

Opis raziskovalnega dela (Research work description)

1. Članica UL (UL member):

Fakulteta za gradbeništvo in geodezijo (Faculty of Civil and Geodetic Engineering)
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2. Ime, priimek in elektronski naslov mentorja/ice (Mentor's name, surname and email):

David Antolinc, david.antolinc@fgg.uni-lj.si
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3. Raziskovalno področje (Research field):

Gradbeništvo / Potresno inženirstvo (Civil and Structural Engineering / Earthquake Engineering)

4. Opis raziskovalnega dela (Research work description):

Vključuje morebitne dodatne pogoje, ki jih mora izpolnjevati kandidat/ka za mladega raziskovalca/ko, ki niso navedeni v razpisu za mlade raziskovalce (It includes any additional conditions that the candidate for a young researcher must meet, which are not listed in the call to tender for young researchers.).

Slov.:

Mladi raziskovalec/ka se bo usposabljal/a na doktorskem študiju Grajeno okolje, Fakulteta za gradbeništvo in geodezijo, Univerza v Ljubljani, z možnostjo izpopolnjevanja na uglednih institucijah po svetu. Tema doktorske disertacije mladega raziskovalca bo usklajena z raziskavami raziskovalne programske Potresno inženirstvo (P2-0185), ki sodeluje v mednarodnih projektih in združenjih, kar zagotavlja, da bodo raziskave aktualne in usklajene na mednarodnem nivoju. Delovno mesto mladega raziskovalca/ke na področju gradbeništva/potresnega inženirstva vključuje interdisciplinarni pristop k raziskovanju, kar je v skladu z resolucijo o krepitvi potresne varnosti do leta 2050. Glavni cilj je pripraviti družbo na bodoče potrese in zaščititi ljudi ter grajeno okolje, ob upoštevanju raznolikosti obstoječega stavbnega fonda in hitrega razvoja novih konstrukcijskih sistemov in materialov.

Sodobna arhitektura narekuje večje transparentne steklene površine stavbnega ovoja, ki lahko v primeru potresne obtežbe na objekte predstavljajo večje tveganje za poškodbe krhkega stekla in posledično nevarnost za uporabnike stavbe. V pripravi je izdaja novega Evrokoda 10 namenjenega projektiranju konstrukcijskega stekla in steklenih fasad, ki ne predvideva uporabe konstrukcijskega stekla za prevzem dela potresne obtežbe. Kljub temu je potrebno preveriti obnašanje teh sistemov med potresno obtežbo in zagotoviti varovanje steklenih elementov pred njihovo krhko hipno porušitvijo. V prihodnosti bo potrebno nadgraditi in posodobiti nastajajoči Evrokod 10 in na določenih delih tudi Evrokod 8 v katerem bodo podana specifična pravila za projektiranje tovrstnih konstrukcij na potresnih območjih. V strokovni javnosti s tega področja je veliko odprtih vprašanj in tematik, mladi/a raziskovalec/ka pa bo imel/a priložnost sodelovati pri tovrstnih raziskavah. V splošnem so to teme, ki se uvrščajo tudi v enega izmed treh raziskovalnih stebrov programske skupine, ki so: (1) potresno-odporno projektiranje in utrditev obstoječih objektov, (2) metode in orodja za vzpostavitev potresno-odpornega grajenega okolja ter (3) nove tehnologije, materiali in konstrukcije za trajnostni razvoj z upoštevanjem vpliva potresnega tveganja.

Raziskave mladega raziskovalca/ke bodo usmerjene v eno izmed naslednjih tem:

- razvoj seizmičnih pritrdilnih elementov in detajlov za strukturne steklene fasade in steklene konstrukcijske elemente na osnovi eksperimentalnih in numeričnih analiz,
- izboljšanje in razvoj postopkov projektiranja konstrukcijskega stekla in steklenih fasad na potresnih območjih ali potresne utrditve obstoječih objektov,
- prispevanje k razvoju novega standarda za konstrukcijsko steklo Evrokod 10.

Kandidat mora izpolnjevati vse kriterije iz razpisa. Zaželena je magistrska izobrazba s področja gradbeništva ali strojništva, ni pa nujna, ter izkazan interes za raziskovanje s področja eksperimentalne in numerične analize konstrukcij, potresnega inženirstva, gradbeništva ali drugih ved, ki jih povezuje potresno inženirstvo. Prednost imajo kandidati z izkušnjami na področju numeričnega modeliranja konstrukcij, laboratorijskih preiskav in razumevanjem projektiranja potresno odpornih konstrukcij. Dodatne informacije lahko dobite na naslovu david.antolinc@fgg.uni-lj.si.

Eng.:

The young researcher will be trained in the PhD study program of Built Environment at the Faculty of Civil Engineering and Geodesy, University of Ljubljana, with the possibility of additional training at reputable institutions

abroad. The topic of the young researcher's doctoral dissertation will be aligned with the research agenda of the Earthquake Engineering Research Programme (P2-0185), which participates in state-of-the-art research international projects and associations. The position of young researcher in the field of civil or earthquake engineering requires an interdisciplinary research approach, which is in line with the Resolution on Strengthening Earthquake Safety by 2050. The main goal is to prepare society for future earthquakes, protect people and the built environment, taking into account the diversity of the existing building stock and the rapid development of new structural systems and materials.

Modern architecture requires larger transparent façade glass surfaces, which can increase the risk of brittle glass failure during the event of an imposed earthquake load and represent hazardous structural behaviour for the occupants of the building. Currently, a new Eurocode 10 is being prepared for the design of structural glass and glass facades, which does not consider the use of structural glass as seismic structural elements and neither the specific rules for the protection of structural glass elements against the seismic loads. Nevertheless, it is necessary to verify the behaviour of these systems during seismic loading and to ensure the protection of glass elements against their nature of brittle failure. In the future, it will be necessary to upgrade and update the emerging Eurocode 10 and in particular sections Eurocode 8, which will provide specific rules for the design of such structures in seismic areas.

