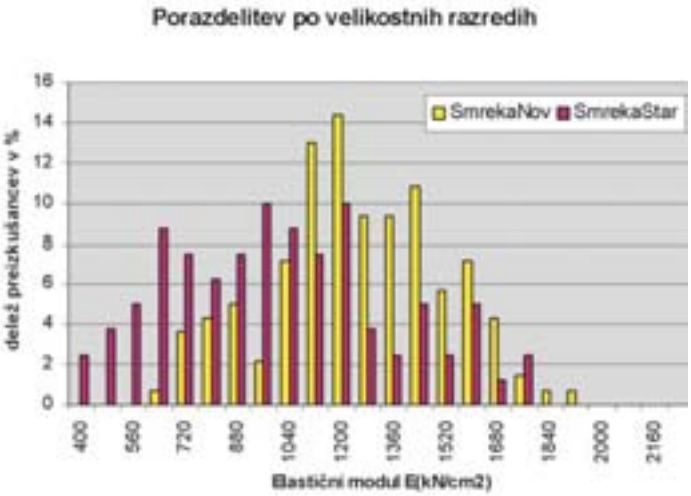
Slika 1: Upogibni preizkus na posameznem preizkušancu iz lesa v predavalnici Fakultete za arhitekturo (Foto: Edo Wallner).
Bending test on a particular wooden sample carried out in the lecture hall at the Faculty of architecture.

Slika 2: Primerjava razpršenosti specifičnih tež preizkušancev iz novega in starega smrekovega lesa.
Comparison of dispersion of specific weights of the new and old spruce samples .



Slika 3: Primerjava elastičnih modulov preizkušancev iz novega in starega smrekovega lesa.
Comparison of different elasticity modules of the new and old spruce samples.

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IZVAJANJE EKSPERIMENTOV NA PREIZKUŠANCIH IZ LESA PRI PREDMETU KID NA FA

CONDUCTING EXPERIMENTS ON WOODEN SAMPLES

raziskava, *research*

povzetek

Študenti so pri eksperimentalnih vajah pri predmetu Konstruiranje in dimenzioniranje (KID) na Fakulteti za arhitekturo opravili upogibni preizkus na preizkušancu iz lesa. Na osnovi izmerjenega povesa pri znani obtežbi in dimenzijah preizkušanca so nato izračunali elastični modul lesa. Z izbranim načinom eksperimentalnih raziskav smo v prvi vrsti želeli vzpodbuditi individualno delo študentov. Ti so uporabljali preizkušance različnih vrst lesa, različnih velikosti in kakovosti, zato je rezultate takšnih meritev težko enačiti. Izbrani pravokotni prerezi preizkušancev so bili za posameznega študenta posebej določeni glede na individualne podatke predhodno izdelane računske vaje in so močno odstopali od predpisanih pogojev standarda EN 408:1995 oziroma so bili za skupino, ki je uporabljala v konstrukcijo že vgrajen les, izbrani dokaj naključno. Zaradi pomanjkanja laboratorijske opreme in zaradi enostavnosti rokovanja so bile izbrane takšne dimenzije preizkušancev, da se pri relativno majhni obtežbi, P = 0.034 kN, dajo izmeriti merljivi povesi. Ker smo povese želeli meriti z merilno urico natančnosti 1/100 mm, smo izbrali bolj ploščate prereze z nizko statično višino, vendar so bili hkrati tudi dovolj široki, da je bila s tem zagotovljena relativna stabilnost naložene obtežbe, ki so jo predstavljali jekleni kotniki. Poleg izvedbe samega upogibnega preizkusa smo paralelno s tem evidentirali še dodatne podatke, ki so na razpolago za dodatne numerične analize, predvsem pa za dodatno kontrolo.

doseženi cilji, namen in rezultati

Pri analizi rezultatov smo primerjali soodvisnosti gostote materiala, ki se kaže skozi specifično težo materiala in elastičnega modula. Elastični modul je v vseh treh primerih preizkušancev, tako za nov smrekov les, za star smrekov les in tudi hrastov les, logičen, kar pomeni, da pri gostejši strukturi prereza običajno lahko pričakujemo večjo vrednost elastičnega modula. Zaradi specifične narave lesa seveda obstaja določeno odstopanje preizkušancev, vendar se izkaže, da je podani trend smiseln. Pri preizkušancih iz hrastovega lesa se pojavljajo večja odstopanja kot pri preizkušancih iz novega smrekovega lesa. Dobljene vrednosti elastičnih modulov so korektne, njihova različnost pa je očitno rezultat raznih vplivov, kot so: struktura materiala, različna vlažnost, majhnost dimenzij in oblika prereza preizkušancev ter možne nenatančnosti meritev.

