Generating animations of JPEG images of closed surfaces in space using Maple and Quicktime

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Too often, in undergraduate several variables calculus courses, surfaces are presented essentially only in the form,

$$z = f(x,y), \text{ or its variants, } y = g(x,z), \, x = h(y,z), \tag{1}$$

instead of the more symmetrical and versatile parametric form,

$$x = x(u,v), \quad y = y(u,v), \quad z = z(u,v). \tag{2}$$

Forms (1) are not very well adapted to evaluate surface integrals in order to illustrate, for example, the divergence theorem for closed surfaces in 3D space (such as a deformed sphere or twisted torus). Indeed, one must decompose the surface into smaller pieces and use several variants of (1) to compute double integrals which are then added or substracted taking into account various orientation issues.

In this talk, we show how to use periodic functions of u and v in the parametric form (2), to generate, via Maple, various large high quality JPEG images of closed surfaces in space for which the surface integrals are easily computed, among other things. Moreover, we also use QuickTime to pass from one surface to another in a very smooth animated way. Many examples as well as the Maple code used are given. Students are then able to easily generate their own surfaces and analyse their various geometrical properties in a very stimulating and colorful way.

References

[1] G. Labelle, *Des surfaces animées qui respirent dans l'espace*, Bulletin AMQ, vol. 50, no.4, 49-58 (2010). `http://archimede.mat.ulaval.ca/amq/Bulletins.html`

[2] G. Labelle, `http://www.lacim.uqam.ca/~gilbert`