

**AGH**AGH UNIVERSITY OF SCIENCE
AND TECHNOLOGY

Module name: Nondestructive testing and structural health monitoring of structures

Academic year: 2019/2020 Code: ZSDA-3-0292-s ECTS credits: 3

Faculty of: Szkoła Doktorska AGH

Field of study: Szkoła Doktorska AGH Specialty: —

Study level: Third-cycle studies Form and type of study: Full-time studies

Lecture language: English Profile of education: Academic (A) Semester: 0

Course homepage: —

Responsible teacher: dr hab. inż. Pieczonka Łukasz (lukasz.pieczonka@agh.edu.pl)

Module summary

The goal of this module is to provide information about a state-of-the-art and state-of-the-use in Nondestructive Testing (NDT) and Structural Health Monitoring (SHM) techniques.

Description of learning outcomes for module

| MLO code | Student after module completion has the knowledge/ knows how to/is able to | Connections with FLO | Method of learning outcomes verification (form of completion) |
|-------------------------------------|--|---------------------------------|---|
| Social competence: is able to | | | |
| M_K001 | Student is able to work in a research/engineering team to discuss the requirements and specify a suitable damage detection strategy for a given application. | SDA3A_K01 | Report, Presentation, Participation in a discussion |
| Skills: he can | | | |
| M_U001 | Student can specify the the requirements and knows the possibilities for damage detection for a given application. | SDA3A_U02, SDA3A_U05, SDA3A_U01 | Report, Presentation, Participation in a discussion |
| M_U002 | Student is able to propose damage detection strategy for a given application | SDA3A_U01 | Report, Presentation, Participation in a discussion |
| Knowledge: he knows and understands | | | |
| M_W001 | Knows the state-of-the-art and state-of-the-use in Nondestructive Testing and Structural Health Monitoring | SDA3A_W02, SDA3A_W01 | Report, Presentation, Participation in a discussion |

Number of hours for each form of classes

| Suma | Form of classes | | | | | | | | | | |
|------|-----------------|--------------------|--------------------|-----------------|----------------------|-----------------|-------------------|-------------------|-----------|-------------------------------|----------|
| | Lectures | Auditorium classes | Laboratory classes | Project classes | Conversation seminar | Seminar classes | Practical classes | Fieldwork classes | Workshops | Prace kontrolne i przejściowe | Lektorat |
| 24 | 8 | 0 | 0 | 0 | 0 | 16 | 0 | 0 | 0 | 0 | 0 |

FLO matrix in relation to forms of classes

| MLO code | Student after module completion has the knowledge/ knows how to/is able to | Form of classes | | | | | | | | | | |
|-------------------------------------|--|-----------------|--------------------|--------------------|-----------------|----------------------|-----------------|-------------------|-------------------|-----------|-------------------------------|----------|
| | | Lectures | Auditorium classes | Laboratory classes | Project classes | Conversation seminar | Seminar classes | Practical classes | Fieldwork classes | Workshops | Prace kontrolne i przejściowe | Lektorat |
| Social competence: is able to | | | | | | | | | | | | |
| M_K001 | Student is able to work in a research/engineering team to discuss the requirements and specify a suitable damage detection strategy for a given application. | - | - | - | - | - | + | - | - | - | - | - |
| Skills: he can | | | | | | | | | | | | |
| M_U001 | Student can specify the the requirements and knows the possibilities for damage detection for a given application. | - | - | - | - | - | + | - | - | - | - | - |
| M_U002 | Student is able to propose damage detection strategy for a given application | - | - | - | - | - | - | - | - | - | - | - |
| Knowledge: he knows and understands | | | | | | | | | | | | |
| M_W001 | Knows the state-of-the-art and state-of-the-use in Nondestructive Testing and Structural Health Monitoring | + | - | - | - | - | + | - | - | - | - | - |

Student workload (ECTS credits balance)

| Student activity form | Student workload |
|---|------------------|
| Udział w zajęciach dydaktycznych/praktyka | 24 h |
| Preparation for classes | 20 h |
| przygotowanie projektu, prezentacji, pracy pisemnej, sprawozdania | 10 h |
| Realization of independently performed tasks | 20 h |
| Summary student workload | 74 h |
| Module ECTS credits | 3 ECTS |

Additional information

Module content

Lectures

-

Seminar classes

-

Teaching methods and techniques:

Lectures: Contact class, transfer of knowledge through multimedia presentations.

Seminar classes: Discussions in the group, preparation of presentation and report on a specific test case.

Warunki i sposób zaliczenia poszczególnych form zajęć, w tym zasady zaliczeń poprawkowych, a także warunki dopuszczenia do egzaminu:

Presence in the class and completion of an assignment documented in a report.

Zasady udziału w poszczególnych zajęciach, ze wskazaniem, czy obecność studenta na zajęciach jest obowiązkowa:

Lectures:

- Attendance is mandatory: Yes
- Participation rules in classes: Participation in this part of the course is required as it is a prerequisite for the seminar class.

Seminar classes:

- Attendance is mandatory: Yes
- Participation rules in classes: Contact class

Method of calculating the final grade

Final grade is assigned based on the evaluation of the final report and presentation in the class.

Sposób i tryb wyrównywania zaległości powstałych wskutek nieobecności studenta na zajęciach:

Absence will have to be made up by participation in class with a different group. If this would not be possible the cases will be treated on individual basis.

Prerequisites and additional requirements

None

Recommended literature and teaching resources

Stepinski, T., Uhl, T., & Staszewski, W. (2013). *Advanced Structural Damage Detection: From Theory to Engineering Applications*. Wiley.

Moore, P.O. (2012) *Nondestructive Testing Handbook, Third Edition: Volume 10, Overview*

Krautkramer, J., & Krautkramer, H. (1990). *Ultrasonic Testing of Materials*

Maldague, X. P. V. (2001). *Theory and Practice of Infrared Technology for Nondestructive Testing*

Scientific publications of module course instructors related to the topic of the module

https://scholar.google.com/citations?user=1Xkk_hsAAAAJ&hl=pl

Pieczonka, L., Klepka, A., Martowicz, A., & Staszewski, W. J. (2015). Nonlinear vibroacoustic wave modulations for structural damage detection: an overview. *Optical Engineering*, 55(1), 011005.

<https://doi.org/http://dx.doi.org/10.1117/1.OE.55.1.011005>

Pieczonka, L., Aymerich, F., & Staszewski, W. J. (2014). Impact Damage Detection in Light Composite Sandwich Panels. *Procedia Engineering*, 88, 216–221. <https://doi.org/10.1016/j.proeng.2014.11.147>

Le Bas, P.-Y., Remillieux, M. C., Pieczonka, L., Ten Cate, J. A., Anderson, B. E., & Ulrich, T. J. (2015). Damage imaging in a laminated composite plate using an air-coupled time reversal mirror. *Applied Physics Letters*, 107(18), 184102. <https://doi.org/10.1063/1.4935210>

Pieczonka, L., & Szwed, M. (2013). Vibrothermography. In T. Stepinski, T. Uhl, & W. J. Staszewski (Eds.), *Advanced Structural Damage Detection: From Theory to Engineering Applications* (pp. 233–261). Wiley.

Pieczonka, L., Aymerich, F., Brozek, G., Szwed, M., Staszewski, W. J., & Uhl, T. (2013). Modelling and numerical simulations of vibrothermography for impact damage detection in composites structures. *Structural Control and Health Monitoring*, 20(4), 626–638. <https://doi.org/10.1002/stc.1483>

Additional information

None