Virtual laboratory of microelectronic mounting and packaging technologies

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Abstract **- This paper deals with a subsidiary module for e-learning system. The work is focused on enhancement of students and public interest about microelectronic mounting and packaging technologies with support of thermo-mechanical modelling in ANSYS. The work arose from needs of new approaches in education system. Web based education is getting more and more popular in education process. Other idea of this work is to present new technologies, especially to students, that are not available at the Department of Microelectronics by the reason of financial or staff terms. The module is based on web content technologies (HTML, CSS, PHP and Macromedia Flash). The module should be able to show microelectronic packaging technologies in process. It will be provided mainly by Flash based multimedia content (2D/3D interactive animations and pictures) accessible via internet. User will be able to study these processes alive. Also will be able to change input parameters and see how this will affect final result. The module should present microelectronic mounting and packaging technologies to students and gain their interest in these technologies.**

Index Terms - virtual laboratory, e-learning, distance learning, mounting technology, packaging technology, microelectronics, ANSYS

INTRODUCTION

E-learning brings advantages for both tutors and students. Further, it provides access to education for students whose geographical location, family responsibilities, or work schedules might be incompatible with traditional classroom instruction. Other push factors driving the expansion of E-learning initiatives are the shift to lifelong learning and the changing demographics of students engaged in higher education. In most cases, media has been used to supplement traditional forms of teaching, but never to its full potential. The challenge in higher education consists mainly in the necessity of finding ways to integrate technological innovations in a highly differentiated educational system and to adapt them to the inherent logic of the system as well as to the concrete local institutional framework of the involved organization [1] and [2].

The project arose from needs of new approach in education process, which covers well balanced ratio between classical education process and ICT (Information and Communication Technology) based education process.

PROJECT STRUCTURE

Final output of the project is web based E-learning portal divided in two main parts and will be placed on the homepage of Department of Microelectronics. The public part is accessible to all users and contains news, links, technologies and equipments descriptions and animations. The second part is only accessible to bachelor and master degree students and contains study agenda, test modules, forums etc.

Whole project is based on HTML [3], CSS [4], PHP [5], MySQL [6] and Macromedia Flash [7] technologies.

Virtual laboratory module

The virtual lab module shows microelectronic technologies in process. It is provided mainly by Flash based multimedia content (2D/3D interactive animations and pictures) accessible via internet. User will be able to study these processes alive. Also will be able to change input parameters and see how this will affect final result. Animations are supplied with description of appropriate technology process.

Figures 1 to 5 show frames of selected microelectronic technologies animations.

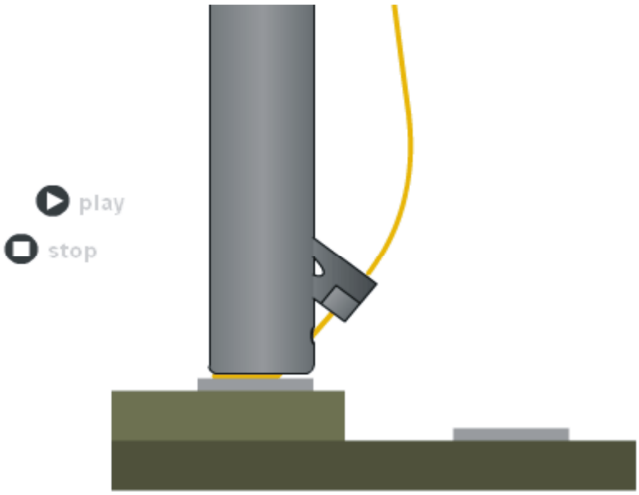


FIGURE 1
ULTRASONIC WIRE BONDING (FRAME A)

This project part describes following technologies:

- thick film technology
- thin film technology
- PWB manufacturing

- SMT technology
- packaging technology
- thermal management and ANSYS modelling.

