Application of Computer Graphics to Headlights Dynamic Simulation Tests

Alexandre Wagner Chagas Faria*★, Arnaldo de Albuquerque Araújo★
*FIAT Automóveis S/A, ★DCC – Departamento de Ciência da Computação,
UFMG – Universidade Federal de Minas Gerais,
Av. Antônio Carlos, 6627,31270-010 Belo Horizonte, MG, Brazil
alexandre.wagner@fiat.com.br, arnaldo@dcc.ufmg.br

Abstract

In this work, we introduce an application of computer graphics to the validation of an automotive illumination system in dynamics conditions. We propose the creation of a virtual road, where it is possible to "drive" the vehicle for different kinds of tracks and to study the performance of the headlights in dynamics conditions on the road. The projection of the light is directly affected by the dynamics behavior of the vehicle [3] and texture of the road.

1. Introduction

In the competitive environment that globalization imposes to the industry nowadays, the demand for quality and time optimization for the development of components and systems is vital for industry survival. Such scenery leads us more and more to the research of means to find this optimization. Computer Graphics may provide good solutions to improve industry competitiveness. In this paper we present an application of Computer Graphics to the validation of an automotive lighting system in dynamics conditions.

Nowadays the validation of an automotive illumination system is achieved by the study of graphics obtained through photometric mapping of headlights, where it is possible to measure the distance of the light on the road, the opening and luminance with which the headlights hit the road.

The current system provides two types of graphics called ISOLUX CHARTS [4]: type A (vertical) provides a projection of the headlights into a screen (Fig. 1), and type B (horizontal) provides a projection of the headlights on the road. In both charts, the images are matrices of *MxN* pixels [2]. An image provided by the system may be defined as a two-dimensional function, $f(x,y)$, where x and y are the spatial (plane) coordinates, in degree unity for graphic type A and metric unity for the type B one, and the amplitude of f at any pair of coordinates (x,y) is called intensity or luminance in Lux.

The analysis of the graphics is considered to have a relative efficiency when used jointly with a subjective evaluation method. In the subjective method, several individuals of different ages, heights and professional activities drive the car through a track, of approximately 5 Km, without ambient lighting, so each evaluator gives a note, for each technical aspect of the headlights in evaluation. After all evaluators give their notes, it is made an average of all notes, to determinate which headlights have the best performance.

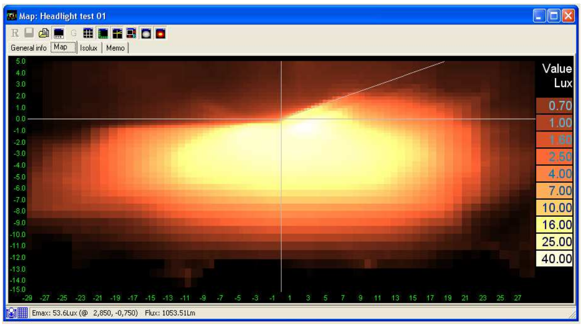

Figure 1: Chart of vertical Isolux.

2. Work proposal

Based in the situation explained above, it comes out the necessity for the development of a tool capable of providing a better performance evaluation of the automotive lighting system. We need a more efficient procedure capable to include in a controllable environment the technical data collected from our system and the subjective evaluation results. This work is being developed by FIAT Automobile Brazil S/A in partnership with the Computer Science Department of the Federal University of Minas Gerais, Belo Horizonte.

The new proposed system transforms the ISOLUX charts generated by the current system and loads them to the computer graphics environment, transforming the charts in a source of light, to emulate the headlights onto the road in dynamics conditions.

As final product of the development, we will have a tool capable to produce a movie or even making possible to drive in real time a virtual car on the virtual track, evaluating the performance of the illumination system on the road.

3. The development of the road

The developed road presents the most usual dimensions, to improve all kind of tests. A very important step on definition of the road is the correct choice of texture [1] to be used in the test road, the kind of texture is very important because it will affect directly on the effects of absorption and reflection of the light from the headlights. A first draw of the road is presented in Fig. 2, a straight road with a good opening for realization of the first tests of texture. Photos (Fig. 3) from real asphalt were taken to be used in the virtual road.

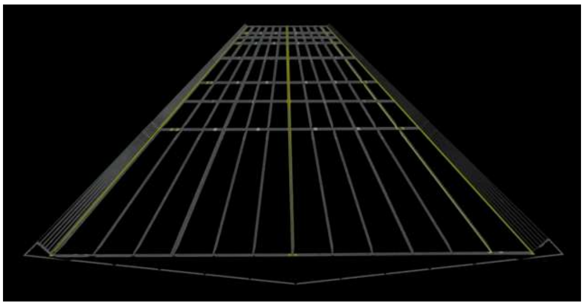

Figure 2: First draw of the road.

Figure 3: Photograph of the asphalt used as texture.

The texture (Fig. 3) was applied to a drawing of the road, the texture was multiplied several times and adjusted to the dimensions of the road's draw. The results are quite good, in Fig. 4, it is possible to see the texture of the asphalt on the road, with some lines that were inserted to look like a real highway.

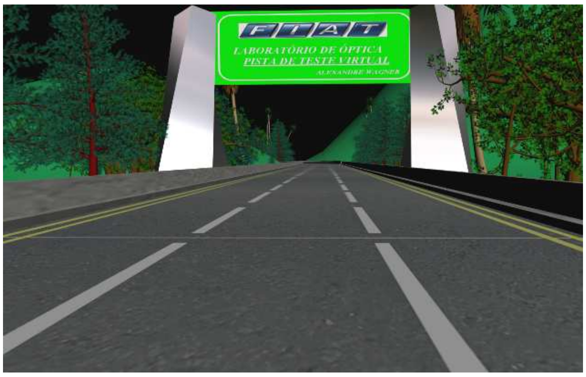

Figure 4: Highway simulation with the texture obtained from photographs taken previously.

Figure 5: Headlights simulation over the highway created with the real texture of asphalt.

4. Conclusions

After some tests, the results obtained until this point with the new proposed method has showed to be quite efficient (Fig. 5), the images generated by the new system provided a more realistic view to better evaluate the projection of the light on the road. Measurements on our real test road confirmed the efficacy of the Computer Graphics system.

5. References

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