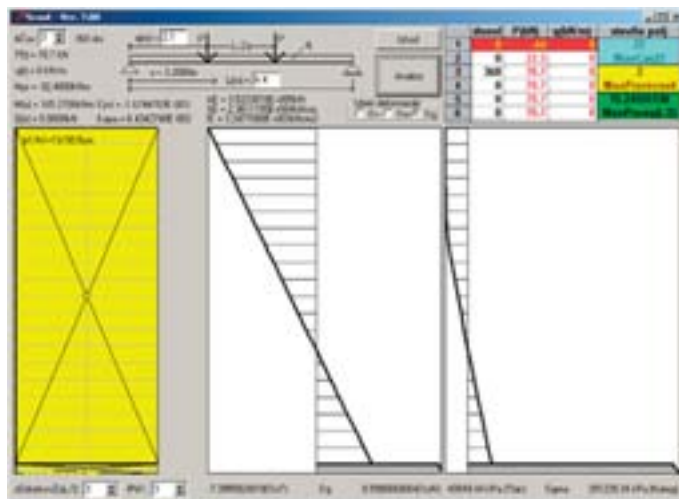
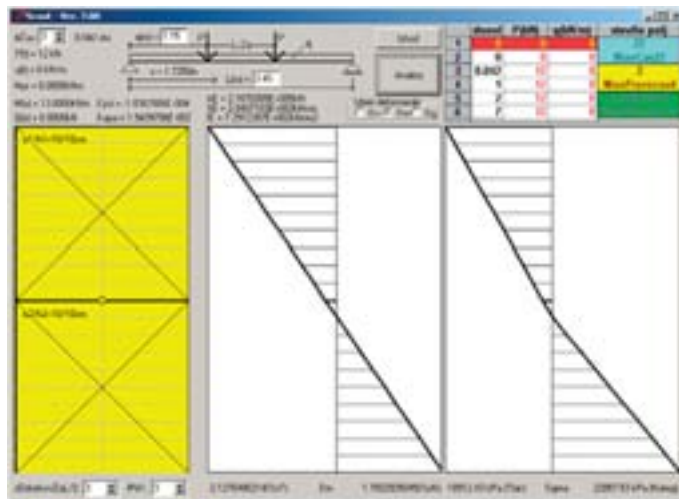


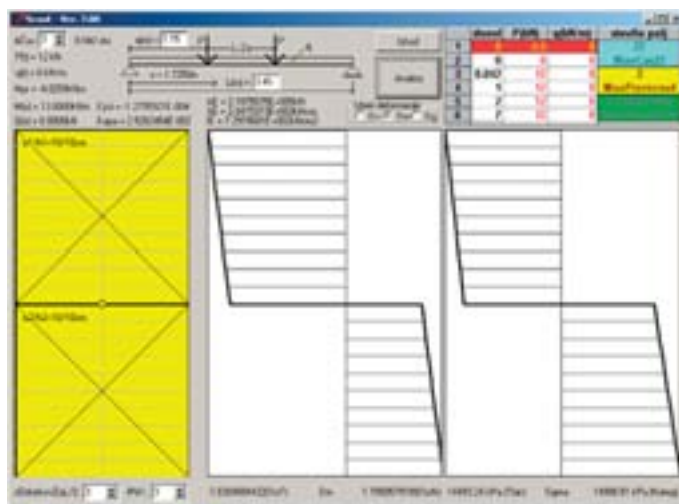
Slika 1: Ojačitev natezne cone z lamelami iz steklenih vlaken (FRP).
Strengthening the bending zone with glass fibre lamellas (FRP).



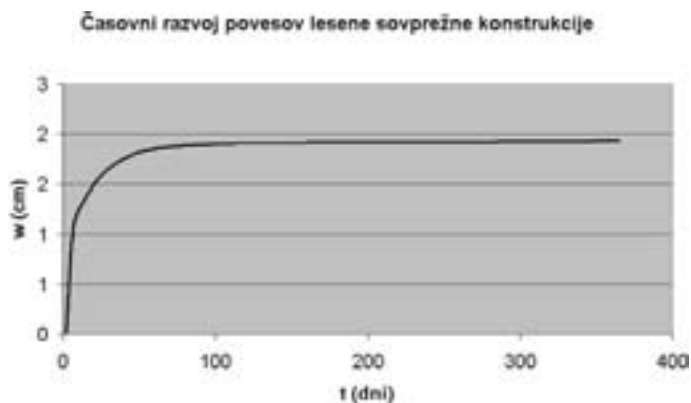
Slika 5: Simulacija ojačitve natezne cone z lamelami iz steklenih vlaken (FRP).
Simulation of strengthening the bending zone with glass fibre lamellas (FRP).