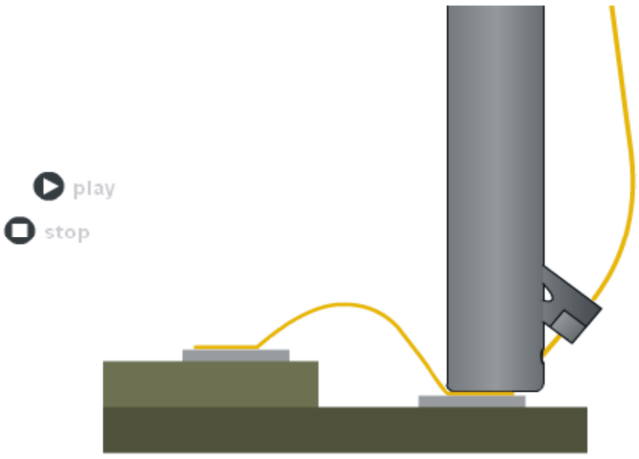
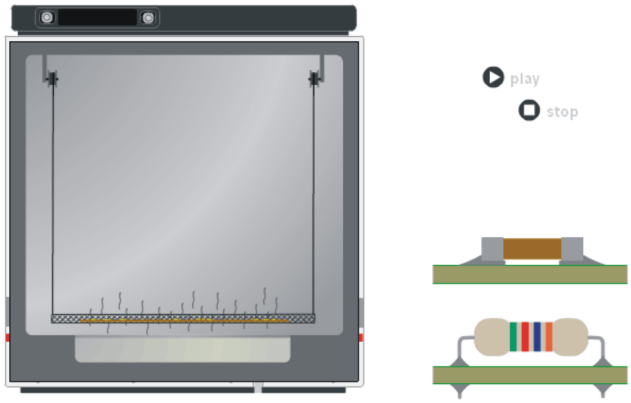


FIGURE 2
ULTRASONIC WIRE BONDING (FRAME B)



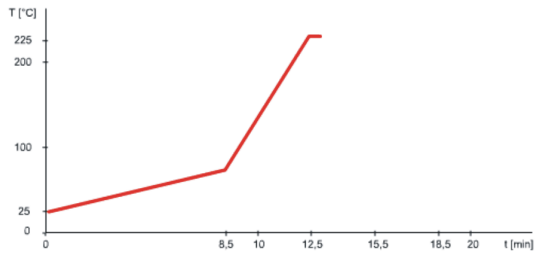


FIGURE 3
VAPOUR PHASE SOLDERING

FIGURE 4
AUTOMATIC SMD PICK & PLACE SYSTEM (FRAME A)

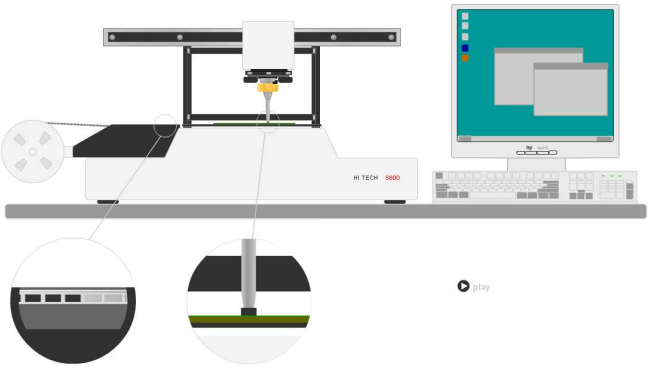


FIGURE 5
AUTOMATIC SMD PICK & PLACE SYSTEM (FRAME B)

Figures 6 and 7 show mathematical modelling of physical properties. This part is also based on interactive Flash animations, where users can change input parameters (material type, input conditions etc.) and watch how these parameters affect final results.