There are many open questions and topics in the professional community in this field, and the young researcher will have the opportunity to participate in mentioned research. In general, these topics also align with one of the three research pillars of the research group, which are: (1) earthquake-resistant design and strengthening of existing buildings, (2) methods and tools for establishing an earthquake-resistant built environment, and (3) new technologies, materials and structures for sustainable development taking into account the impact of seismic risk.

The research of the young researcher will be focused on one of the following main topics:

- improvement of design procedures for structural glass and glass facades in seismic areas or seismic strengthening of existing buildings,
- development of seismic connection details and structural details for structural glass facades and structural glass elements based on experimental and numerical analyses,
- contribution to the development of the new standard for structural glass Eurocode 10.

The candidate has to fulfil all the criteria from the public call. A master degree in civil or mechanical engineering is desirable, as well as demonstrated interest in research in the field of experimental and numerical analysis of structures, structural systems, earthquake engineering, civil engineering and sciences related to earthquake engineering. Preference will be given to candidates who have experience in numerical structural modelling, experimental laboratory work and understand earthquake-resistant design of structures. Additional information can be obtained at david.antolinc@fgg.uni-lj.si.

5. Priloge, ki jih kandidat priloži k prijavi (*Documents that the candidate submits with the application*):

- ☒ **diplomska listina/potrdilo o zaključku študijskega programa** (*diploma certificate for study programme, with which the candidate has enrolled/ will enroll in a doctoral degree programme*)
- ☒ **priloga k diplomi/ potrdilo o opravljenih obveznostih** (*official transcript of all the grades for study programme, with which the candidate has enrolled/will enroll in a doctoral degree programme*)
- ☒ **potrdilo o do sedaj opravljenih obveznostih z ocenami študijskega programa, s katerim se bo kandidat prijavil na študij** (*official transcript of all the grades the candidate has received so far for the study programme, with which the candidate will enroll to a doctoral degree programme*)
- ☒ **nagrade** (*awards (e.g. Prešeren Prize of the University of Ljubljana, Prešeren Prize of a University of Ljubljana member and/or another equivalent award)*)
- ☐ **bibliografija** (*bibliography*)
- ☒ **življenjepis** (*CV*)
- ☒ **motivacijsko pismo** (*motivation letter*)
- ☒ **opis dosedanjega sodelovanja pri raziskovalnem delu** (*description of the candidate's research work*)
- ☐ **osnutek idejne zasnove raziskovalnega dela** (*preliminary research proposal*)

☒ **priporočilno pismo** (*letter of recommendation*)

☒ **druge priloge** (*other attachments*)

Opis raziskovalnega dela (Research work description)

1. Članica UL (UL member):

Univerza v Ljubljani, Fakulteta za gradbeništvo in geodezijo
University of Ljubljana, Faculty of Civil and Geodetic Engineering

2. Ime, priimek in elektronski naslov mentorja/ice (Mentor's name, surname and email):

Violeta Bokan Bosiljkov, violeta.bokan-bosiljkov@fgg.uni-lj.si

3. Raziskovalno področje (Research field):

2.01 Gradbeništvo / 2.01 Civil Engineering

4. Opis raziskovalnega dela (Research work description):

Vključuje morebitne dodatne pogoje, ki jih mora izpolnjevati kandidat/ka za mladega raziskovalca/ko, ki niso navedeni v razpisu za mlade raziskovalce (It includes any additional conditions that the candidate for a young researcher must meet, which are not listed in the call to tender for young researchers.).

Mladi raziskovalec/-ka se bo usposabljal/-a v okviru raziskovalnega programa P2-0185 Potresno inženirstvo (<https://www.fgg.uni-lj.si/raziskovalna-dejavnost/programske-skupine/>).

Raziskovalno delo bo osredotočeno na razvoj in preizkušanje naprednih cementnih kompozitov za 3D tisk v gradbeništvu (3DCP – 3D concrete printing) z uporabo robotske celice, ki vključuje robotsko roko s 6 prostostnimi stopnjami in kontinuirni mešalec/črpalko za sveže betone in malte.

Mladi raziskovalec/-ka bo proučeval/-a:

- interakcijo med materialom in strojem pri različnih tehnologijah 3D tiska (ekstruzija, brizganje,...),
- vpliv dodatkov (pospešila, zavlačevala, mikroarmatura, ...) na reološke lastnosti svežih ter mehanske in trajnostne lastnosti strjenih 3DCP elementov,
- optimizacijo procesnih parametrov ter razvoj strategij krmiljenja robotske roke,
- možnosti uporabe 3D tiska za potresno utrjevanje obstoječih konstrukcij, vključno z mikroarmiranimi ometi za stavbno dediščino in ojačitvami AB elementov.

Pričakovani profil kandidata je magistrska izobrazba na področju tehničnih in naravoslovnih znanosti (gradbeništvo, strojništvo, znanost o materialih, kemijsko inženirstvo, geologija, ...), z veseljem do laboratorijskega dela. Kandidat mora imeti znanje angleškega jezika stopnje vsaj B2. Prednost bodo imeli kandidati z izkušnjami na področju 3D tiska z betoni ali drugimi kompozitnimi materiali, tehnologijami posebnih cementnih betonov, reološkimi preiskavami svežih betonov in/ali programiranjem robotskih celic.

Raziskovalno delo bo prispevalo k razvoju digitalizacije in avtomatizacije v gradbeništvu ter k iskanju novih rešitev za povečanje potresne odpornosti objektov.

