Modelling of railway tracks - BMEEOUVDT83

I. Tantárgyleírás

1. Alapadatok

1.1 Tantárgy neve

Modelling of railway tracks

1.2 Azonosító (tantárgykód)

BMEEOUVDT83

1.3 Tantárgy jellege

Kontaktórás tanegység

1.4 Óraszámok

Típus	Óraszám / (nap)
Előadás (elmélet)	2

1.5 Tanulmányi teljesítményértékelés (minőségi értékelés) típusa

Vizsga

1.6 Kreditszám

3

1.7 Tárgyfelelős

név	Dr. Liegner Nándor
beosztás	Egyetemi docens
email	liegner.nandor@emk.bme.hu

1.8 Tantárgyat gondozó oktatási szervezeti egység

Út és Vasútépítési Tanszék

1.9 A tantárgy weblapja

https://epito.bme.hu/BMEEOUVDT83
https://edu.epito.bme.hu/course/view.php?id=2567

1.10 Az oktatás nyelve

angol

1.11 Tantárgy típusa

Ph.D.

1.12 Előkövetelmények

1.13 Tantárgyleírás érvényessége

2022. szeptember 1.

2. Célkitűzések és tanulási eredmények

2.1 Célkitűzések

The aim of the course is to model the superstructure of the railway track with FEM softwares with regards of load bearing capacity and stability of the track. Laboratory tests are to carry out so the results serve as basis of the FEM models. The students will get acquainted with the methods of the use and stability testing of the railway superstructure in addition to the latest developed track structures. After completing the course, they are able to determine the behavior of the various superstructures, the relationship between the bridges and the superstructure. Participants can also listen to case studies related to state-of-the-art superstructures.

2.2 Tanulási eredmények

A tantárgy sikeres teljesítése utána a hallgató

A. Tudás

1. knows the most important superstructure dimensioning procedures,
2. knows the latest developed superstructure elements, their background,
3. knows the internal forces of a CWR track,
4. knows how to model the loads transferred to the track during deceleration and acceleration of trains
5. is familiar with the superstructure solutions of bridges, in connection with this, the types of rail expansion devices and their location on bridges,
6. knows the theoretical background and technical solutions of the transitional sections formed at the connection of the bridges and the earthwork.
7. is familiar with the theoretical background and modelling methods of the lateral stability test of the track.

B. Képesség

1. be able to form an opinion on superstructure dimensioning procedures,
2. is able to determine the relevant loads using FEM models even in more complex cases,
3. be able to determine the forces and displacements in a CWR superstructure in both crushed stone and flexible bearing tracks as well as in the case of a rail with expansion device,
4. able to compile gap tables,
5. able to model track stability testing,
6. able to model load bearing capacity of railway track structural elements such as rail-joints, rail fastenings, sleepers and ballast bed, embedded rail superstructure, etc.

C. Attitűd

1. cooperates with the instructor in the preparation of partial performance evaluations,
2. strives for an accurate and error-free solution,
3. strives for precise, professional wording in its oral and written statements,
4. In the course of its written performance evaluations, it strives to produce orderly documentation of the

quality and appearance expected at the researcher level.

D. Önállóság és felelősség

1. prepare responsibly for the successful completion of performance appraisals,
2. perform the tasks issued during the independent partial performance assessments independently and to the best of his / her knowledge,
3. openly welcomes substantiated critical remarks.

2.3 Oktatási módszertan

Lectures and laboratory tests with presentations, self-made home planning assignment, written and oral communication: performance evaluation, exam, and active participation in contact classes.

2.4 Részletes tárgyprogram

Week	**Topics of lectures and/or exercise classes**
1.	Development and evaluation of railway superstructure dimensioning procedures. Use of the Zimmermann-Eisen mann superstructure sizing method.
2.	Presentation of the latest rail fastening systems and track structures, developments (case study).
3.	Building up FEM models to model the load bearing capapcity of the railway tracks. Computation of internal forces in the track.
4.	Laboratory test to measure the static and dynamic stiffness of rail fastening systems and investigate the effect of stiffness on the internal forces of the track by FEM models.
5.	Longitudinal forces in the CWR superstructures. Determination of rail end motion in case of a superstructure with crushed stone and in case of slab tracks. Modeliing oneway change of temperature and return change of temperatue.
6.	Laboratory test on determining the longitudinal rail restraint of different types of rail fastenings. Effects of rail clips with reduced and increased longitudinal rail restraint.
7.	Modelling the effect of reduced and increased longitudinal rail restraint on expansion of the rail with FEM models in case of ballasted tracks and concrete slab tracks.
8.	Types of rail expansion devices. Calculation of gap tables, factors influencing its design. Structures of bridges, static layouts. Longitudinal forces arising from the movement of bridges in the rail and on the supports. Effect of loaded and unloaded superstructure. Case study.

9.	Modelling the effects of breaking and acceleration forces of trains, superimposed on effects of change of temperature.
10.	Expansion behavior of rail fiber embedded in elastic material. More accurate determination of inhibited dilatation based on experimental resistance curves. Effect of train start - up and braking.
11.	FEM modelling of flexible transition sections between bridges and CWR tracks. Case study on the behavior of bridge structures.
12.	Stability of CWR tracks against buckling, factors influencing stability. The equation of equilibrium. Options for increasing resistance of ballast bed.
13.	Modelling stability of CWR tracks.
14.	Consultation

A félév közbeni munkaszüneti napok miatt a program csak tájékoztató jellegű, a pontos időpontokat a tárgy honlapján elérhető "Részletes féléves ütemterv" tartalmazza.

2.5 Tanulástámogató anyagok

Coenraad Esveld: Modern Railway Tracks, Digital Edition 2014, version 3.1, ISBN 978-1-326-05172-3

2.6 Egyéb tudnivalók

2.7 Konzultációs lehetőségek

Jelen TAD az alábbi félévre érvényes:

Inactive courses

Modelling of railway tracks - BMEEOUVDT83

II. Tárgykövetelmények

3. A tanulmányi teljesítmény ellenőrzése és értékelése

3.1 Általános szabályok

The assessment of the learning outcomes formulated in point A is based on two homework assignments (continuous independent partial performance assessment).

3.2 Teljesítményértékelési módszerek

Evaluation form	Abbreviation	Assessed learning outcomes
Homework (small homework, one-time partial performance evaluation	HW	A.2-A.3
Written exam (summary performance evaluation)	E	A.1-A.7; B.1-B.6

The actual place and date of the assessments carried out in the active period, the dates of handing out and handing in the homeworks are contained in the "Detailed schedule of the semester", that is available on the website of the subject.
A szorgalmi időszakban tartott értékelések pontos idejét, a házi feladatok ki- és beadási határidejét a "Részletes féléves ütemterv" tartalmazza, mely elérhető a tárgy honlapján.

3.3 Teljesítményértékelések részaránya a minősítésben

Abbreviation	Score
HW	20
Exam	80
Sum	**100%**

3.4 Az aláírás megszerzésének feltétele, az aláírás érvényessége

3.5 Érdemjegy megállapítása

Grade	Points
excellent (5)	87.5
good (4)	75
satisfactory (3)	62.5
passed (2)	50
failed (1)	0

3.6 Javítás és pótlás

3.7 A tantárgy elvégzéséhez szükséges tanulmányi munka

Activity	Hours/semester
participation in contact classes	28
homework preparation	30
preparing for the exam	32

Sum	**90**

3.8 A tárgykövetelmények érvényessége

2022. szeptember 1.

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Inactive courses