

Making Accurate Drawings by Means of LaTeX

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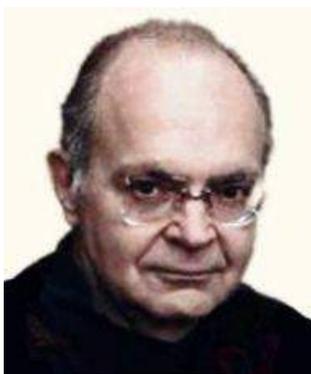
Abstract:- Computer technology is used ubiquitously in modern life. Mathematics and science education is not the exception. In our work, we investigate the possibilities of desktop publishing system LaTeX for application in the mentioned area. In our first paper in this direction, we have investigated the problem in general. In the second paper, we have considered our problem in application to plane geometry. Here we turn to the spatial geometry, namely, to the problem of easy and correct drawing of cone.

Keywords: ICT, LaTeX, TikZ, tkz-euclide

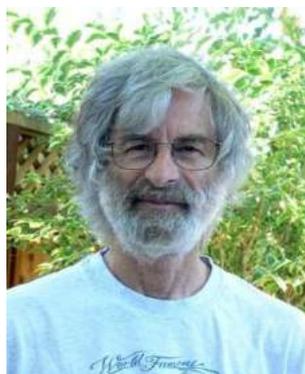
1. INTRODUCTION

LaTeX [1] is desktop publishing system made by Donald Knut [2] ("TeX") and Leslie Lamport [3] ("La"); see photos below. We showed with P. Monina [4] that made by these great programmers system LaTeX is the ideal tool for the integration of ICT and mathematics in the science teaching.

Generally speaking, LaTeX is best known as a system of computer typesetting and is popular among scientists because of its possibility to produce the complex scientific texts (mathematical, physical, technical, chemical, and even musical) of the highest typographical quality. But the ideal means of integration of ICT and mathematics it is due to its numerous extensions appeared in the last 15–20 years.



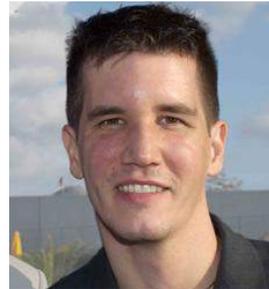
Donald Knut



Leslie Lamport

One of such extensions is the package **TikZ** and its extension **tkz-euclid**. Features of these packages are described in detail by their authors Till Tantau [5] (the first package) and Allan Mattes (Alain Matthes in French) [6] (the second package). From these descriptions we know that the packages (especially the

second) allow to produce and describe plane geometric drawings in the TeX notation in much the same way as in the ordinary course of geometry: **tkz Draw Point** (take a point), **tkz Label Point** (denote it), **tkz Draw Line** (draw the line), and so on.



Till Tantau



Allan Mattes

Recently, the author of this work in collaboration with P. Monina found [7] that the package **tkz-euclid** permits comfortably and quite naturally produce not only *plane* geometric but also *spatial* geometric drawings of the school type. To one example from these findings is devoted our note.

2. DRAWING A RIGHT CIRCULAR CONE

Now we illustrate the power of LaTeX with one drawing in the stereometry. Namely, we look at the problem of drawing a cone. In the literature and the Internet one can find a lot of incorrect drawings of cones similar to the following: one

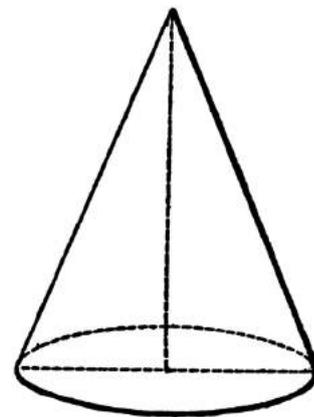


Fig.2. Incorrect drawing of a cone (from the Internet).

What is incorrect in this picture? The base of a cone must be represented by an ellipse. Contour generators of the conic surface must be tangential to this ellipse. But the tangent lines to the ellipse at the ends of any diameter are parallel. So, contour generators of the

conic surface (which both go through the point representing the vertex of the cone) cannot go through the ends of a diameter.

Now we must draw a correct picture of a cone. In order to do this, remember that ellipse is compressed or stretched circle. Let us choose compression. Draw a circle, select a point for the vertex of a cone, draw two tangents to the circle through this point and compress this picture along the height. We obtain a correct picture of a cone! To do this we use the package **tkz-euclide** [3].

Here is the code.

```
\begin{tikzpicture}
\tkzSetUpPoint[size=6]
\begin{scope}[yscale=.5]
\tkzDefPoint(0,0){O_1}
\tkzDefPoint(0,2.5){R}
\tkzDefPoint(0,10){A}
\tkzTangent[from = A](O_1,R)
\tkzGetPoints{B}{C}
\tkzDrawArc[dashed](O_1,C)(B)
\tkzDrawArc(O_1,B)(C)
\tkzDefPointBy[symmetry=center O_1](B)
\tkzGetPoint{B'}
\draw[dashed](B)--(B');
\draw (A)--(B');
\draw[dashed] (A)--(O_1);
\draw (A)--(B) (A)--(C);
\end{scope}
\tkzDefPoint(0,3.055){P}
\tkzDrawPoints(B,C,B',O_1)
\end{tikzpicture}
```

And here is the resulting picture.

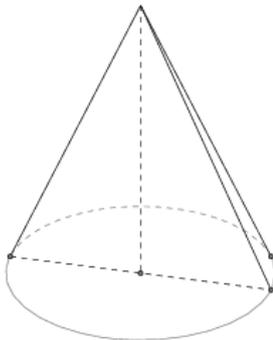


Fig. 3. Correct drawing of a cone

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