NETTING OF STUDENTS TO THE GRINDING PROCESS MONITORING

Nataša Náprstková[1], Vladimír Náprstek[2], František Holešovský[1]
[1]Jan Evangelista Purkyně University in Ústí nad Labem, Faculty of production technologies and management, Department of Technologies and material engineering, [2]RWE
naprstkova@fvtm.ujep.cz, vladimir.naprstek@rwe.cz, holesovsky@fvtm.ujep.cz

Abstract. Article describes joining of students into building of site for monitoring of grinding process at Faculty of production technologies and Management of University Jan Evangelista Purkyně in Ústí nad;Labem. As the other university, at FPTM students may take place at research works, generally when they prepare diploma work.

Key words: grinding, monitoring, work place.

Introduction

Joining students into research tasks at universities is inseparable part of teaching process. At University of Jan Evangelista Purkyně in Ústí nad Labem we keep this idea, too. We join students into heterogeneous tasks. At FPTM we provide some research in a few labs and one of our research targets is a grinding process. Here we do some experimental work targeted at characters of grinding wheels, integrity of resulting surface, influence of working liquid and monitoring of grinding process itself. And this research is one of that we join our students.

Working place for grinding process monitoring

Nowadays at FPTM we work on monitoring of grinding process using grinder BU 16 (Fig. 1). Building of this monitoring workplace is long term task. And here is a place for students and their force. In this research – ie. monitoring workplace – students work for a few years.
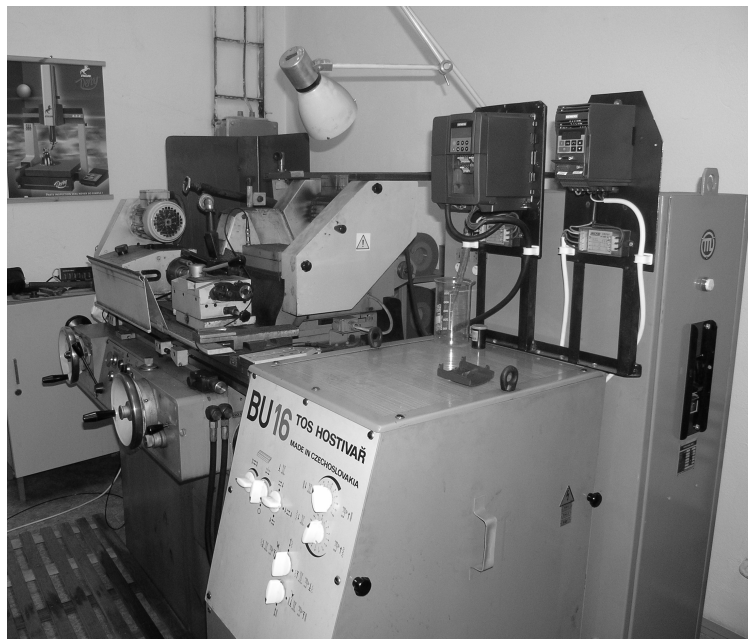

Fig. 1. **Grinding machine BU 16**

One of the first task was gathering, describing and designing necessary resources required to establish monitoring workplace using grinder BU 16 (one machine available in our labs) and achievable at FPTM. It was really beginning of our research of our monitoring workplace. See Fig. 2 showing one of the first monitoring workplace design, based on students work and their results.

In that phase students may discover many devices and their possibilities. They may communicate with their producers or suppliers; see how to create real working design and what details they need [1, 2, 3, 4].
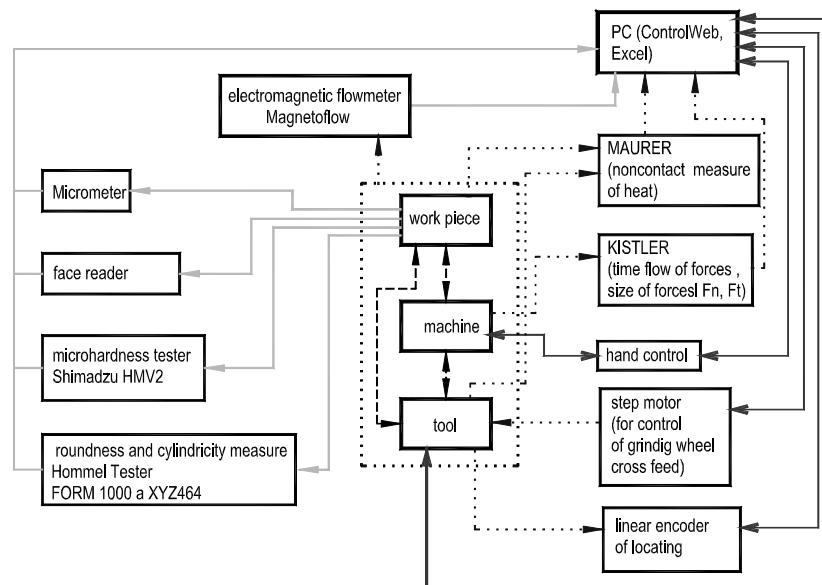
Fig. 2. **Example of one student design of block diagram
of the monitoring target solution on the BU16:** ——— – postprocess values;
·············· – process values; ——————▶ – information flow;
━ ━ ━ ━ ━ – bind machine – tool-workpiece

