

Optimization Design of Protective Helmet Structure

Guided by Machine Learning

Yongxing Chen^{1,2}, Junlong Wang^{1,2}, Peng Long², Bin Liu², Yi Wang², Tian Ma^{1*}, Xiancong Huang¹, Weiping Li¹, Yue Kang^{1*},

Haining Ji^{2*}

Systems Engineering Institute, Academy of Military Science, Beijing 100010, China

School of Physics and Optoelectronics, Xiangtan University, Xiangtan 411105, China

wangxhbjfu@163.com

goodluckky@163.com

sdytjhn@xtu.edu.cn

Supplementary Table S1. Identifier structure comparison table.

Number	Corresponding structure name
Ba1	Helmet width
Ba2	Side helmet width
Ba3	Helmet height
Ba4	Helmet quality
St1	Thickness of the forehead part of the helmet
St2	The vertical distance from the forehead to the top of the helmet
St3	Curvature of lower edge of helmet forehead
St4	Helmet front edge protrusion width
St5	The projected area of the forehead part of the helmet
St6	Helmet ear protection starting protrusion angle
St7	Overall protrusion angle of helmet ear protection
St8	Longitudinal curvature of the most anterior part of the forehead
St9	Lateral curvature of helmet top
St10	Longitudinal curvature of helmet top
St11	Maximum curvature of the longitudinal centerline of the front of the helmet
St12_1	Coordinates 1 of the maximum position of the longitudinal centerline curvature
St12_2	Coordinates 2 of the maximum position of the longitudinal centerline curvature
St13	The maximum curvature of the left and right sides of the front end of the helmet
St14_1	Coordinates 1 of the maximum curvature positions on the left and right sides
St14_2	Coordinates 2 of the maximum curvature positions on the left and right sides
St16	Starting angle of ear protection when viewed from the side
St17	Elevation angle of the lower part of the forehead when viewed from the side
St18	Elevation angle 1 of the lower side of the ear protection part when viewed from the side
St19	Elevation angle 2 of the lower side of the ear protection part when viewed from the side