Design and Technology

The creation and the design of competitive industrial products needs a tuning of these products to the available equipment of production for an optimal output in quality and quantity. At a technological realization very often appears the contradiction of time and quality. A good product and technology design can minimize or avoid this problem. With the present computer performance is it more and more possible to explore the very complicated connection between product design and the useable technological equipment. This can be done by simultions cycles of product design and manufacture output (Fig.1). Thus the geometrical arrangement frequently dictates in a very decisive manner the properties of the final product.

For a given geometry can such properties be described with several mathematical methods. Unfortunately is the opposite way mostly not passable. This is the reason why efficient and effective computer modells are needed for this simulation cycle to reduce the expensive time consumption in the technology design phase and to have a competitve advantage of an optimal designed production process for a valuable product.

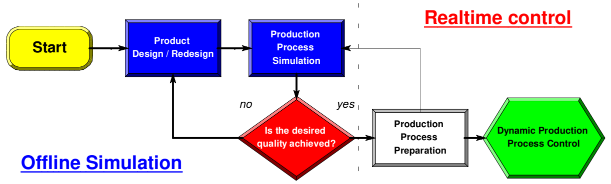

Fig. 1 Simulation Cycle

An Example: High Precision Trim Technology for Microelectronic and Hybrid IC's

It is necessary for a proper work of electronic circuits to adjust the electrical work parameters of the circuit. This will be mostly done by a change or adjust of several resistors on the circuit. Such adjustments will be made only one times while the production. The quality of the final product and the effectivity of the manufacture depends on the precision and the velocity of this process. Imagine the production of an precision measurement equipment for example.

Nowadays electronic resistors will be made as even flat films. The concrete value of the resistor depends on the used material, on the geometry and on the dimension of the film. For an adjustment the film geometry will be changed step by step with an qualified Laser cut. This irreversible process is called trimming.

To guarantee a high reproducible quality of the trim process is the knowledge about the trim characteristic and the trim sensetivity necessary. A trim characteristic is the functional dependance of the resistance change from the trim way length. The usual resistance distribution of untrimmed resistors in the actual circuit manufacture process complicate the situation, because this forces a dynamically adaption method in the production. Unfortunately is an analytical expression, that is a mathematical equation, for the trim characteristic unknown, so that only very expensive real world samples or numerical methods remain for an approximation of the characteristic. In the case of a numerical calculations these are rest on the partial differential equations for a stationary flux field, deduced from the well known Maxwell Equations (Fig.2). For this task a number of mathematical methods are applicable, e.g. FDM, FEM, FIT or BEM.

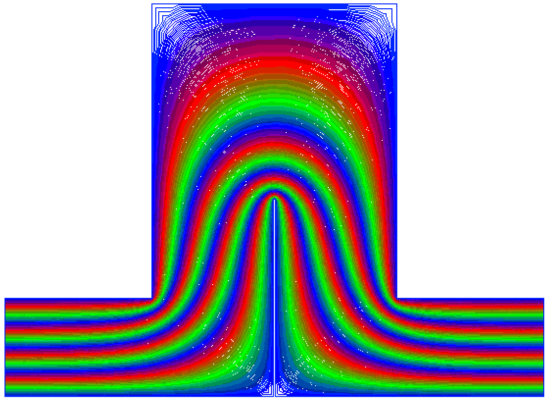

Fig. 2 Current flux field of a Top-Hat-Resistor with a Down-Top-Cut

Our Contribution

Particularly for the above mentioned application we developed a fast as possible algorithm to compute the trim characteristic and trim sensitivity (Fig.3). Found on these data we sythesize new and confirm existing film resistor design and trim rules (Fig.4). Under consideration of the origin resistance distribution we also code the suited control routines and determine the appropriate dynamic machine control data for the trim equipment.