

**TTÜ EHITUSTEADUSKOND**  
**EHITISTE PROJEKTEERIMISE INSTITUUT**  
**TEADUS- JA ARENDUSTEGEVUSE AASTAARUANNE 2014**

## **1. Struktuur**

**Ehitiste projekteerimise instituut, Department of Structural Design**  
**direktor professor Jarek Kurnitski**

Struktuuriüksuse koosseisu kuuluvad järgmised õppetoolid ja laboratoorium:

- Ehitusfüüsika ja energiatõhususe õppetool - Chair of Building Physics and Energy Efficiency juhataja professor Targo Kalamees
- Ehituskonstruksioonide õppetool - Chair of Structural Engineering õppetoolihoidja külalisdotsent Ivar Talvik
- Ehituskonstruksioonide teadus- ja katselaboratoorium - Laboratory of Structures juhataja Elmar-Jaan Just

## **2. Instituudi teadus- ja arendustegevuse (edaspidi T&A) iseloomustus**

### **2.1 struktuuriüksuse koosseisu kuuluvad uurimisgrupid**

Uurimisgrupi nimetus (*eesti ja inglise keeles*) ja juhi nimi

- uurimisgrupi teadustöö kirjeldus (*inglise keeles*)
- uurimisgrupi aruandeaastal saadud tähtsamad teadustulemused (*inglise keeles*)
- uurimisgrupi kuni 5 olulisemat publikatsiooni aruandeaastal

#### **2.1.1 Liginullenergiahoonete uurimisgrupp – Nearly Zero Energy nZEB Research Group** **juht professor Jarek Kurnitski**

Nearly Zero Energy nZEB Research Group was established 01.04.2012 at Tallinn University of Technology (TUT). The group has a web page [www.nzeb.ee](http://www.nzeb.ee). This multi- and interdisciplinary nZEB research group represents a strong networking effort within TUT among four different disciplines: Energy performance of buildings, Building Service Systems, Building Physics and Construction Economics and Management. With active involvement of two other professors this research group consist of about 10 persons. Professor Targo Kalamees (Building Physics) has actively been involved in the research of nZEB group, especially the research of airtightness and infiltration. Professor Hendrik Voll (HVAC-technology, co-funded by the grant) has been involved in one core topic of the group, fenestration design principles for nZEB office buildings in a cold climate.

In 2014 six PhD students have worked in the group:

- Mikk Maivel works with low temperature radiator (and floor heating) systems with the aim to find optimal heating solutions with minimal systems losses for nZEB buildings;
- Martin Thalfeldt is conducting building simulation in order to find optimal fenestration solutions and design regarding daylight, heating and cooling energy as well electric lighting;
- Ergo Pikas works with cost optimality and other economic aspects related to high performance solutions needed for nZEB. With his help, the fenestration analyses can show not only novel technical solutions to control energy use but also cost optimal solutions;

- Jevgeni Fadejev is focused on energy pile and ground source heat pump modeling questions and performance analyses in a whole building simulation environment;
  - Erkki Seinre is working with quantification of environmental and economic impacts for main categories relevant for building labeling schemes and sustainability assessment.
  - Raimo Simson is working with overheating issues and simulation methodology in apartments.
- The research has been generally been focused on technical solutions for nZEB most urgently needed in Estonia, which may be condensed as follows:
- new heating and ventilation solutions suitable for specific operation conditions in nZEB;
  - new external wall assembly solutions studied with computational analyses and climate chamber tests;
  - office building solar shading and facade analyses will use energy simulations and measurements at TUT technological facility;
  - energy simulations combined with economic and cost optimal analyses.

From autumn 2013 we have been capable for laboratory research: two facilities, nZEB technological research facility and climate chambers for controlled laboratory experiments are completed, and first studies are already ongoing.

The main research outcomes have been scientific publications, contributions to Estonian energy action plan ENMAK 2030+ preparation and on European level through chairing REHVA nZEB Task Force and participating into EPBD 2<sup>nd</sup> generation standards development in TC371, TC156 and TC228.

#### Some selected publications:

- Kurnitski, J.; Kuusk, K.; Tark, T.; Uutar, A.; Kalamees, T.; Pikas, E. (2014). Energy and investment intensity of integrated renovation and 2030 cost optimal savings. *Energy and Buildings*, 75, 51 – 59;
- Seinre, E.; Kurnitski, J.; Voll, H. (2014). Building sustainability objective assessment in Estonian context and a comparative evaluation with LEED and BREEAM. *Building and Environment*, 82, 110 – 120;
- Pikas, E.; Thalfeldt, M.; Kurnitski, J. (2014). Cost optimal and nearly zero energy building solutions for office buildings. *Energy and Buildings*, 74, 30 – 42;
- Seinre, E.; Kurnitski, J.; Voll, H. (2014). Quantification of environmental and economic impacts for main categories of building labeling schemes. *Energy and Buildings*, 70, 145 – 158;
- Arumägi, E.; Kalamees, T. (2014). Analysis of energy economic renovation for historic wooden apartment buildings in cold climates. *Applied Energy*, 115, 540 – 548.

### **2.1.2 Konstruksioonide tulepüüvisus – Structural fire design juht külalisdotsent Ivar Talvik**

Main task of the research group „Structural fire design“ is to deal with development of design methods for fire design of steel and timber structures.

Research group consists of Ass.Prof. Ivar Talvik, Ass.Prof. Alar Just and PhD students Andrei Kervalishvili and Mattia Tiso.

The work group has good co-operation with SP Technical Research Institute of Sweden, Estonian Academy of Security Sciences and Estonian Rescue Board.