problematika v arhitekturi, umestitev obravnavane teme v te tokove in njen pomen

Eksperimentalne raziskave na Fakulteti za arhitekturo niso bile izvedene v idealnih pogojih, ki jih predpisujejo evropski standardi, saj stavba nima primernega prostora in potrebne strojne opreme. Pri eksperimentih iz starega smrekovega lesa smo ugotovili, da je opazen trend primanjkljaja lesne mase v povezavi s starostjo lesa. Seveda pri dobrih pogojih okolja ni tako, slabosti se kažejo predvsem na posameznih mestih, ki so izpostavljena gnilobi, črvom in ostalim škodljivim vplivom, kjer pride do v povprečju 9-odstotnega zmanjšanja lesne mase oziroma v povprečju do 19-odstotnega zmanjšanja elastičnega modula. Raziskava primerjav med starim in novim konstrukcijskim lesom je pokazala, da je povprečje elastičnih modulov in verjetno tudi trdnosti obstoječih lesenih konstrukcij še vedno zadovoljivo, zato je verjetno, da je v večini primerov rekonstrukcij treba zamenjati le dotranjane elemente, ne pa celotne konstrukcije.

ključne besede

lesena konstrukcija, elastični modul, upogibni preizkus.

summary

During the experimental tutorials within the course Constructions and dimensioning at the Faculty of architecture students conducted bending tests on wooden samples. By measuring bending with known weights and dimensions of the samples they calculated the wood's elasticity module. The chosen method of experimental research was primarily applied to stimulate individual work by students. They used samples of various types of wood, size and quality, thus the results of such measurements cannot be easily compared. The samples had different rectangular sections, which significantly differ from the proscribed conditions in the EN 408:1995 standard, and were given to the individual student after a previously completed computer calculations exercise or were fairly randomly given to a group, which tested a wood sample that had previously been used in a structure. Because of deficient laboratory equipment and to simplify handling, the selected dimensions of the samples were such that even with small loads (P=0.034 kN) could provide measurable bending. Since we wanted to measure with a measure gauge with 1/100 mm precision, we chose rather flat sections with low static height, but nevertheless wide enough to ensure relative stability of the added load, which were steel braces. Besides conducting the bending test itself we produced a parallel evidence of additional data that was made available for additional numerical analyses, but above all additional control.

intentions, goals and results

In our analysis of results we compared the correlation between material density, seen by specific weight of the material and its elasticity module. In all three samples: new spruce wood, old spruce wood and oak, the elasticity module was fairly logical, meaning that with a denser structural section we can also expect a higher value elasticity module. Because of the specific nature of wood there are of course certain deviations amongst the samples, but the given trend nevertheless proves to be correct. There were more deviations amongst the oak samples than amongst the new spruce samples. The obtained values of elasticity modules are correct, variations obviously appear because of various influences, such as: structure of the material, varying moisture content, small dimensions and forms of the sample's sections and possible inaccurate measurements.

architectural issues, positioning the topic in ongoing debate and its' significance

The experimental research at the Faculty of architecture wasn't carried out in ideal conditions, as are proscribed by European standards, since the building doesn't have adequate facilities or the necessary mechanical equipment. With the experiments on old spruce wood we discovered that the shrinking of wood mass in correlation to the sample's age is a visible trend. Of course under good environmental conditions this doesn't happen, weaknesses appear only in particular places, such as those exposed to decay, woodworms and other damaging influences, where on average 9 percent of the wood mass is lost and the elasticity module on average diminishes by 19 percent. The research comparing old and new structural wood proved that the average elasticity module and probably also the resilience of the extant wooden structure is still satisfactory, therefore probably in most cases of reconstruction only worn out parts of the structure have to be replaced and not the entire structure as such.

key words

wooden structure, elasticity module, bending test