Physics and Art: Doctoral Study

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Abstract

This contribution summarizes the experiences obtained during years 1997 - 2003 from leadership of diploma and postgraduate students of science group at Institute of Physics of Technical University Ostrava. The activities have been concentrated both on the basic research (magneto-optics of planar and periodic structures, dark mode spectroscopy, and magneto-ellipsometry) and the applied research and realization (magnetic nondestructive defectoscopy and diagnostics). One of the most steps to support the physics education is to extend this process to the aesthetics and the humanities. The aspects with the preparation of the doctoral theses on the base of the internal cooperation are discussed in detail.

Introduction

The doctoral degree requires completion of a research project at a professional level as well as excellent performance in the courses. At Institute of Physics of Technical University in Ostrava we try to solve the theoretical and experimental doctoral research projects in the framework of domestic and international grants. To improve and make the doctoral study more attractive it can be achieved by the incorporation of Ph.D. students to international research teams, realization of the doctoral thesis under foreign supervision, preparation of the common experimental arrangements, and publication advancement in the referee journals [1, 2, 3].
To improve and make the doctoral study more attractive we can make steps both on national and international level:

- the incorporation of Ph.D. students to international research teams and the interchange of students
- the realization of the doctoral thesis under the supervision of two or more advisors from different countries
- the preparation of the common experimental arrangements
- the publication advancement in the referee journals
- the compatibility of the doctoral programs
- the international examining boards

1 International research teams and Ph.D. study

The work of research group has especially experimental character. That is the reason why it was necessary to start and widen the international partnerships with European and non-European universities:

- the study of selected students on top workplaces
- the compatibility of study programs
- the provision the technical background (experimental samples)
- the extension of experimental possibilities

2 Doctoral thesis under the supervision of two advisors from different countries and the international examining boards

This eventuality has been realized in the frame of Barrande project (Czech-French co-operation). The doctoral studies have been successfully finished by vindication of doctoral theses ”Light propagation in magneto-optical multilayers. Magnetization behavior” and “Etudes des propriétés magnétiques, par méthode magnéto-optique, de systémes de couches minces pour l´électronique de spin“ to Czech-French boards. The academic councils of relevant universities awarded to the doctoral students Ph.D. degree that is valid both in Czech Republic and France.

3 Preparation of the common experimental arrangements

Mobility and interchange of graduated and Ph.D. students brings new inspirations for development of measuring systems and faster application of new elements in experimental practice. One example : 2D generators of rotating magnetic field (Maltesian cross model, O-ring model) for magneto-optical study were developed and manufactured in laboratories of Department of Physics VŠB-TUO and consequently applied in experimental configurations at Institut National des Sciences Appliquées de Toulouse (INSA), Simon Fraser University (Vancouver), and Université Paris Sud.

4 Publication advancement in the international journals

- the presentation on domestic seminars
- the lecture (poster) in the frame of international conferences
- the paper for presentation in journal

5 Participation of top international experts on doctoral study

- **the realization of skilled seminars**
- **the consultation of some special problems with students**
- **the experimental samples and data replacement**
- **the preliminary of collective projects concentrated on the students' mobility and on the cooperation in basic and applied research**
- **the preliminary of collective science publications and presentations**

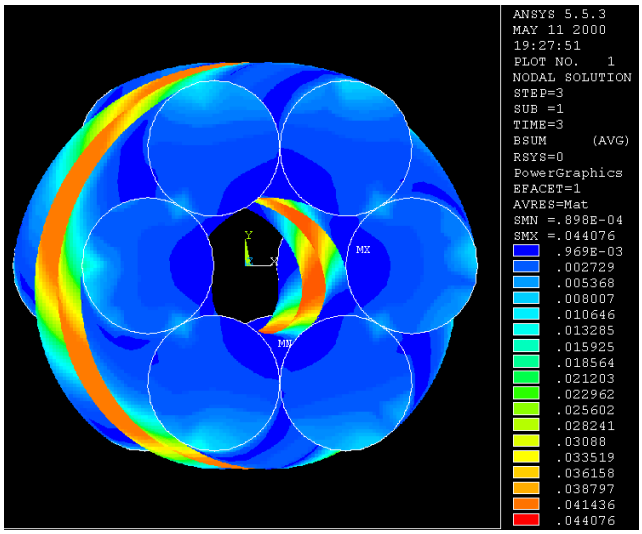

Figure 1. Distribution of magnetic field in magnetized wire rope.

6 Long time scholarships

- the participation of international expert on running theoretical and applied research
- the realization of lecture sets dealing with concrete problems
- the leadership of students' seminar works

One of the most steps to support the physics education is to extend this process to the aesthetics and the humanities. This approach is concretely declared in our contribution by electromagnetic field modeling. The strength coupling between physics description and art is documented by the order of pictures describing the distribution of magnetic field in the magnetized bodies and youkes of the generators of magnetic fields, which have been modeled and constructed for basic and applied research (see Figs. 1, 2).

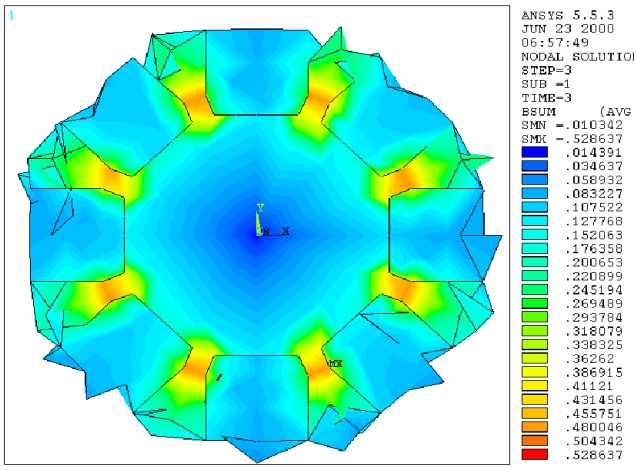

Figure 2. Field distribution in the cavity of magnetic generator.

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