The young researcher will be trained within the research programme P2-0185 Earthquake Engineering (<https://www.en.fgg.uni-lj.si/research/research-programmes/>).

The research work will focus on the development and testing of advanced cementitious composites for 3D concrete printing (3DCP) using a robotic cell that includes a 6-axis robotic arm and a continuous mixer/pump for fresh concretes and mortars.

The young researcher will investigate:

- the interaction between material and machine in various 3D printing techniques (extrusion, spraying, ...),
- the effect of admixtures (accelerators, retarders, micro-reinforcement) on the rheological properties of fresh composites as well as on the mechanical and durability properties of 3DCP elements,
- the optimisation of process parameters and the development of robotic arm control strategies,
- the potential use of 3D printing for seismic strengthening of existing structures, including micro-reinforced plasters for heritage buildings and strengthening of reinforced concrete elements.

The expected candidate profile is a Master's degree in technical or natural sciences (civil engineering, mechanical engineering, materials science, chemical engineering, geology, ...), with a strong motivation for laboratory work. The candidate must have English language proficiency of at least level B2. Preference will be given to candidates with experience in 3D printing with concrete or other composite materials, special cement-based concrete technologies, rheological testing of fresh concretes and/or programming of robotic cells.

The research will contribute to the advancement of digitalisation and automation in the construction sector and to the development of innovative solutions for increasing the seismic resilience of structures.

5. Priloge, ki jih kandidat priloži k prijavi (*Documents that the candidate submits with the application*):

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University of Ljubljana, Faculty of Civil and Geodetic Engineering

2. Ime, priimek in elektronski naslov mentorja/ice (Mentor's name, surname and email):

Matjaž Dolšek, matjaz.dolsek@fgg.uni-lj.si

3. Raziskovalno področje (Research field):

Gradbeništvo / Potresno inženirstvo,
Civil Engineering / Earthquake Engineering

4. Opis raziskovalnega dela (Research work description):

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Slov.:

Izkušnje kažejo, da močni potresi ogrožajo blaginjo ljudi, če se na tovrstne ekstremne naravne dogodke neustrezno pripravimo. Majhne skupnosti na potresno nevarnih območjih so še posebej ogrožene, kar je v Sloveniji prepoznano z Resolucijo o krepitvi potresne varnosti do leta 2050 »Prehitimo potres«. Ker potresi ogrožajo praktično celotno grajeno okolje in vsa področja delovanja skupnosti, posredno pa vplivajo tudi na naravo, je tematika raziskovalnega dela mlade raziskovalke ali mladega raziskovalca lahko tudi interdisciplinarna, kar terja sodelovanje med različnimi strokami. Zato je razpisanih več različnih tem raziskovalnega dela, s tem pa so k prijavi vabljeni tudi kandidatke in kandidati z različnih strokovnih področij.

Možne teme raziskovalnega dela:

1. Potresna odpornost obstoječih in novih gradbenih konstrukcij

- Preverjanje in zagotavljanje potresne odpornosti gradbenih konstrukcij je osnova za zagotavljanje potresne varnosti grajenega okolja. To je še posebej povezano z negotovostmi pri potresni analizi objektov, zlasti pri analizah obstoječih stavb ter pri uvajanju novih tehnologij gradnje ali novih standardov v prakso.
- Ključne besede: stavbe, mostovi, vodne pregrade, drugi inženirski objekti, lesene konstrukcije, zidane konstrukcije, armiranobetonske konstrukcije, jeklene konstrukcije, nove gradbene tehnologije, Evrokod 8.
- Priporočena osnovna znanja: gradbeništvo ali konstrukcijsko strojništvo.
- Možno somentorstvo za specializirana znanja s področja gradbeništva oz. potresnega inženirstva.

2. Potresi v okviru sestavljenih nevarnosti

- Potrese spremljajo različne sočasne nevarnosti, ki so lahko odvisne od potresa (npr. plazovi, likvefakcija, tsunami), neodvisne (npr. pandemija, pluvialne poplave, nevihte) ali verižne potresu (eksplozije, požari, širjenje nevarnih snovi), ki se običajno ne upoštevajo pri analizah potresnega tveganja.
- Ključne besede: potresi, analiza sestavljenih nevarnosti, analiza tveganja sestavljenih nevarnosti, požar, eksplozije, širjenje nevarnih snovi, plazovi, poplave in druge nevarnosti.
- Priporočena osnovna znanja: gradbeništvo ali znanja iz področja druge sočasne ali verižne nevarnosti, ki bo upoštevana v raziskavi.
- Možno somentorstvo za področje druge izbrane nevarnosti.

3. Potresno tveganje grajenega okolja in modeliranje kriznih situacij

- Za razvoj strategije zmanjševanja potresnih tveganj in omejitve posledic po potresih je treba analizirati potresno tveganje, vključno s simulacijo potresnih dogodkov in odzivom civilne zaščite na takšne dogodke.
- Ključne besede: potresno tveganje mest, civilna zaščita, upravljanje v izrednih razmerah.
- Priporočena osnovna znanja: gradbeništvo ali okoljsko inženirstvo.
- Možno somentorstvo, če kandidat prihaja iz tujine.

4. Informacijsko modeliranje grajenega okolja ali posameznih objektov za potrebe potresnega inženirstva

- Čeprav obstaja precej različnih baz podatkov, te niso optimalne za potrebe potresnega inženirstva v povezavi z analizami potresnega tveganja grajenega okolja in razvojem strategije prenove grajenega okolja.
- Ključne besede: potresno tveganje grajenega okolja, BIM, GIS, GIS-BIM integracija, digitalni dvojček.
- Priporočena osnovna znanja: gradbeništvo, geoinformatika, geodezija, računalništvo, informacijska tehnologija.
- Predvideno somentorstvo s področja računalništva, IT ali geoinformatike.

