

PROJECT NO. 125/ CP/I/2007
COMPLEX LABORATORY FOR THE DIAGNOSIS, RELIABILITY ANALYSIS
AND PREDICTIONS OF MECHATRONICS EQUIPMENTS INTEGRATED IN
THE FLEXIBLE MANUFACTURING CELLS

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Abstract. In this paper to present the project no. 125/cp/I/ 2007 named “Complex laboratory for the diagnosis, reliability analysis and predictions of mechatronics equipment integrated in the flexible manufacturing cells”, financial supported in the framework of PN II/ Program 2 Capacities.

1. THE INTEGRATION OF THE PROJECT IN THE FUNDAMENTAL OBJECTIVES OF PROGRAM 2. CAPACITIES

The quality of mechatronics equipments integrated in flexible manufacturing cells (MEIFMC) becomes a more complex problem in comparison to the classical theory for the quality of the systems, both because of the complexity and of the heterogeneity of these systems. All these aspects have influences also upon the temporal dimension of quality – reliability, requiring to considering, in a greater and greater proportion, of the security and safety aspects in the function of MEIFMC.

The diagnosis, reliability analysis and synthesis of MEIFMC require advanced modeling, simulation and prediction techniques. The mechatronics equipments with application in manufacturing of our university are not integrated in flexible manufacturing cells. Most of these equipments are in part overcome and cannot be used for the essential diagnosis, reliability MEIFMC modeling and prediction activities.

The aim of this project is to develop a complex research laboratory, which allows researchers to work with high performant equipments in an interdisciplinary field. The development of the project will conduct to the first laboratory in our country in the field of diagnosis, reliability modeling and prediction of MEIFMC. One of the main advantage of this laboratory will be its open character, that means the possibility to add new components corresponding to real, specific and particular problems, due to the complexity and heterogeneity of MEIFMC.

The research infrastructure developed in this project will contribute at the improvement of capacity and efficiency of the research activities. The adequate hardware support and specialized software will offer one of the most modern systems for the diagnosis and reliability prediction of the present equipments, contributing to the development of human resources both at the academia and the young researchers and doctoral students level.

The project is also correlated to the thematic area and domains of European Research Area, and will sustain the participation and integration of Romanian research in the common researches with similar organizations at the european and international level.

In conclusion, the project responds to the fundamental objectives of the Program 2. Capacities, and particularly to the specific objectives of Module I. The development of research public infrastructure.

2. THE GENERAL AND SPECIFICS OBJECTIVES OF THE PROJECT

By its development, mechatronics has imposed as a synergetic combination of mechanics, electronics and information technology, which aims to increase the flexibility and efficiency of these systems. The structure of MEIFMC is based on heterogenic equipments, with a higher and higher degree of complexity and intelligence.

A MEIFMC is an integrated complex, conducted by computer, of Computer Numerical Control flexible manufacturing machines, automated components for the manipulation of the pieces and testing equipments, which can manufactured any products in the limits of a capacity and manufacturing algorithm,

One of the main problems concerning the knowledge about the diversities of relationships, influence and causal determination between failure phenomena of MEIFMC, as well the knowledge of physics processes and the causal determination between them, at each subsystem and at the whole system level, is that of a poor quantitative information. This leads to a relatively high degree of uncertainty in estimation the reliability and safety of MEIFMC.

In this framework and taking into account the necessity of upgrade and extend the research infrastructure in universities, the strategic objective of the project is the development of the first laboratory in our country for the diagnosis, reliability modeling and prediction of MEIFMC.

In order to accomplish the strategic objective, the following specific objectives were established:

- a) development in the laboratory of a state of art MEIFMC system;
- b) integration in the laboratory of a system for MEIFMC diagnosis using vibration analysis;
- c) integration in the laboratory of a software module for the identification of function states of MEIFMC using fuzzy techniques;
- d) integration in the laboratory of a software module for the reliability analysis and prediction of MEIFMC;
- e) integration in the laboratory of a software module for the inspection planning and renewal policies design of the MEIFMC.

The development of the project will lead to the improvement of education programs of future engineers, master and PhD students. It must be noticed the participation of young researchers at the each stage of the project. In this way, they will be able to develop and increase the researches capabilities and to consider the research work as an viable solution for their careers.