In the next phase students were dealing with further design and installment of each single part. They design, for example, attachment for step engine and installing at controlling board of the grinder. On the Fig. 3 and 4 there are demonstration of possible solution. Students applied their knowledge of CAD software Solidworks – our next subject [5, 6, 7].
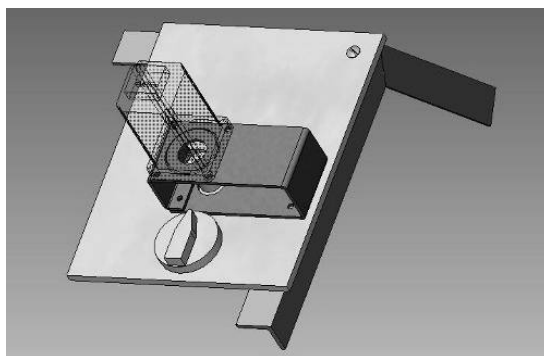

Fig. 3. **Sample of possible solution of step engine installment at controlling board of BU 16**
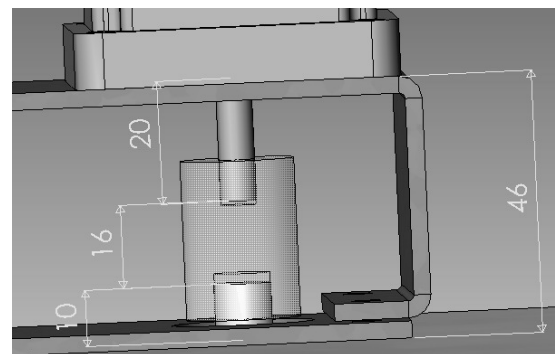

Fig. 4. **Sample of connection of step engine and shaft, dimension sketch**

One of the following task that students solved was design of measurement of decreasing of grinding wheel using microwave devices. Fundamental of this method is to split microwaves from source (H) into measuring and comparing branch. In both branches are reflections and sensor gets two signals.

One is reflection from measured element and second is influenced by control elements - paralleling apparatus, calibrated attenuator. If reflected microwaves are on different intensity, input in output measuring branch is signal responding difference between those two reflected signals. At the beginning can reach zero difference (bridge alignment). Then grinding wheel loss changes reflection in measuring branch and in output branch appears non zero signal. Using additional equipment we cat value of signal convert into value of grinding wheel loss. As we mentioned above, experiments are taken on machine BU16 in FPTM labs. Until now, experiments are successful and research of this method is supposed to be continued [8, 9, 10].
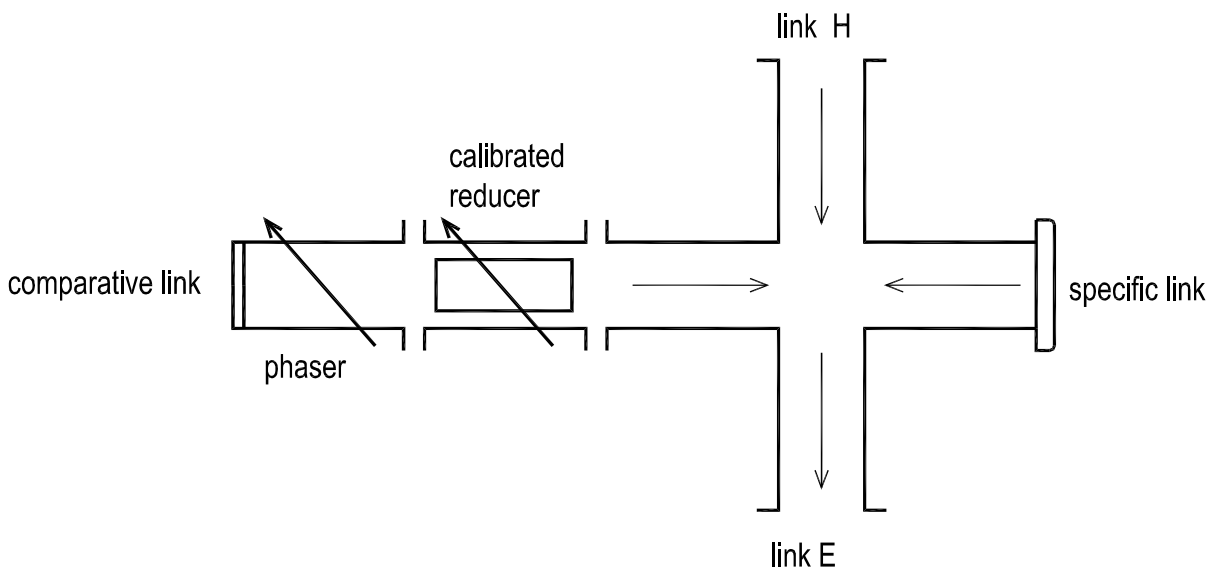
Fig. 5. **Bridge T**

