An Application of the Finite Element Method for Flexible PCB Components Tense-Deformed State Simulation

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Abstruct - **In this paper the possibility of finite element method application is analysed for internal tensions design simulation in microbonds elements.**

Keywords - **finite element method, microbonds, internal tensions.**

I. INTRODUCTION

Various materials, having different temperature coefficient of linear expansion (TCLE) and modules of resiliency, are used in flexible PCB construction (metallic conductor and contact pads, dielectric base, silicon microchips). In the internal structures of various materials having mechanical deformation and stress in the thermal power and external influences. When the mechanic stresses reach the tensile strength and compressive, materials are destroyed.

The tasks of dissimilar materials connection stress-strain state research because of their complexity require the use of numerical methods, based on the computational domain discrete processing using the finite element method (FEM).

II. THE CONSTRUCTION OF MICROBOND MODEL USING THE FINITE ELEMENT METHOD

FEM allows to work with arbitrary geometry and shapes objects, which are composed of heterogeneous materials. The method consists in developing an analytical model of the object by removing unimportant details, the reduction of dimensions, splitting the object into finite elements (FE), preparing data for analysis and finding the best solution. The solutions accuracy depends on the proper choice of geometry, constructing the finite element grid (FE number, their shape and size), the boundary conditions and external influences, material properties validity.

The finite element method has been used successfully to solve various problems [1, 2]. This method is indispensable if you want to take into account the geometric features of regions - while the computer is used not only for solving systems of equations, but first and foremost - for discrete approximations formulation and construction.

The algorithm of calculating the microbonds stress-strain state method includes a module of source materials physical properties that used in microbond components.

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The basic properties of materials include: strength, stiffness, elasticity, flexibility and endurance. The choice of microbond construction materials must be justified, above all, by the mechanical strength, elastic modulus and the temperature coefficient of linear expansion.

The process of modeling microbond stress - strain state consists of two phases [1]. At the first stage, the maximum equivalent stresses in assembly materials based on the theory of energy changes form are determined. Then, the maximum equivalent stresses are compared with permissible for the material and concluded, if microbond design is sufficiently strong.

The fundamental principle of the FEM is in the physical partition of investigated area of the body to the elementary regions of finite size, which are called finite elements (FE). The method of approximation of a continuous medium by the finite element method is as follows:

- the microbond with the imaginary surface is divided into a number of the FE, all the family which is called the finite element mesh;
- finite elements are interconnected at finite number of points that are on the circuit elements and called nodes;
- the state in each FE (field displacements, stresses, temperatures, etc.) are treated with the help of interpolation functions and a finite number of parameters in the nodes.

To maintain the accuracy and informativeness there is choosed that model that best approximates the corresponding boundary value problem.

III. CONCLUSION

In this paper we analyze the possibility of using the finite element method for microbonds monitoring. Microbond monitoring is necessary to increase the reliability of electronic module whole construction resource of work. One of the main monitoring tasks is to investigate the influence of the technological process factors on the residual stresses value and thermal-strength reliability of microbonds. This research is convenient to carry out on the model constructed on the finite element method basis.

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