THE SHAPE OPTIMIZATION FOR THE HOHLRAUM WITH OCTAHEDRAL 6 LEHS BASED ON A NOVEL FREE-FORM REPRESENTATION

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The Hohlraum is very crucial for the inertial confinement fusion. Usually, the Hohlraum is designed as cylindrical or rugby shapes with some kind of fixed functions such as ellipse, parabola or LAME, which leads to only one kind of shape be selected to build the Hohlraum. Recently, the spherical Hohlraum with octahedral 6 LEHS has been compared with cylindrical Hohlraum in [1-2], in which, only the ratio of the diameters of the spherical Hohlraum to centrally located capsule is optimized, and the Hohlraum has higher flux symmetry when it is 1.54. Since only the shape of the Hohlraum is fixed as sphere, whether or why such Hohlraum is optimal over other shapes such as Rugby or LAME needs to be investigated.

In this paper, we build a model of the Hohlraum with octahedral 6LEHS based on a novel free-form representation [3], or a Non-Uniform Rational B-spline Surface defined with order, B-spline shape function, control points, and their weights to investigate such problem. Based on NURBS, we can achieve the following:
1) Any complex Hohlraum shapes can be accurately represented.
2) All kinds of available Hohlraum shapes such as cylinder, rugby or sphere can be uniformly represented in one kind of mathematical form.
3) More parameters are allowed for shape optimization, and new optimal shape can be found with much higher flux symmetry and driven temperature.
4) And then it can be used to understand which or why the spherical Hohlraum is optimal.

Finally, the NURBS represented Hohlraum with octahedral 6LEHS is modeled on a view-factor based physical experiments design and optimization software –IRAD3D [4] for Shenguang III laser facility built 2011 in China. In such model, 10 shape parameters including control points and their weights are allowed to be optimized to achieve a higher driven flux symmetry on the centrally located capsule. The resulting shape shows that the spherical Hohlraum with octahedral 6 LEHS is optimal, which ensures us that the spherical Hohlraum has much higher flux symmetry over the other kinds of shapes.

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