5. Prometni tokovi v kriznih situacijah

- Potresi lahko povzročijo ustavitev prometnih tokov, kar upočasni reševanje takoj po ekstremnih pojavih in oteži proces okrevanja skupnosti. Učinki tovrstnih ustavitev še niso dovolj dobro raziskani.
- Ključne besede: potresna ranljivost cestne infrastrukture, potresna ranljivost mest, modeliranje prometnih tokov.
- Priporočena osnovna znanja: potresno inženirstvo, gradbeništvo ali prometno inženirstvo.
- Predvideno somentorstvo za področje prometnega inženirstva.

6. Potresi in prostorsko načrtovanje

- Zaradi kompleksnosti industrijsko-urbanega okolja je treba analize potresnega tveganja vključiti v prostorsko načrtovanje in razviti strategije za potresno odporno in trajnostno urbanizacijo.
- Ključne besede: potresno tveganje, strategija urbanizacije, integracija tveganj v prostorsko načrtovanje.
- Priporočena osnovna znanja: gradbeništvo, urbanizem ali prostorsko načrtovanje.
- Predvideno somentorstvo za področje urbanizma ali prostorskega načrtovanja.

7. Zavarovanje grajenega okolja pred škodo zaradi potresov

- Eden izmed načinov omiljenja posledic potresov je zavarovanje pred potencialno škodo, vendar pa je modeliranje premij zaenkrat slabo povezano s potresnim tveganjem, ocenjenim s sodobnimi analizami.
- Ključne besede: potresno tveganje grajenega okolja, potresno tveganje stavbe, zavarovanje, modeliranje škodnih zahtevkov, ocena premije, verjetnostni modeli škod.
- Priporočena osnovna znanja: gradbeništvo ali ekonomija – aktuarstvo.
- Predvideno somentorstvo za področje aktuarstva.

8. Predlog kandidata

- Kandidatka ali kandidat po svoji presoji predlagata raziskavo (lahko interdisciplinarno), pri čemer je treba tematiko opredeliti v motivacijskem pismu. Lahko se predloži priporočilno pismo potencialnega somentorja.

Mladi raziskovalec bo član programske skupine Potresno inženirstvo in se bo usposabljal v okviru doktorskega študija Grajeno okolje na Fakulteti za gradbeništvo in geodezijo, Univerza v Ljubljani, z možnostjo izpopolnjevanja na drugih uglednih institucijah doma in v tujini. Tema doktorske disertacije mladega raziskovalca bo usklajena z raziskavami programske skupine Potresno inženirstvo (P2-0185), ki sodeluje v mednarodnih projektih in združenjih, kar bo zagotavljalo, da bodo raziskave aktualne in usklajene z mednarodnimi raziskavami.

Kandidat si izbere eno izmed predlaganih tem in pri vlogi predloži motivacijsko pismo in potencialno predlaga somentorja. Dodatne informacije so možne po e-pošti: matjaz.dolsek@fgg.uni-lj.si.

Eng.:

Experience shows that strong earthquakes threaten the well-being of people if we are inadequately prepared for such extreme natural events. Small communities in earthquake-prone areas are especially vulnerable, which has been recognized in Slovenia through the Resolution on Strengthening Earthquake Safety by 2050. Since earthquakes threaten practically the entire built environment and all areas of community functioning, and indirectly affect nature as well, the topic of the research work of a young researcher can be interdisciplinary, requiring cooperation among various disciplines. Therefore, several different research topics have been announced, and candidates from different professional fields are invited to apply for the call.

Possible research topics:

1. Earthquake resistance of existing and new building structures

- Verifying and ensuring the earthquake resistance of building structures is essential for ensuring the earthquake safety of the built environment. This is particularly related to uncertainties in seismic analysis of buildings, especially for existing buildings, and the introduction of new construction technologies or new standards into practice.
- Keywords: buildings, bridges, water dams, other engineering structures, timber structures, masonry structures, reinforced concrete structures, steel structures, new construction technologies, Eurocode 8.
- Recommended foundational knowledge: structural engineering or structural mechanical engineering.
- Possible co-supervision in specialized structural engineering or earthquake engineering.

2. Earthquakes within the framework of compound hazards

- Earthquakes are accompanied by various dependent hazards (e.g., landslides, liquefaction, tsunamis), potential independent hazards (e.g., pandemics, pluvial flooding, storms), and cascading hazards (e.g., explosions, fires, hazardous material spread), which are often not considered in earthquake risk analyses.
- Keywords: earthquakes, compound hazard analysis, compound risk analysis, fire, explosions, hazardous material spread, landslides, floods, and other hazards.
- Recommended foundational knowledge: civil engineering or knowledge from other fields of concomitant or cascading hazards to be considered in the research.
- Possible co-supervision in another selected hazard field.

3. Earthquake risk of the built environment and modeling of crisis situations

- To develop strategies for reducing earthquake risks and mitigating post-earthquake consequences, it is necessary to analyze earthquake risks, including simulating earthquake events and responses from civil protection to such events.
- Keywords: earthquake risk of cities, civil protection, emergency management, digital twin in crisis situations.
- Recommended foundational knowledge: civil engineering or environmental engineering.
- Possible co-supervision in the specific field of earthquake engineering or if the candidate is from abroad.

4. Information modeling of the built environment or individual facilities for earthquake engineering purposes

- Although there are several existing databases, they are suboptimal for earthquake engineering related to built environment risk analysis and the development of strategies for the renovation of the built environment.
- Keywords: earthquake risk of the built environment, BIM, GIS, GIS-BIM integration, digital twin.
- Recommended foundational knowledge: civil engineering, geoinformatics, geodesy, computer science, information technology.
- Expected co-supervision in computer science, IT, or geoinformatics.

