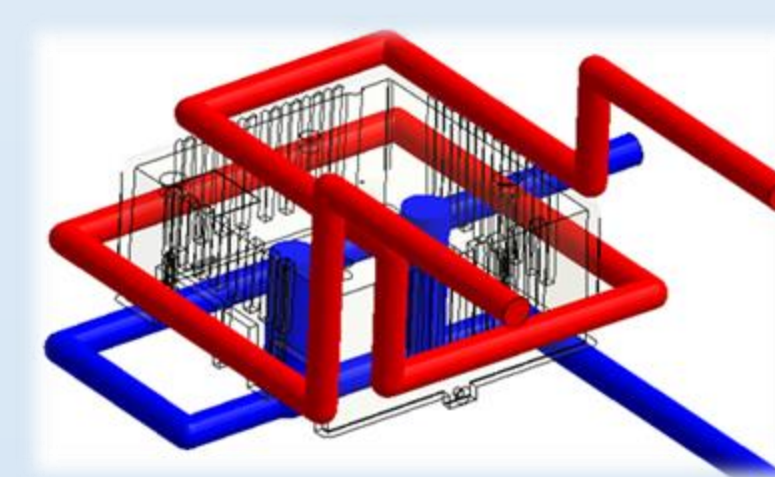
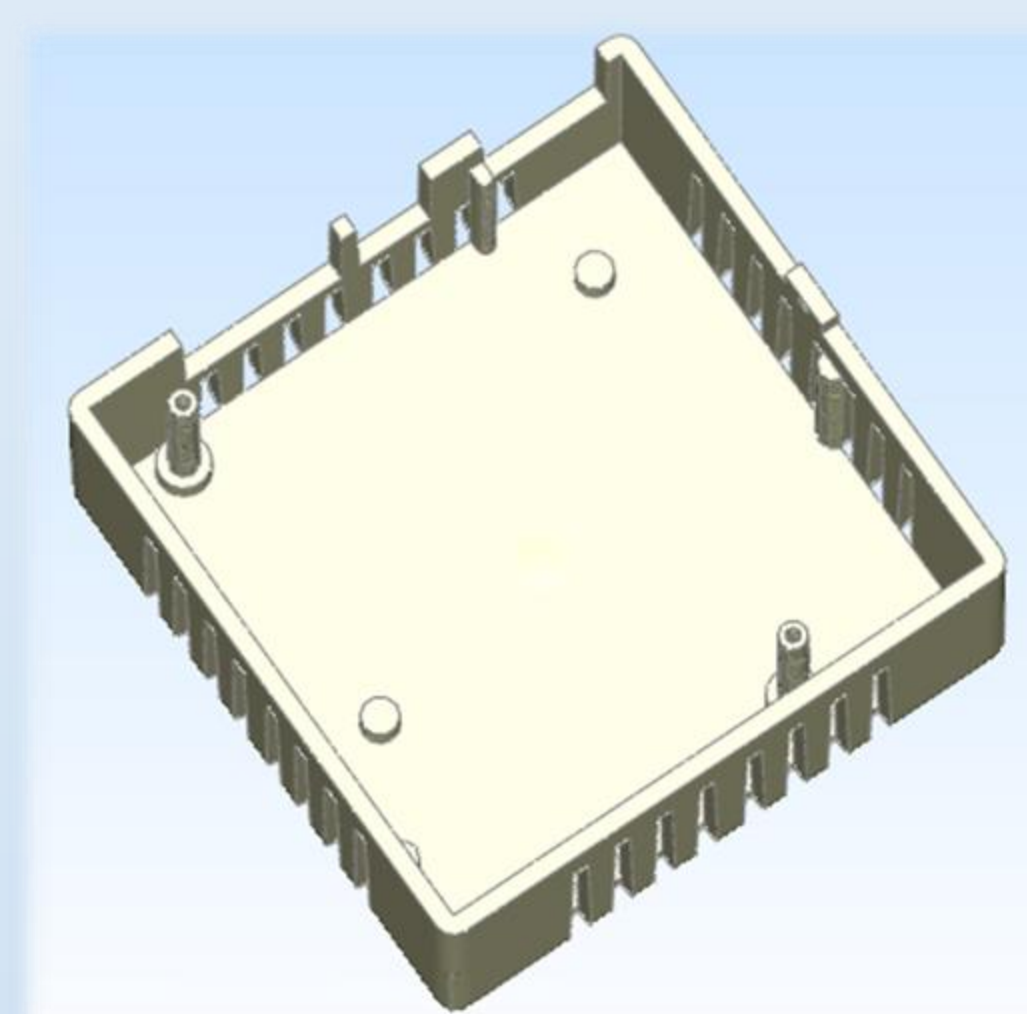
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The aim of this research is to investigate whether the cycle time of an injection molding can be reduced by using an additive manufacturing instead of traditional machining. The geometry of the chosen product is not so complicated, but it has a sufficient depth to make using of a deep tool insert. Additionally, the technology sheet of the product was available, the simulations are compared with the real production conditions. The simulation of the process was created with the tool and the cooling circuit of the selected product. After that the cooling circuits of the tool inserts have been modified so, that those can not be formed by machining anymore, only by additive manufacturing. Simulations were also made of the new cooling circuit thus formed.



Results

During the simulations, the temperature of the product and the tool, the degree of warping of the product were examined. The cooling time is determined: if 95% of the elements reached the ejection temperature was given on the technology sheet, the product can be removed safely. Based on the results obtained, the 21 second cooling time originally dropped by one second, representing a nearly five percent improvement of cooling time. Using the previous experiences on the cooling circuit, the injection molding tool was further upgraded. Thus, the required cooling time decreased to 19 seconds

Conclusions

- Injection moulding tool created by additive manufacturing is possible and has even attributes as tools created by cutting machining.
- In the case of simple product geometry, the use of additive manufacturing tools is not necessary
- In the manufacture of high-complexity products, the form-fitting cooling system (which is not possible with traditional manufacturing methods) can greatly increase productivity, due to more efficient heat shift and shorter cycle time.

