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A Physically- Based Model for Rendering Realistic Scratches

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Individually visible scratches, also called isolated scratches, are very common in real world surfaces. Although their microgeometry is not visible, they are individually perceptible by the human eye, lying into a representation scale between BRDF and texture. In order to simulate this kind of scratches in synthetic images we need to know their position over the surface (texture scale), so we can determine where to use the speciï¬•c scratch BRDF instead of the ordinary surface BRDF. Computing the BRDF of a scratch is difï¬•cult because it depends on the scratchâ€™s invisible microgeometry. In this paper, we propose a new physically based model to derive this microgeometry by simulating the formation process of scratches. We allow specifying intuitively the parameters involved in the process such as the scratching tool, the penetration forces, and the material properties of the object. From these parameters, we derive the microgeometries of the scratches by taking into account the real behaviour of the process. This behaviour has been determined by analysing existing models in the ï¬•eld of materials engineering and some â€œscratch testsâ€• that we performed on metals. Our method has the advantages of easily simulating scratches with a wide range of microgeometries and taking into account the variability of their microgeometry along the scratch path. Another contribution is related to the location of the scratches over the surface. Instead of using an image of the paths as in previous work, we present a new representation based on curves deï¬•ning the paths. This offers an independence on the image resolution or the distance from the observer and accurately provides the scratch direction in order to compute scratch BRDFs

http://dx.doi.org/10.1111/j.1467-8659.2004.00767.x