Design and simulation of thin-walled, laser-sintered polyamide front fairings for racing motorcycles

David Tasch*,1,2, Martin Schagerl[1] and Hans Lochner[2]

[1] Institute of Structural Lightweight Design
Christian Doppler Laboratory for Structural Strength Control of Lightweight Constructions
Johannes Kepler University Linz, A-4040 Linz, Austria
e-mail: leichtbau@jku.at – web page: http://www.ikl.jku.at/laboratory/

[2] KTM-Technologies GmbH
A-5081 Anif, Austria
e-mail: info@ktm-technologies.com – Web page: http://www.ktm-technologies.com

ABSTRACT

Additive manufacturing (AM) technologies, such as laser sintering, give the possibility to reduce lead time for aerodynamic test track parts whilst maintaining or increasing geometrical complexity. Many aerodynamic test track parts based on an AM design can be toollessly manufactured and evaluated regarding their aerodynamic performance. However, the AM parts have to provide the same ride quality as typical carbon fiber reinforced plastic (CFRP) parts with respect to stiffness, mass and handling requirements.

Mechanical properties of laser sintered (LS) polyamide (PA2200) exhibit dependency of wall thickness, influence of build position and laser sintering system [1]. The reduction of wall thickness decreases the already low mechanical properties compared to CFRP. To create thin-walled LS structures the limits of dimensional accuracy of laser sinter systems were investigated [2].

To reach stiffness and lead time targets with geometrically optimized substructures, an appropriate design and simulation process based on generic, shape optimized ribbed test specimens, topology optimized subcomponents and components in an assembly was developed. To find a compromise between design effort and accuracy for subsequent simulations, different approaches for designing these substructures on subcomponent level were evaluated. On component level the AM-design for the front fairing was compared with the CFRP-design in a finite element analysis.

With the simulation results we have demonstrated that it is possible to create laser-sintered structures which fulfill stiffness and mass requirements when using the investigated design approach. However, design freedom is time consuming in additive engineering in addition to the limits of commercially available computer aided engineering software on component level.

REFERENCES

[1] D. Tasch, A. Mad, R. Stadlbauer, and M. Schagerl, "Thickness dependency of mechanical properties of laser-sintered polyamide lightweight structures," *Additive Manufacturing*, vol. 23, pp. 25–33, 2018.

[2] A. Mad, "Prozesssimulation und Geometrieadaptierung dünnwandiger, lasergesinterter Leichtbaustrukturen," Master's thesis, Technical University Vienna, Vienna, 2019.