5. Traffic flows in crisis situations

- Earthquakes can cause the disruption of traffic flows, which delay immediate response and hinder recovery processes. The effects of such disruption are still insufficiently understood.
- Keywords: seismic vulnerability of road infrastructure, earthquake vulnerability of cities, traffic flow modeling.
- Recommended foundational knowledge: earthquake engineering, civil engineering or traffic engineering.
- Expected co-supervision in traffic engineering.

6. Earthquakes and spatial planning

- Due to the complexity of the industrial-urban environment, earthquake risk analyses need to be integrated into spatial planning, and strategies for earthquake-resistant and sustainable urbanization need to be developed.
- Keywords: earthquake risk, urbanization strategy, risk integration in spatial planning.
- Recommended foundational knowledge: civil engineering, urban planning, or spatial planning.
- Expected co-supervision in urban planning or spatial planning.

7. Insurance of the built environment against earthquake damage

- One way to mitigate the consequences of earthquakes is through damage insurance, but modeling premiums are still poorly connected to contemporary seismic risk analysis.
- Keywords: seismic risk of the built environment, seismic risk of buildings, insurance, damage claim modeling, premium assessment, probabilistic damage models.
- Recommended foundational knowledge: civil engineering or economy – actuarial science.
- Expected co-supervision in actuarial science.

8. Earthquake engineering and law

- The construction law in Slovenia allows for the possibility that earthquakes can collapse buildings and consequently endanger lives, while other actions on civil structures should not cause their collapse and put people at risk. On the other hand, the Slovenian National Assembly has adopted the Resolution on Strengthening Earthquake Safety in Slovenia, as it has been realized that Slovenia is an earthquake-vulnerable community, which will not be solved without legislative changes.
- Keywords: community earthquake resilience, construction legislation, law.
- Recommended foundational knowledge: civil engineering or law.
- Expected co-supervision in law.

9. Candidate proposal

- The candidate may propose a research topic (which can be interdisciplinary) at their discretion, specifying the topic in the motivation letter. A recommendation letter from a potential co-supervisor may also be submitted.

The young researcher will be a member of the Earthquake Engineering Research Program and will undergo training within the doctoral program Built Environment at the Faculty of Civil and Geodetic Engineering, University of Ljubljana, with the possibility of further training at other prestigious institutions both domestically and internationally. The topic of the doctoral dissertation will be aligned with the research of the Earthquake Engineering Research Program (P2-0185), which participates in international projects and associations, ensuring that the research will be up-to-date and aligned with global research.

The candidate selects one of the proposed topics and submits a motivation letter with the option to suggest a potential co-supervisor along with the application. Additional information can be obtained via email: matjaz.dolsek@fgg.uni-lj.si.

5. Priloge, ki jih kandidat priloži k prijavi (*Documents that the candidate submits with the application*):

☒ **diplomska listina/potrdilo o zaključku študijskega programa** (*diploma certificate for study programme, with which the candidate has enrolled/ will enroll in a doctoral degree programme*)

☒ **priloga k diplomi/ potrdilo o opravljenih obveznostih** (*official transcript of all the grades for study programme, with which the candidate has enrolled/will enroll in a doctoral degree programme*)

☒ **potrdilo o do sedaj opravljenih obveznostih z ocenami študijskega programa, s katerim se bo kandidat prijavil na študij** (*official transcript of all the grades the candidate has received so far for the study programme, with which the candidate will enroll to a doctoral degree programme*)

☒ **nagrade** (*awards (e.g. Prešeren Prize of the University of Ljubljana, Prešeren Prize of a University of Ljubljana member and/or another equivalent award)*)

☒ **bibliografija** (*bibliography*)

☒ **življenjepis** (*CV*)

☒ **motivacijsko pismo** (*motivation letter*)

☒ **opis dosedanjega sodelovanja pri raziskovalnem delu** (*description of the candidate's research work*)

☒ **osnutek idejne zasnove raziskovalnega dela** (*preliminary research proposal*)

☒ **priporočilno pismo** (*letter of recommendation*)

☐ **druge priloge** (*other attachments*)

Opis raziskovalnega dela (Research work description)

1. Članica UL (UL member):

Univerza v Ljubljani, Fakulteta za gradbeništvo in geodezijo
University of Ljubljana, Faculty of Civil and Geodetic Engineering

2. Ime, priimek in elektronski naslov mentorja/ice (Mentor's name, surname and email):

Matjaž Dolšek, matjaz.dolsek@fgg.uni-lj.si

3. Raziskovalno področje (Research field):

Gradbeništvo / Potresno inženirstvo,
Civil Engineering / Earthquake Engineering

4. Opis raziskovalnega dela (Research work description):

Vključuje morebitne dodatne pogoje, ki jih mora izpolnjevati kandidat/ka za mladega raziskovalca/ko, ki niso navedeni v razpisu za mlade raziskovalce (It includes any additional conditions that the candidate for a young researcher must meet, which are not listed in the call to tender for young researchers.).

Slov.:

Izkušnje kažejo, da močni potresi ogrožajo blaginjo ljudi, če se na tovrstne ekstremne naravne dogodke neustrezno pripravimo. Zagotavljanje potresne varnosti za jedrske in sevalne objekte v povezavo s trajnostjo je zato še posebej pomembno, saj imamo v Sloveniji jedrske in sevalne objekte na potresno nevarnih območjih poleg tega pa načrtujemo gradnjo nove jedrske elektrarne.