Another task, we solved within a realization of grinding process monitoring workplace and students cooperated was choosing of suitable software allowing to develop of necessary program for connection of all measuring devices, retrieving measured data and storing them into appropriate database or controlling of grinding process. Students cooperates in searching of suitable software (they had to get acquainted with functionality of each software tools and choose applicable only; they walked through a SCADA/HMI software category targeted to monitoring of technological process). Then students helped with developing of necessary application intended to measure grinding process, it's controlling and storing data into database for later analysis. Sample of one version is shown on Fig. 6. Students got knowledge about functionatily of different software and programming skills when developed our application [11, 12, 13].

Fig. 6. **Data-entry form**

Conclusion

Students are joined continuously into solving of monitoring workplace during working on their diploma papers. They are joined into other reason – (extra student programme) for example within new based Ph.D. studies. Students may get practical skills and new knowledge. Therefore joining students into research activities is valuable for students and for FPTM too. According to our practice we intend to continue in joining students with further developing our monitoring workplace of grinding process.

References

1. L. Buriánková. Řízení procesu broušení s aplikací na brusku BU16, Bakalářská práce, UTŘV UJEP, Ústí nad Labem ,2003.
2. V. Popeová; N. Čuboňová; J. Uríček; D. Kumičáková. Automatizácia strojárskej výroby. Žilina: EDIS ŽU Žilina, 2002. ISBN 80-8070-009-5
3. K. Vasilko, G. Bokučava. Brúsenie kovových materiálov. Bratislava: Alfa, 1988.
4. F. Holešovský, N. Náprstková. Automation of the Grinding Machine Working Cycle. In CEEPUS: Science Report, Project PL-1, Computer-Aided Systems for Manufacture and Measurement of Machine Elements. Kielce: 2003, str.125-134, ISBN 83-88906-30-5.
5. J. Brabec. Instalace řídících a monitorovacích prvků na brusce BU 16 pro monitorování a řízení procesu broušení, Bakalářská práce, ÚTŘV UJEP, 2005
6. P. Hrabě, M. Miller. Abrasive wear resistance of overlay material. 9. Mezinárodné vedecké sympozium Kvalita a spolehlivosť strojov. Nitra: 2004, SPU v Nitre, stran 183 – 186. ISBN 80 – 8069-369-2
7. J. Zajac, I. Vojtko. Tendency of Running on-line Diagnostics. Výrobné inžinierstvo vol. 3, No. 1, 2004, pp. 41-44
8. J. Fiala. Mikrovlnný most pro zjišťování úbytků brusných kotoučů, bakalářská práce, ÚTŘV UJEP, 2003
9. V. Tysl, V. Růžička. Teoretické základy mikrovlnné techniky. Praha: SNTL, 1989
10. D. Stančeková, D. Štekláč. Orovnávacie nástroje na brúsne kotúče. In Nástroje 2001/Tools 2001 Medzinárodná nástrojárska konferenci. Zlín19. – 20. jun 2001, ISBN 80 – 7318 - 008 – 1, s. 148 – 153.
11. M. Průša. Implementace systému ControlWeb do systému monitorování procesu broušení na brusce BU16. Bakalářská práce, Ústí nad Labem: UTŘV UJEP,2005.
12. N. Náprstková. Charakteristické veličiny procesu broušení a možnosti jejich monitorování. In Automatizácia a počítačová podpora predvýrobných etáp, výrobných a technologických procesov. Sborník přednášek. Žilina – Suľov: 24.3.2003, str. 59 – 69
13. N. Náprstková. Application of SCADA/HMI Software in monitoring of Grinding Process. In MATAR PRAHA 2004. Sborník přednášek, sv.2. Praha:21.-22.9.2004. ISBN 80-903421-4-0