



## Principal supervisor's final report on the PhD study

### 1. PhD candidate

Ing. Mahmoud Houssam / mahmoud@fme.vutbr.cz

### 2. Name of PhD programme

Design and Process Engineering

### 3. Title of PhD thesis

Diagnosis of pneumatic cylinders using acoustic emission methods

### 4. Principal supervisor

Doc. Ing. Pavel Mazal, CSc. / qmmazal@vutbr.cz

### 5. Co-supervisor

Doc. Ing. Michal Černý, CSc. / michal.cerny.utad@mendelu.cz

### 6. Stays at other institutions (min. 7 days)

Dakel Praha / Czech Republic / 06/06/2016 / 17/06/2016  
(application of software DaeShow, DaeMon, IPL...)

### 7. Teaching activities

3-CD-A and 3-CD (CAD), 4 KC-A and 4KC (Design and CAD), ZKP (Team project) /  
6 hours per week, 26 weeks, 3 years (2015, 2016 and 2017) – app. 470 hours

### 8. List of main publications

Total issued 20 publications (magazines, conferences, technical reports, methodology, functional sample)  
MAHMOUD, H.; VLAŠIČ, F.; MAZAL, P.; JÁNA, M. Leakage Analysis of Pneumatic Cylinders Using Acoustic Emission. *INSIGHT*, 2017, vol. 59, no. 9, p. 500-505. ISSN: 1354-2575. Impact 0,754.  
MAHMOUD, H.; VLAŠIČ, F.; MAZAL, P. Application of Acoustic Emission Method to Diagnose Damage in Pneumatic Cylinders. In *First World Congress on Condition Monitoring*. 1st. UK, Northampton: BINDT, 2017. p. 858-868. ISBN: 9781510844759.  
MAHMOUD, H.; VLAŠIČ, F.; MAZAL, P.; NOHÁL, L.; KRATOCHVÍLOVÁ, V. Analysis of pneumatic cylinder damage by acoustic emission method. In *Defektoskopie 2017 (NDE for Safety)*. první. Brno: VUT v Brně ve spolupráci s ČNDT, 2017. p. 151-161. ISBN: 978-80-214-5554-2.  
MAZAL, P.; VLAŠIČ, F.; MAHMOUD, H.; JANA, M. The Use of Acoustic Emission Method for Diagnosis of Damage of Pneumatic Cylinders. In *19th WCNDT 2016 - World Conference on NDT*. Munchen, Germany: German Society for NDT, 2016. p. 1-10. ISBN: 978-3-940283-78-8.

MAZAL, P.; MAHMOUD, H.; VLAŠIČ, F. Condition monitoring of pneumatic cylinders by acoustic emission. In *Application of contemporary non-destructive testing in engineering*. Ljubljana, Slovenija: University of Ljubljana, 2017. p. 231-238. ISBN: 978-961-93537-3-8.

MAZAL, P.; VLAŠIČ, F.; MAHMOUD, H.; NOHÁL, L.: VUT AE pneutest 2017; Stanice pro zkoušky pneumatických válců VUT UK 1. Vysoké učení technické v Brně, Fakulta strojního inženýrství, budova A3/111, Technická 2896/2, 61669 Brno. URL: <http://www.uk.fme.vutbr.cz/projekty/seznam/>. (funkční vzorek)

MAZAL, P.; VLAŠIČ, F.; MAHMOUD, H.; BUKÁČEK, V.: Testy pneuválců akustickou emisí; Hodnocení provozního stavu přímočarých pneumatik pomocí metody akustické emise. Vysoké učení technické v Brně, Fakulta strojního inženýrství, Ústav konstruování, Technická 2, Brno Poličské strojírny a.s., Bořiny 1145, 57201 Polička. (metodika certifikovaná uplatněná)

RICHTER, V.; MAHMOUD, H.; MAZAL, P.; SKŘIVÁNKOVÁ, V. *The Parameters of Acoustic Emission Signal Proposed to Identification of Damaged and Undamaged Cylinders*. European Conference on Acoustic Emission (EWGAE) 2018. Senlis, France: CETIM, 2018. p. 1-13.

The other two publications are actually accepted for publication in impacted journals.

#### 9. Assessment of the supervision process

##### Very good

In accordance with the study plan the student passed all required exams in specialized subjects and English by the end of June 2016. The state doctoral examination successfully passed in June 2017. Specialization doctoral studies were concerned to the development of diagnostics of pneumatic cylinders using modern methods of non-destructive testing.

#### 10. Assessment of the candidate's ability to work independently

##### Very good

The basic aim was to find suitable characteristics and then develop procedures for monitoring of these cylinders in production and also for their operation, which has so far been realized only to a very limited extent. To solve the problem, a series of experimental measurements of real cylinders with selected types of defects was carried out in order to optimize the measurement and subsequent data processing. The result of the dissertation thesis is verification of measurement repeatability, design of evaluated parameters of AE signals, determination of values of new coefficients and creation of basic measurement methodology. These results have already been successfully verified in the production practice of Poličské strojírny a.s.. Ph.D. student solved independently all tasks related to the topic of the dissertation work, he accomplished his doctoral degree assignments with a high level of commitment. Ing. Houssam Mahmoud has demonstrated the ability to independently solve complex research tasks.

#### 11. Assessment of the contribution that the research makes to knowledge in the field

##### Very good

The results are beneficial for the further development of the field and can be used immediately to significantly improve the manufacturing and operational diagnostics of pneumatic cylinders. The work can

be considered the basis of a new application of the acoustic emission method. The special diagnostic devices are now being developed based on the dissertation results.

**12. Other comments**

Ing. Houssam Mahmoud started his doctoral studies in the specialization D-KPI Design and Process Engineering at the Institute of Mechanical and Industrial Design at FME BUT in 2014. His original topic was focused on the spot welding diagnostics by acoustic emission (AE). Given the currently investigated projects were the subject immediately after the onset of Mr. Houssam Mahmoud and with the consent of the school management, changed the actual topic. During his PhD studies he worked on several projects of TA CR and MIT CR, which were focused on application of acoustic emission method.

**13. Conclusion**

PhD thesis is an independent scientific work that presents a novel solution to a significant problem in the research area and demonstrates the candidate's ability to conduct independent research.

YES

**14. Date and signature**

03/07/2019

Pavel Mazal



Please note

- A. Evaluate categories 9 to 11 using the following scale: unacceptable, acceptable, satisfactory, good, very good, excellent.
- B. In each category 9 to 11 explain reasons for evaluation using between 100–200 words.
- C. E-mail the completed form to: [Klara.Javorcekkova@vut.cz](mailto:Klara.Javorcekkova@vut.cz)