Topics of dissertations for the admission procedure
to the doctoral study programmes
at the CTU in Prague Faculty of Transportation Sciences

Commencement of Study: March 1, 2025

Department of Mechanics and Materials (K618)

Study programme: Transportation Systems and Technology

Supervisor:
prof. Ing. Ondřej Jiroušek, Ph.D.

Topic:
Constitutive modelling of 3D printed materials under complex loading in a broad range of strain rates

Research topic is *agreed with supervisor* | **Language:** English

Abstract:
The goal of the dissertation is to develop a constitutive model for numerical simulation of behaviour of 3D printed structures during complex loading modes at intermediate and high strain rates. Nowadays, additively manufactured materials are being used in demanding industrial application including dynamic and impact loading. Detailed description of deformation behaviour and a reliable constitutive model for the intended application spectrum is an essential tool for relevant numerical simulations, optimization tasks and design studies. Content of the dissertation will be an identification of mechanical properties of a 3D printed material with emphasis on printing parameters, anisotropy, time-dependent processes using methods for quasi-static and particularly dynamic measurements. The material will be tested in complex loading modes using specialized devices for, e.g., dynamic penetration or dynamic bending (SHPB/OHPB, linear motors). For the identification of deformation behaviour and an internal damage, the advanced analysis methods using high speed cameras and high speed X-ray imaging will be employed. The experimental results will be used for formulation of a constitutive model for simulations of the material during dynamic loading including dynamic damage or failure.
The work will be solved using modern laboratory equipment of the Department of Mechanics and Materials and utilizing wide international cooperation of the Department in this field.

References:

B. Nurel, et. al., Split Hopkinson pressure bar tests for investigating dynamic properties of additively manufactured AlSi10Mg alloy by selective laser melting, Additive Manufacturing, Volume 22, 2018, pp 823-833, doi:10.1016/j.addma.2018.06.001.

S.C. Garcea et al.: X-ray computed tomography of polymer composites, Composites Science and Technology, 2018, 156, DOI:10.1016/j.compscitech.2017.10.023

L. Xuekun et al.: Anisotropic Crack Propagation and Deformation in Dentin Observed by Four-Dimensional X-ray Nano-Computed Tomography, Acta Biomaterialia, 2019, 96(3), DOI:

10.1016/j.actbio.2019.06.042
Number of doctoral students: 1
Form of study: ***full-time***