Kratek opis predvidene teme raziskovalnega dela:

- Konstrukcije, sisteme in komponente jedrskih elektrarn je treba načrtovati potresno odporno, še posebej, če so locirane na potresno nevarnih območjih. Tema je aktualna za zagotavljanje odpornosti Slovenije in zaradi dejstva, da je načrtovana gradnja novih jedrskih elektrarn po svetu, brez razvoja na področju projektiranja na potresne vplive in analiz potresnega tveganja jedrskih elektrarn.
- Ključne besede: jedrska in sevalna varnost, potresno tveganje in projektiranje konstrukcij, sistemov in komponent, analiza potresne ranljivosti, verjetnostna varnostna analiza.
- Priporočena osnovna znanja: gradbeništvo, strojništvo, jedrska fizika ali elektro inženirstvo.
- Možno somentorstvo za področje strojništva, jedrske fizike ali elektro inženirstva.

Mladi raziskovalec bo član programske skupine Potresno inženirstvo in se bo usposabljal v okviru doktorskega študija Grajeno okolje na Fakulteti za gradbeništvo in geodezijo, Univerza v Ljubljani, z možnostjo izpopolnjevanja na drugih uglednih institucijah doma in v tujini. Tema doktorske disertacije mladega raziskovalca bo usklajena z raziskavami programske skupine Potresno inženirstvo (P2-0185), ki sodeluje v mednarodnih projektih in združenjih, kar bo zagotavljalo, da bodo raziskave aktualne in usklajene z mednarodnimi raziskavami.

Kandidat si izbere eno izmed predlaganih tem in pri vlogi predloži motivacijsko pismo z možnostjo predloga somentorja. Dodatne informacije so možne po e-pošti: matjaz.dolsek@fgg.uni-lj.si.

Eng.:

Experience shows that strong earthquakes threaten human well-being if society is not properly prepared for such extreme natural events. Ensuring seismic safety for nuclear and radiation facilities in connection with sustainability is therefore particularly important, as Slovenia already has nuclear and radiation facilities in seismically active areas, and the construction of a new nuclear power plant is also planned.

Brief description of the proposed research topic:

- Structures, systems, and components of nuclear power plants must be designed to be seismically resistant, especially when located in earthquake-prone areas. This topic is relevant for ensuring the resilience of Slovenia and due to the worldwide plans for new nuclear power plants, while there is still insufficient development in the field of seismic design and seismic risk analysis for nuclear facilities.
- Keywords: nuclear and radiation safety, seismic risk and design of structures, systems, and components, seismic vulnerability analysis, probabilistic safety assessment.
- Recommended foundational knowledge: civil engineering, mechanical engineering, nuclear physics, or electrical engineering.

Potential co-mentorship: mechanical engineering, nuclear physics, or electrical engineering. The young researcher will be a member of the Earthquake Engineering Research Program and will undergo training within the doctoral program Built Environment at the Faculty of Civil and Geodetic Engineering, University of Ljubljana, with the possibility of further training at other prestigious institutions both domestically and internationally. The topic of the doctoral dissertation will be aligned with the research of the Earthquake Engineering Research Program (P2-0185), which participates in international projects and associations, ensuring that the research will be up-to-date and aligned with global research.

The candidate will choose one of the proposed topics and submit a motivation letter with the option to suggest a co-supervisor. Additional information can be obtained via email: matjaz.dolsek@fgg.uni-lj.si.

5. Priloge, ki jih kandidat priloži k prijavi (*Documents that the candidate submits with the application*):

- ☒ **diplomska listina/potrdilo o zaključku študijskega programa** (*diploma certificate for study programme, with which the candidate has enrolled/ will enroll in a doctoral degree programme*)
- ☒ **priloga k diplomi/ potrdilo o opravljenih obveznostih** (*official transcript of all the grades for study programme, with which the candidate has enrolled/will enroll in a doctoral degree programme*)
- ☒ **potrdilo o do sedaj opravljenih obveznostih z ocenami študijskega programa, s katerim se bo kandidat prijavil na študij** (*official transcript of all the grades the candidate has received so far for the study programme, with which the candidate will enroll to a doctoral degree programme*)
- ☒ **nagrade** (*awards (e.g. Prešeren Prize of the University of Ljubljana, Prešeren Prize of a University of Ljubljana member and/or another equivalent award)*)
- ☒ **bibliografija** (*bibliography*)
- ☒ **življenjepis** (*CV*)
- ☒ **motivacijsko pismo** (*motivation letter*)
- ☒ **opis dosedanjega sodelovanja pri raziskovalnem delu** (*description of the candidate's research work*)
- ☒ **osnutek idejne zasnove raziskovalnega dela** (*preliminary research proposal*)
- ☒ **priporočilno pismo** (*letter of recommendation*)
- ☐ **druge priloge** (*other attachments*)

Opis raziskovalnega dela (Research work description)

1. Članica UL (UL member):

Fakulteta za gradbeništvo in geodezijo / Faculty of Civil and Geodetic Engineering

2. Ime, priimek in elektronski naslov mentorja/ice (Mentor's name, surname and email):

Sara Piculin, sara.piculin@fgg.uni-lj.si

3. Raziskovalno področje (Research field):

2.01 Gradbeništvo (Civil Engineering)

4. Opis raziskovalnega dela (Research work description):

Vključuje morebitne dodatne pogoje, ki jih mora izpolnjevati kandidat/ka za mladega raziskovalca/ko, ki niso navedeni v razpisu za mlade raziskovalce (It includes any additional conditions that the candidate for a young researcher must meet, which are not listed in the call to tender for young researchers.).

