Measuring and Quantifying the Surface-Roughness Anisotropy of Modelled and Industrially Produced Surfaces

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Abstract. 'Three-dimensional surface profilometry' when used for analysis and product specification reports roughness parameters that provide an average surface description over a relatively large area. Many commercial sheet steels are produced with special textured surfaces for tribological benefits or appearance benefits. These surfaces, as well as others, may demonstrate high levels of roughness anisotropy that is not quantifiable by simple three dimensional surface parameters. This anisotropy can play an important role in the surface appearance of the finished product and in the tribological behaviour during forming. The current work presents a method for quantifying surface-roughness features as a function of angular orientation with respect to rolling direction. The measurement methodology was applied to several model surfaces and one industrially produced electron-beam textured-surface (EBT). This methodology extracts multiple surface-height profiles of the same angular orientation from a single surface and calculates an average roughness parameter for the orientation angle based on the multiple profiles. Particularly interesting results were the large number of profiles necessary to obtain repeatable values for the roughness variation with respect to direction and the strong influence of surface feature size on the repeatability of said results. These results indicate that care must be taken when using a single extracted profile to represent a 'three-dimensional' surface.