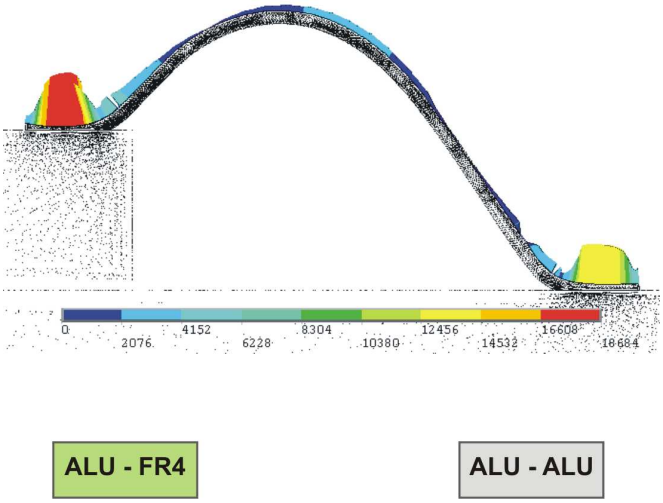


FIGURE 6
STRESS DISTRIBUTION ALU – FR4 STRUCTURE

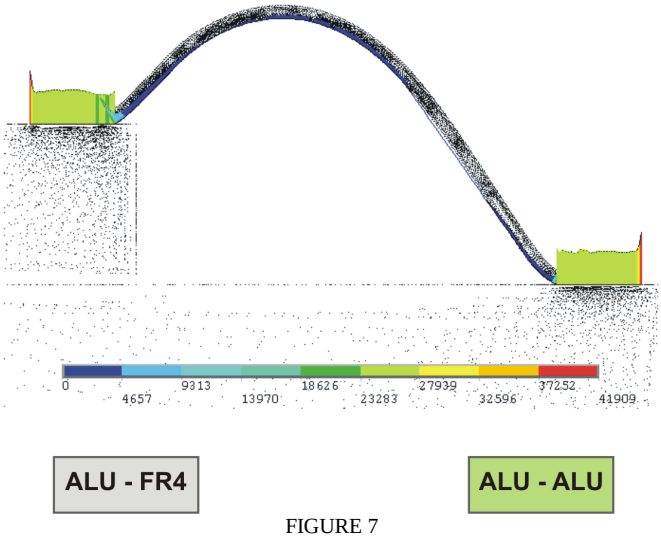


FIGURE 7
STRESS DISTRIBUTION ALU – ALU STRUCTURE

Internal module

Internal module handles students agenda who attend courses at Department of Microelectronics, FEEC, BUT. The agenda contains these parts:

- laboratory reports control part
- test examination part
- forums related with themes of Virtual laboratory module
- other study materials related with microelectronic technologies
- administration related parts
- etc.

Users will dispose different types of access rights, as shows figure 8, to different parts of both modules.

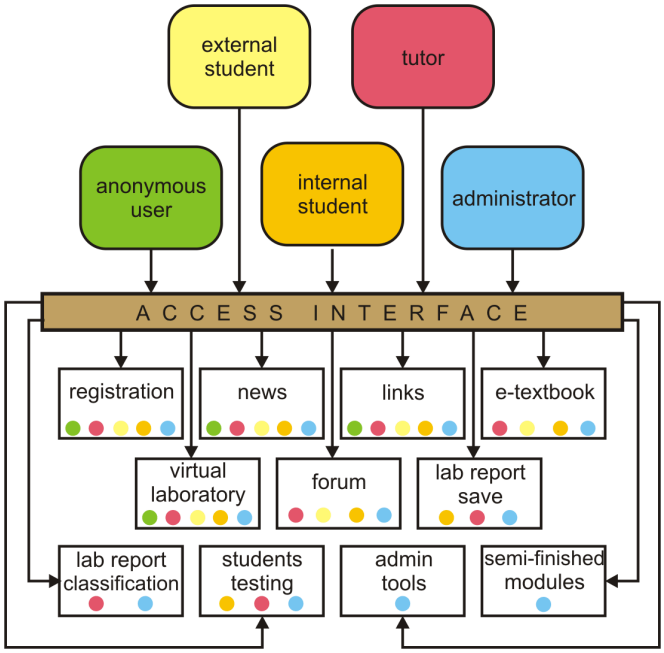


FIGURE 8
USERS ACCESS RIGHTS DIAGRAM

CONCLUSIONS

Information and communication technologies (ICT) bring new possibilities to different branches of industry and also higher education process. Educational model based on ICT removes place and time dependent limitations. In comparison with classical educational model, ICT offers to students much more information resources. The possibility to share information in world wide basis creates from internet rich source of education information and wide global cooperation of scientists, tutors and students.

As well as in most of the cases the best solution is somewhere between both, classical education approach and ICT based education process. Final aspect ratio between classical and ICT based education process differs concerning different fields of application.

ACKNOWLEDGMENT

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REFERENCES

In Czech language

[1] Květoň, K., *Základy e-learningu 2003.* Ostrava, University of Ostrava, 2004, 1st edition,61 pp, ISBN 80-7042-986-0.

[2] Zlámalová, H. *Příručka pro autory distančních vzdělávacích opor: jak tvořit distanční studijní text.* Praha, Centrum pro studium vysokého školství, Národní centrum distančního vzdělávání, 2006, 1st edition, 67 pp, ISBN 80-86302-39-3.

Internet resources

[3] http://www.w3.org/html/

[4] http://www.w3.org/Style/CSS/

[5] http://www.php.net/

[6] http://www.mysql.com/

[7] http://en.wikipedia.org/wiki/Macromedia_Flash