Slov.: Bodoči mladi raziskovalec/ka bo raziskovalno delo opravljal/a v okviru raziskovalne skupine Gradbene konstrukcije in gradbena fizika, ki pokriva področje numeričnega in eksperimentalnega modeliranja ter projektiranja jeklenih, masivnih in lesenih konstrukcij. Pristopi k načrtovanju konstrukcij bodo v prihodnosti zahtevali materiale oziroma konstrukcijske sisteme, ki se bodo aktivno odzivali v času in prostoru na dane obremenitve. Razvoj metod na področju 3D tiska kovin odpira nove možnosti aplikacije sodobnih tehnologij v konstrukcijah, zlasti v smislu namensko zasnovane notranje strukture, ki omogoča optimalne lastnosti konstrukcije in konstrukcijskih elementov glede na njihov namen. Sodobno gradbeništvo vključuje uporabo metamaterialov in funkcionalno gradientnih materialov ter pametnih materialov in konstrukcij. Razvoj novih materialov in konstrukcij je tesno povezan z metodami umetne inteligence, ki so trenutno v samem središču razvoja numeričnih metod, saj predstavljajo osnovo visokotehnoloških rešitev. Raziskovalno delo bodočega mladega raziskovalca/ke bo zajemalo zgoraj naštetе sodobne metode in tehnologije, od uporabe naprednega numeričnega modeliranja ter metod umetne inteligence, do eksperimentalnega dela v laboratoriju in 3D tiska jeklenih konstrukcijskih elementov.

Programska skupina je ena vodilnih raziskovalnih skupin na področju razvoja tehničnih standardov in eksperimentalnih metod pri analizi konstrukcijskih rešitev, kar bo dobra osnova za doseg zastavljenih ciljev. Dolgoletno sodelovanje z evropskim tehničnimi univerzami, kot so Univerzi v Pavii, Tehniška univerza v Delftu, Univerza v Budimpešti, Univerza v Stuttgartu, center za numerično modeliranje na Univerzi v Hannoveru, idr. bo dalo kandidatu/ki možnost izvedbe dela usposabljanja v tujini. Splošnost uporabljenih numerično-eksperimentalnih metod ter široka znanja v programski skupini, bodo omogočala kandidatu/ki, da si, v dogovoru z mentorjem, izbere konkretne cilje in poudarke raziskav, ki bodo tako lahko osnova tudi za kandidatovo bodočo strokovno ali raziskovalno kariero. Vabljeni so kandidati/ke s področja tehnike ali naravoslovja.

Eng.: The future young researcher will carry out his/her research work in the research group Building Structures and Building Physics, which covers the field of numerical and experimental modeling and design of steel, concrete and timber structures. Future approaches to structural design require materials or structural systems that will actively respond in time and space to given loads. The development of methods in the field of 3D printing of metals opens up new possibilities for the use of modern technologies in structures, especially in the production of materials and structures whose internal structure is specifically designed to have optimal properties depending on their purpose. Today's construction industry includes the use of metamaterials, functionally gradient materials and intelligent materials and structures. The development of new materials and structural elements is closely linked to artificial intelligence methods, which are currently at the center of the development of numerical methods, as they represents the basis of high-tech solutions. The research work of the future young researcher includes the use of advanced numerical modelling, artificial intelligence methods, experimental work in the laboratory and 3D printing of metal.

The research group is one of the leading research groups in the field of development of technical standards and experimental methods in the analysis of structural systems, which will be a good basis for achieving the set goals. Long-term collaborations with some of the leading European technical universities, such as the University of Pavia, Delft University of Technology, Budapest University of Technology and Economics, University of Stuttgart, the centre for numerical modeling at the University of Hannover and others will give the candidate the opportunity to complete part of the training abroad. The generality of the numerical-experimental methods used as well as the broad knowledge in the research group allow the candidate to choose specific goals and focuses of research in

consultation with the mentor. The mentioned can be the basis for the candidate's future professional or research career. Candidates in the field of engineering or natural sciences are invited.

5. Priloge, ki jih kandidat priloži k prijavi (*Documents that the candidate submits with the application*):

☒ **diplomska listina/potrdilo o zaključku študijskega programa** (*diploma certificate for study programme, with which the candidate has enrolled/ will enroll in a doctoral degree programme*)

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☐ **nagrade** (*awards (e.g. Prešeren Prize of the University of Ljubljana, Prešeren Prize of a University of Ljubljana member and/or another equivalent award)*)

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☒ **življenjepis** (*CV*)

☒ **motivacijsko pismo** (*motivation letter*)

☐ **opis dosedanjega sodelovanja pri raziskovalnem delu** (*description of the candidate's research work*)

☐ **osnutek idejne zasnove raziskovalnega dela** (*preliminary research proposal*)

☐ **priporočilno pismo** (*letter of recommendation*)

☐ **druge priloge** (*other attachments*)

Opis raziskovalnega dela (Research work description)

1. Članica UL (UL member):

Univerza v Ljubljani, Fakulteta za gradbeništvo in geodezijo
University of Ljubljana, Faculty of Civil and Geodetic Engineering

2. Ime, priimek in elektronski naslov mentorja/ice (Mentor's name, surname and email):

Prof. dr. Žiga Turk, ziga.turk@fgg.uni-lj.si

3. Raziskovalno področje (Research field):

Gradbena informatika / Construction informatics

4. Opis raziskovalnega dela (Research work description):

Vključuje morebitne dodatne pogoje, ki jih mora izpolnjevati kandidat/ka za mladega raziskovalca/ko, ki niso navedeni v razpisu za mlade raziskovalce (It includes any additional conditions that the candidate for a young researcher must meet, which are not listed in the call to tender for young researchers.).

