Depth Profiling of Physical Properties by a Neural Network Approach

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Depth profiling problems represent a technologically important subclass of inverse problems, in which the depth dependence of a physical property P(z) is extracted from a signal spectrum S(f). In depth profiling methods the dependence of the probed depth below a sample surface on the adjustable parameter f is exploited. Often the information on the physical parameter of interest cannot be analytically extracted from the signal, and the solution of this so-called 'inverse problem' requires a dedicated signal analysis. In this work, we tackle a variety of inverse problems using a neural network approach. First a large number of simulated but realistic examples are generated, using a physical model to calculate S(f) from P(z). Then a neural network is optimized to extract P(z) values from S(f) for the examples and a later on for experimental signals. Besides photothermal depth profiling of thermophysical and optical properties, other neural network depth profiling applications are presented.