

## The Parametric Design of the Frame of Agricultural Machinery Cab based on Analysis of Ergonomics Data

Sha Liu<sup>1</sup>, Xue Yang<sup>2</sup>

<sup>1</sup>Faculty of College of Engineering, China Agricultural University in Beijing, China. E-mail: shashaday@126.com

<sup>2</sup>College of Engineering, China Agricultural University, Beijing, China. E-mail: 873949719@qq.com

The cab of the big-scale and medium-sized agricultural machinery is not only the main environment of the drivers operate the machine, but also by which the driver interact with the machine. Currently most China's agricultural machinery manufacturers will order the whole cabs for production, but not make them by themselves. Therefore to design the cab models by parametric customization would be better adapt to business needs and reduce the repetitive and mindless calculation and design. The design of cab mainly includes two types of parameters: the driver's ergonomics data and the constraint parameters provided by agricultural machine such as space area, etc.. In addition its shape should match the the whole style of the machine. The paper provides a parametric design procedure of cab's frame based on RhinoScript. Firstly the characteristics of a variety of cabs are analyzed and classified into several typical sorts; then the main ergonomics parameters and constraints of these cabs are extracted; finally the basic framework of the cab can be automatically completed on these data and constraints and a digital model can be generated by the chosen style of the agricultural machine.

**Keywords:** Agricultural machine, Cab, Parametric design, RhinoScript, CAD

### Acknowledgement

*This work was financially supported by Special fund for Agro-scientific Research in the Public Interest (20123024).*

### References

- [1] DONG, G. G. (2012). Research on CAD technology of crystal lamps. *Master dissertation*. Zhejiang University of Technology. Hangzhou, China.
- [2] LIU, Y. R., GOU, B. C., LI, B., YANG, Y. P. (2012). The development of the rapid appearance design system of fire fighting vehicle. In: *Science Technology and Engineering*. Vol. 12, No. 3, pp. 596-600. China.
- [3] SUN, H. (2010). Ship Design System Development Based on Rhino Software. *Master dissertation*. Harbin Engineering University, Harbin, China.
- [4] HU, L. J., CHEN, J., MAO, E. R. (2009). Ergonomic design of tractor cab. In: *Tractor & Farm Transporter*. Vol. 36, No. 4, pp. 6-8. China.
- [5] LIANG, H. S. (2012). Design and research of tractor cab based on Ergonomics. *Master dissertation*. Nanjing Agricultural University. Nanjing, China.
- [6] WAN, X. L. (2012). Design and research of high-power tractor cab. *Master dissertation*. Nanjing Agricultural University. Nanjing, China.
- [7] ZHOU, Y. M. (1988). The Ergonomics of Tractor. In: *China Machinery Industry Press*. pp. 142. Beijing. China.
- [8] WEI, L., LIU, S., WANGY, Q. (2013). Study of the Digital Method on Tubular Steel Chair. In: *Journal of Applied Sciences*. Vol. 13, No. 21, pp. 4355-4362. Elsevier, Amsterdam and New York.
- [9] VASILIKI, S. IOANNIS, F. (2005). A parametric feature-based CAD system for reproducing traditional pierced jewellery. In: *CAD Computer-aided Design V37*. pp. 431-449. Elsevier, Amsterdam and New York.
- [10] STAMATI, V., ANTONOPOULOS, G., AZARIADIS, P. H., FUDOS, I. (2011). A parametric feature-based approach to reconstructiong traditional filigree jewelry. In: *CAD Computer-Aided Design.V43*.pp. 1814-1828. Elsevier, Amsterdam and New York.
- [11] BREITENBERGER, M., APOSTOLATOS, A., PHILIPP, B., WUCHNER, R., BLETZINGER, K. U. (2015). Analysis in computer aided design: Nonlinear isogeometric B-Repanalysis of shell structures. In: *Computer methods in applied mechanics and engineering*. V284. pp. 401-457. Elsevier, Amsterdam and New York.
- [12] Rhinoceros. [Http://www.rhino3d.com](http://www.rhino3d.com).

- [13] CHOI, B. K. (1991). Surface modeling for CAD/CAM. In: *Advances in Industrial Engineering*, vol. 11, Elsevier, Amsterdam and New York.
- [14] COTTRELL, J. A., HUGHES, T. J. R., BAZILEVS, Y. (2009). *Isogeometric Analysis: Toward Integration of CAD and FEA*, Wiley, Chichester and West Sussex and U.K and Hoboken and NJ.
- [15] NAHM, Y. E., ISHIKAWA, H. (2006). A new 3D-CAD system for set-based parametric design. In: *International Journal of Advanced Manufacturing Technology*, v 29, n 1-2, pp. 137-150. Springer-Verlag, London
- [16] CUBONOVA, N. (2013). Postprocessing of cl data in CAD/CAM system edecam using the constructor of post-processors. In: *Manufacturing Technology*, v 13, n 2, pp. 158-164. Elsevier, Amsterdam and New York.
- [17] A. TEN TEIJE. INT.J. (1998). Construction of problem-solving methods as parametric design. In: *Human-Computer Studies*. Vol. 49. PP.363-389.
- [18] MA, Y. L., HEWITT, W. (2003). Point inversion and projection for NURBS curve and surface: Control polygon approach. In: *Computer Aided Geometric Design*. 20(2) pp.79–99.
- [19] SEQUIN, C. (2007). Computer-aided design and realization of geometrical sculptures. In: *Computer-Aided Designs and Applications*; 4(5). PP. 671–81.
- [20] BRONSVOORT, W., BIDARRA, R., VAN DER MEIDEN, H., TUTENEL, T. (2010). The increasing role of semantics in object modeling. *Computer Aided Design and Applications* 7(3). pp. 431–440.

---

**Paper number: M2016105**

Copyright © 2016. Published by Manufacturing Technology. All rights reserved.