Slov.: Raziskovalno delo bo usmerjeno v nadaljnji razvoj integracije med velikimi jezikovnimi modeli (LLM) in okolji za informacijsko modeliranje gradenj (BIM), s posebnim poudarkom na razvoju in preizkušanju dvosmernih, pogovornih delotokov, ki izboljšujejo produktivnost načrtovanja ter interoperabilnost med različnimi platformami. Od raziskovalca se pričakuje znanje s področja umetne inteligence ter poznavanje programske opreme in standardov BIM (npr. Revit, IFC). Kandidat mora imeti ali pridobiti programerska znanja, zaželeno je poznavanje digitalnih gradbenih procesov ter sposobnost sodelovanja tako z akademskimi kot z industrijskimi partnerji. Zaželeno so predhodne izkušnje na področju raziskav AI-BIM, razvoja programske opreme za načrtovalska orodja ali na področju gradbene informatike.

Eng.: The research will focus on advancing integration between Large Language Models (LLMs) and Building Information Modeling (BIM) environments, with particular emphasis on developing and testing bidirectional, conversational workflows that improve design productivity and interoperability across platforms. The researcher will be expected to combine expertise in AI (natural language processing, model integration) with knowledge of BIM software and standards (e.g., Revit, IFC). Candidates are expected to have or be able to gain programming skills, familiarity with digital construction workflows, and the ability to collaborate with both academic and industry partners. Prior experience in AI-BIM research, software development for design tools, or applied construction informatics will be considered an asset.

5. Priloge, ki jih kandidat priloži k prijavi (Documents that the candidate submits with the application):

☒ **diplomska listina/potrdilo o zaključku študijskega programa** (diploma certificate for study programme, with which the candidate has enrolled/ will enroll in a doctoral degree programme)

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☒ **druge priloge** (*other attachments*)

Opis raziskovalnega dela (Research work description)

1. Članica UL (UL member):

Fakulteta za gradbeništvo in geodezijo

2. Ime, priimek in elektronski naslov mentorja/ice (Mentor's name, surname and email):

Prof. dr. Dejan Zupan, dejan.zupan@fgg.uni-lj.si

3. Raziskovalno področje (Research field):

Mehanika (Engineering Mechanics)

4. Opis raziskovalnega dela (Research work description):

Vključuje morebitne dodatne pogoje, ki jih mora izpolnjevati kandidat/ka za mladega raziskovalca/ko, ki niso navedeni v razpisu za mlade raziskovalce (It includes any additional conditions that the candidate for a young researcher must meet, which are not listed in the call to tender for young researchers.).

Slov.: Usposabljanje za pridobitev doktorata znanosti bo potekalo v okviru raziskovalne skupine Katedra za mehaniko in v sodelovanju z njihovimi industrijskimi in akademskimi partnerji v Sloveniji in tujini. Skupina proučuje stabilnost in dinamiko konstrukcij ter razvija nove modele in računske algoritme za reševanje aktualnih problemov na tem področju. Znotraj skupine gojimo široka znanja, uspešno izdelane metode in algoritme, ki predstavljajo dobro in trdno osnovo za raziskovalno delo mladega raziskovalca.

Mentor in raziskovalna skupina tako kandidatki ali kandidatu nudita odlične delovne pogoje za študij in raziskovalno delo, ustvarjalno, konkurenčno in prijateljsko ozračje in možnosti znanstvenih diskusij tudi z znanstveniki iz tujine ter primerno računalniško strojno in programsko opremo. Doktorsko delo bi bilo nadaljevanje in razširitev dosedanjih rezultatov raziskovalne skupine s poudarkom na aktualnih problemih pri modeliranju slojevitih konstrukcij z možnostjo delaminacij.

Iščemo kandidatke in kandidate, ki jih zanima poglobljen študij in imajo ustrezna znanja na področju modeliranja, reševanja enačb in programiranja. Primerna izobrazba je zaključena druga stopnja gradbeništva, strojništva, matematike, fizike ali druge tehnične smeri z dovolj vsebin mehanike in modeliranja konstrukcij. Zaželeno je znanje programiranja, še posebej v okoljih kot sta Matlab in Python. Zahtevano je aktivno znanje angleškega jezika.

Eng.: The PhD position is at the Research group Chair of Mechanics at Faculty of Civil and Geodetic Engineering, University of Ljubljana. The group investigates the stability and dynamics of structures and develops new models and numerical formulations for structural mechanics. The wide knowledge and research results within the research group represent an excellent starting point for the early-stage researcher – doctoral student.

The selected candidate will work in a stimulating and collaborative research environment, benefiting from excellent working conditions, access to cutting-edge computational tools, and opportunities for scientific discussions with both local and international researchers. The doctoral research will build upon the group's existing work, with a particular focus on modeling layered structures and addressing challenges related to delamination.

We are looking for highly motivated candidates with a strong academic background and a keen interest in structural modeling and computational mechanics. Appropriate background is the completion of the second level studies in civil engineering, mechanical engineering, mathematics, physics or similar with sufficient coursework in mechanics and structural modelling. Programming skills are highly desirable, in particular experiences with Matlab or Python. High standard of spoken and written English is required.

5. Priloge, ki jih kandidat priloži k prijavi (Documents that the candidate submits with the application):

☒ **diplomska listina/potrdilo o zaključku študijskega programa** (diploma certificate for study programme, with which the candidate has enrolled/ will enroll in a doctoral degree programme)

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☒ **motivacijsko pismo** (*motivation letter*)

☐ **opis dosedanjega sodelovanja pri raziskovalnem delu** (*description of the candidate's research work*)

☐ **osnutek idejne zasnove raziskovalnega dela** (*preliminary research proposal*)

☐ **priporočilno pismo** (*letter of recommendation*)

☐ **druge priloge** (*other attachments*)