Slika 4: Dolepljenje lesa brez predkrivljenja.
Additional glued wood without pre-bending.



Slika 5: Dolepljenje lesa s predkrivljenjem.
Additional glued wood with pre-bending.



Slika 2: Simulacija lezenja lesa pri dolgotrajni obtežbi.
Simulation of creeping in wood under long-term loads.

OJAČITVE LESENIH NOSILCEV REINFORCEMENT OF WOODEN BEAMS

raziskava, research

povzetek

Načinov kako ojačamo lesene nosilce je več in so odvisni predvsem od trenutne situacije in možnosti. Lesen nosilec lahko ojačamo še pred montažo, lahko pa nosilec ojačujemo šele po tem, ko je nosilec že vgrajen in celo obremenjen.

Za simulacijo razvoja časovno odvisnih deformacij in napetosti v lesu smo izdelali računalniški program Scout, s katerim je mogoče simulirati dolepljenje lamel iz različnih materialov in celo tehnologijo predkrivljenja.

Pri materialih lahko simuliramo poljuben material, tudi take z nelinearnim odzivom vključno z lezenjem. V okviru raziskave smo naredili nekaj primerjalnih simulacij, ki smo jih uporabili za preverjanje programa. Numerični rezultati programa Scout in eksperimentalni podatki dosegljivi iz literature so se razmeroma dobro ujemali.

Dokazali smo, da je dolepljenje natezni lamel vsekakor koristno in, da s prednapenjanjem po tehnologiji predkrivljenja še dodatno povečamo učinek ojačitve. S tem smo dokazali, da je za enak učinek potrebno manj materiala.

doseženi cilji, namen in rezultati

Glavni cilj naše raziskave je bil preveritev možnosti ojačevanja nosilcev izdelanih iz lesa slovenskih iglavcev. Z namenom, da pocenimo raziskavo, smo upogibne obremenitve prostoležečih nosilcev simulirali s programom Scout. Rezultati analize so pokazali, da tako ojačani leseni prerezi dosežejo tudi 50% večjo upogibno odpornost. Uporaba iste kombinacije materialov in sistema predkrivljenja, s katerim dosežemo prednapetje armature, pa lahko doseže celo za 75% večjo upogibno odpornost nosilcev.

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

V arhitekturi pogosto naletimo na primere, ko se namembnost objektov menja ali pa, da je obstoječa konstrukcija preslabotna in je potrebna rekonstrukcija, kjer lahko uporabimo prikazane principe. Prav tako lahko to znanje uporabimo tudi pri novogradnjah, kjer se zahteva minimalne prereze konstrukcijskih elementov.

ključne besede

konstrukcija, upogib, lesen lameliran lepljen nosilec, tehnologija predkrivljenja

summary

There are numerous methods used for strengthening wooden beams, depending on given circumstances and possibilities. Wooden beams can be strengthened before or after assembly, when the beam is already in place and under loads.

To stimulate the development of time-conditioned deformations and stress in wood we produced the computer programme Scout, which facilitates simulation of additional glued lamellas of various materials and even pre-bending technology.

When simulating materials we can specify any given material, even such with non-linear response, including creeping. In the research we conducted several comparative simulations, and used them to test the programme. Numerical results from the programme and experimental data gathered from literature were relatively similar.

We proved that additional glued lamellas were beneficial against stretching and that pre-stressing done with the pre-bending technology actually enhanced the effect of strengthening. Therefore we proved that the same effect could be achieved with less material.

intentions, goals and results

The main research goal was to check possibilities for strengthening load-bearing wooden beams produced from domestic coniferous timber. To diminish research costs we simulated bending of simple beams with the programme Scout. Results of the analysis showed that wooden sections strengthened in the described manner increase bending resilience by more than 50%. Use of the same combination of materials and pre-bending systems, which help in achieving pre-stressed reinforcement, can increase bending resilience of beams by more than 75%.

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

In architecture we often encounter cases where the use of buildings changes or where the structure is too weak and demands reconstruction and can thus implement the presented principles. Similarly the knowledge can be used even for new developments, in which minimal sections of structural elements are demanded.

key words

structure, bending, glued laminated wooden beam, technology of prebending