AGH UNIVERSITY OF SCIENCE AND TECHNOLOGY

Module name: Fundamentals of Fracture Mechanics

Academic year: 2019/2020 Code: ZSDA-3-0211-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: prof. Hamilton Carter (hamiltbc@miamioh.edu)

Module summary

This course introduces students to the mechanics of fracture due to the presence of cracks in structural materials. Primary focus is given to linear-elastic fracture mechanics (LEFM) covering such topics as energy release rate, crack resistance, crack stability/instability and fracture toughness testing. Emphasis is placed on both theory and applied problem solving with a materials engineering perspective. The course also presents the basics of non-linear fracture mechanics from concepts in elastic-plastic fracture mechanics (EPFM) and time-dependent fracture mechanics (TDFM). These topics include the J-integral, J-resistance curves, the C• integral and Ct.

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	SDA3A_K01	
Skills: he can			
M_U001	Studen can derive the K-controlled and J-controlled crack tip stress/strain fields and assess the influence of crack configuration, specimen geometry and material properties on these solutions	SDA3A_U01	
M_U002	Student can construct models of the crack tip stress/strain fields, plastic zone sizes and plastic zone shapes using commercial software and analyze the results	SDA3A_U01	
Knowledge: he knows and understands			
M_W001	Student posesses general knowledge on fracure of engineering materials	SDA3A_W01	Examination

M_W002	Student knows principles of linear-elastic fracture mechanics (LEFM)	SDA3A_W01	

Number of hours for each form of classes

	Form of classes										
Suma	Lectures	Auditorium classes	Laboratory classes	Project classes	Conversation seminar	Seminar classes	Practical classes	Fieldwork classes	Workshops	Prace kontrolne i przejściowe	Lektorat
30	15	15	0	0	0	0	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	+	+	-	-	-	-	-	-	-	-	-
Skills: he can												
M_U001	Studen can derive the K-controlled and J-controlled crack tip stress/strain fields and assess the influence of crack configuration, specimen geometry and material properties on these solutions	+	+	-	-	-	-	-	-	-	-	-
M_U002	Student can construct models of the crack tip stress/strain fields, plastic zone sizes and plastic zone shapes using commercial software and analyze the results	+	+	-	-	-	-	-	-	-	-	-
Knowledge: he knows and understands												
M_W001	Student posesses general knowledge on fracure of engineering materials	+	+	-	-	-	-	-	-	-	-	-
M_W002	Student knows principles of linear-elastic fracture mechanics (LEFM)	+	+	-	-	-	-	-	-	-	-	-

Student workload (ECTS credits balance)

Student activity form	Student workload
Udział w zajęciach dydaktycznych/praktyka	30 h
Preparation for classes	30 h
przygotowanie projektu, prezentacji, pracy pisemnej, sprawozdania	20 h
Realization of independently performed tasks	20 h
Examination or Final test	2 h
Contact hours	5 h
Summary student workload	107 h
Module ECTS credits	3 ECTS

Additional information

Module content

Lectures

This course introduces students to the mechanics of fracture due to the presence of cracks in structural materials. Primary focus is given to linear-elastic fracture mechanics (LEFM) covering such topics as energy release rate, crack resistance, crack stability/instability and fracture toughness testing. Emphasis is placed on both theory and applied problem solving with a materials engineering perspective. The course also presents the basics of non-linear fracture mechanics from concepts in elastic-plastic fracture mechanics (EPFM) and time-dependent fracture mechanics (TDFM). These topics include the J-integral, J-resistance curves, the C• integral and Ct.

Auditorium classes

This course introduces students to the mechanics of fracture due to the presence of cracks in structural materials. Primary focus is given to linear-elastic fracture mechanics (LEFM) covering such topics as energy release rate, crack resistance, crack stability/instability and fracture toughness testing. Emphasis is placed on both theory and applied problem solving with a materials engineering perspective. The course also presents the basics of non-linear fracture mechanics from concepts in elastic-plastic fracture mechanics (EPFM) and time-dependent fracture mechanics (TDFM). These topics include the J-integral, J-resistance curves, the C• integral and Ct.

Teaching methods and techniques:

Lectures: Presentation and discussion
Auditorium classes: Solving examples and discussion

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

The following tools will be used to assess students' progress toward the Course Outcomes:
•Three exams will measure all outcomes for individual students under time constraint
•Homework assignments will measure all outcomes for individual students without time constraint

•Project assignments (independent case studies and/or research problems)
•Course evaluations by individual students at the end of the semester will assess all outcomes

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

Lectures:
– Attendance is mandatory: No
– Participation rules in classes: 1.Lecture attendance is required.
2.Lecture will begin promptly at the scheduled time.
3.On time attendance counts as 100%; late attendance as 50%; absence as 0%.
4.More than 15 minutes late counts as an absence.
5.No make-up tests will be given for unexcused absences.
6.University policy concerning academic honesty will be strictly enforced.

Auditorium classes:
– Attendance is mandatory: Yes
– Participation rules in classes: 1.Lecture attendance is required.
2.Lecture will begin promptly at the scheduled time.
3.On time attendance counts as 100%; late attendance as 50%; absence as 0%.
4.More than 15 minutes late counts as an absence.
5.No make-up tests will be given for unexcused absences.
6.University policy concerning academic honesty will be strictly enforced.

Method of calculating the final grade

Final grade is an exam grade

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

Exam

Prerequisites and additional requirements

Basic Physics and Mechanics

Recommended literature and teaching resources

Elementary Engineering Fracture Mechanics, David Broek, Kluwer Academic Publishers, 4th Edition, 2002 (available as a Google book online)
Reference Texts
•Fracture Mechanics: Fundamentals and Applications, Ted L. Anderson, Taylor & Francis, 3rd Edition, 2005
•Deformation and Fracture Mechanics of Engineering Materials, Richard W. Hertzberg, Wiley, 5th Edition, 2013

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

Additional scientific publications not specified

Additional information

None