

ZMATH 2005d.01720

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Geometry of surfaces using Maple.

N. Z. J. Math. 32, Suppl., 29-36 (2003).

Maple is being used to fundamentally change the teaching, learning and assessment paradigm for a third year mathematics subject for geospatial science students (surveyors) from the traditional lecture mode of two lectures per week to a lecture + computing laboratory "practical" mode. This is a very classical differential geometry "geometry of surfaces" subject which supports the study of geodesy. The content of the subject includes space curves (the Frenet apparatus), quadric surfaces (parameterization and plots), the metric tensor components (the first fundamental form, length, area and angles), the second fundamental form and the classification of shape of a surface, normal curvature, principal directions and curvature, the contravariant metric tensor, the Christoffel symbols and geodesics. All the Maple worksheets used have been developed by the author. This is an immersion course where the lectures are also (mostly) presented using Maple and all student computation is done using Maple. The examination (presented as a Maple file and in hardcopy) is conducted in the computer laboratory and the Maple files are submitted as the students' responses. The examination is marked from the electronic responses (without printing out the files). This course has been run for many years, with the first computing laboratory version introduced in 1998 using Mathematica. However, since we have a site licence for Maple, the course has been rewritten and developed using Maple since 1999. Using the computing laboratory as an integral part of their course is new, educationally effective and enjoyable for the students and for the staff.

Classification: G95

Keywords: geometry of surfaces; computer algebra; visualization; space curves; tensors; geodesic