3. THE ACTIVITIES OF PROJECT

The project includes 3 stages, in concordance with the specific objectives of the project. For each stage, a research team was established, with one or two responsables for the accomplishment of the stage. There are several activities in each stage that will be deployed in a specific schedule. The activities included in each stage are eligible activities for the

Module I, the purchasing and integration in the laboratory of research and development (RD) equipments (including putting in function and personal training).

Stage 1. Technical study- will be carried out in the first three months after the sign of the project. The stage includes 4 activities and at its end the entire team members will know the adaptation possibilities of the existing software modules at the specific requirements of laboratory (Software module for the identification of function states of MEIFMC using fuzzy techniques, software module for the reliability analysis and prediction of MEIFMC, software module for the inspection planning design of the MEIFMC, software module for the renewal policies design of the MEIFMC). At the end of the stage, the report documents will be elaborated.

Stage 2. The extension of the research infrastructure of the laboratory – will be carried on in the first 6 months of the year 2008 and contains 6 activities. At the beginning, a state of art mobile system for spectral analysis of vibrations will equip the laboratory, which will allow the diagnosis of MEIFMC. After the purchasing and integration in the laboratory, this system will be tested and the training of the team members will be carried out. Because there are only few experimental data about the identification of MEIFMC function states, a software module for the investigation of MEIFMC function states using fuzzy techniques will be adapted, integrated and tested. The necessary components for the development of the laboratory will be purchased and then they will be integrated with the other equipments. At the end of this stage, the testing of the MEIFMC will be performed, as well as the training of the team members which will work in the laboratory. The stage will be finished with a research report.

Stage 3. The analysis, prediction , maintenance of MEIFMC and dissemination of the project results – will be deployed in 6 months and involves 12 activities. The integration and testing of existing software module for reliability analysis, prediction and simulation of MEIFMC components will be carried on in this stage. The integration and testing of software modules for the design of optimal predictive and preventive maintenance strategies will be also performed.

The presentation and dissemination of the project results will involve: the development of a Web page of the laboratory, the presentation of the laboratory on the web page of scientific organizations, different workshops at the national/international conferences, at the interested industrial companies. A guide with the good practices for the intellectual property rights will be elaborated, too. The final report will be realized at the end of the stage.

4 . THE NECESSARY OF HUMAN RESOURCES, THEIR EXPERIENCE FOR THE PROJECT

University of Oradea is the only participant in the project. All the team members have experience and competences in the field of the project. The responsible of the project has the scientific, technical and managerial experience in the field and the number of team members was established to fulfill the stages of the project on a period of 15 months.

The team is composed by: one responsible (with a PhD degree in the project's field), one scientific coordinator (with a PhD degree in the project's field), 12 researchers (one PhD adviser, 8 people with PhD degrees and 3 PhD students) and 3 engineers (2 are PhD students).

Each project stages is coordinated by one or two responsables and in function of stage complexity, involves several researchers. The responsables of the each stage hold a PhD degree in the field of stages activities, while the researchers are doctors or PhD students in the stages fields (only one member of the team is not PhD student, but in this fall he will participate at the competition to be accepted as PhD student at our university). The participation of young researchers at each stage of the project must be emphasized. The participation of the team members at the project' stages is presented in Table 1.

Table 1. Participation of each team member at the project's stages

Year	Stage	Coordinator(s)	Participants
2007	Stage I. Technical study	Baban Calin Florin, Pele Alexandru Viorel	Radu,I., Moga,I., Suteu,M., Meszaros, C. , Pasc I., Stanasel, I.,
2008	Etapa II. The extension of the research infrastructure of the laboratory	Blaga Florin Sandu, Bungau C-tin	Stanasel,I., Moga, I., Buidos, T., Baban M, Pop, A., Hirte, D., Radu, I., Pasc, I., Suteu M,
	Etapa III. The analysis, prediction ,maintenance of MEIFMC and dissemination of the project results	Baban Marius, Vesselenyi Tiberiu,	Blaga, F., Pele, A., Pop, A., Fazekas, M., Meszaros, C., Popentiu Florin

5. CONCLUSION

The impact of the project consist in: a) the development of romanian RD system capable to obtain knowledge, experience and results in a high scientific and technological field and to transfer toward the intern economic and social environment for the increase of its competitiveness; b) the development of research perspective in this field; c) the development of new directions and opportunities for the participation in FP 7 program; d) the development of new research opportunities for the young researchers in the field, in an interdisciplinary environment.

6. REFERENCES

1. http://www.mct.ro/ancs_web/index.php?action=view&idcat=228