In 2014 the work contained following topics:

- Andrei Kervalishvili and Ivar Talvik worked with alternative approach to buckling of square hollow section steel columns in fire;
- research work with fire design of timber structures in 2014 was related to protection provided by claddings and mineral wool as well as influence of elevated temperatures to the strength properties of timber elements;
- Alar Just worked with effect of zero-strength layers of timber members and protection properties by claddings and insulations. There are different master theses ongoing on those topics. Results are published in Fire Safety Journal and in the conference „Structures in Fire“;
- PhD student Mattia Tiso started the research on contribution of the insulation materials to the fire performance of timber structures;
- Master student Johanna Liblik started with research on fire technical properties of clay plasters;
- Master student Priit Tohver made a comparative study on design methods for fire performances of timber buildings for longer time;
- Master student Kairit Kraudok started with analyse of database of fire tests with different claddings.

Some selected publications:

- Kervalishvili, A.; Talvik, I. (2014). Alternative approach to buckling of square hollow section steel columns in fire. Journal of Constructional Steel Research, 96(May), 140 – 150;
- Just, Alar; Schmid, Joachim; Werther, Norman; Frangi, Andrea (2014). Fire Protection of the timber members - determination of the fire protection system characteristics for the verification of the load-bearing resistance by means of calculation models. In: Structures in Fire—Proceedings of the 8th International Conference on Structures in Fire: Structures in Fire, Shanghai, 9.-12.6.2014. (Toim.) Li, Guo-Qiang; Kodur, Venkatesh; Jiang, Shou-Chao; Jiang, Jian; Chen, Su-Wen; Lou, Guo-Biao. Tongji: Tongji University Press, 2014, 557 – 566;
- Schmid, J.; Klippel, M.; Just, A.; Frangi, A. (2014). Review and analysis of fire resistance tests of timber members in bending, tension and compression with respect to the Reduced Cross-Section Method. Fire Safety Journal, 68, 81 - 99;
- Schmid, J.; Just, A.; Klippel, M.; Fragiacom, M. (2014). The Reduced Cross-Section Method for Evaluation of the Fire Resistance of Timber Members: Discussion and Determination of the Zero-Strength Layer. Fire Technology, 50(5), 1043 - 1326.

2.2 Loetelu struktuuriüksuse töötajate rahvusvahelistest tunnustustest

Energy & Buildings

2013

Certificate of Excellence in Reviewing

awarded to Jarek Kurnitski

in recognition of an outstanding contribution to the quality of the journal.

2.3 Loetelu struktuuriüksuse töötajatest, kes on välisakadeemiate või muude oluliste T&A-ga seotud välisorganisatsioonide liikmed.

Targo Kalamees: CIB-International Council for Building Research Studies and Documentation – W40- Heat and-Moisture Transfer in Buildings, member of commission;  
-International Society of Indoor Air Quality and Climate, member.

Jarek Kurnitski: Vice-President of the REHVA (Federation of European Heating and Air-Conditioning Associations), since April 18, 2012;

- Chairman of the REHVA (Federation of European Heating and Air-Conditioning Associations) Task Force on Nearly Zero Energy Buildings, 2010 –;
- Co-Chair of the REHVA Technology and Research Committee (TRC) since 2012;
- member of the editorial board of Energy and Buildings (an international scientific journal);
- member of the editorial board of the REHVA European HVAC Journal;
- Member of the editorial board of the Journal of Building Physics, since 2014;
- Vice-chairman of The Finnish Association of HVAC Societies SuLVI, 2010 – 2015;
- member in CEN TC228 Heating Systems in Buildings WG4 Calculation methods and system performance and evaluation, 2014 – 2015;
- member in CEN TC371 Project Committee – Energy Performance of Buildings project group WG1 EPBD Standards group, 2012 – 2015;
- Expert in CEN TC156 Ventilation for Buildings WG21 Revision of calculation standards EN15241, 15242 and 15243, 2013 – 2015.

Aldur Parts: International Association of Bridge and Structural Engineering (IABSE), member.

Alar Just: International Association of Bridge and Structural Engineering (IABSE), member:

- Rahvusvahelise ekspertgrupi Fire Safe Use of Wood, member;
- CEN/TC 250/SC 5 Eurocode 5, member.

Valdek Kulbach: Rakenteiden Mekaniikan Seura RY, member;

- Honorary Doctor of Tampere University of Technology (since 1995)

Vello Otsmaa: CEN/TC 250/SC 2 Eurocode 2: Design of concrete structures, expert,

Valdo Jaaniso: International Society for Soil Mechanics and Geotechnical Engineering (ISSMGE), member.

Johannes Pello: International Society for Soil Mechanics and Geotechnical Engineering (ISSMGE), member.

Väino Voltri: CIB-International Council for Building Research Studies and Documentation -W23 - Wall Structures, member of commission.

Karl Õiger: Honorary Doctor of Science in Technology (Tampere University of Technology since 18.05.2012).

2.4 Soovi korral esitatakse aruandeaastal saadud T&A-ga seotud tunnustused (va punktis 2.3 toodud tunnustused), ülevaade teaduskorralduslikust tegevusest, teadlasmobiilsusest ning hinnang oma teadustulemustele

Aruandeaastal saadud muud T&A-ga seotud tunnustused

Emeriitdtsent Vello Otsmaa valiti 2014.a. Eesti Betooniühingu auliikmeks;

Eesti Betooniühingu üliõpilaspreemia saajad olid 2014.a.:

-Veiko Zovo magistritöö „ Betoonkonstruktsioonide väsimusarvutus 3,6 MW tuulegeneraatori vundamendi näitel“ eest. Töö juhendaja lektor Johannes Pello;

- Martin Truuts magistritöö „ Lainete ja liikuva jääga koormatud elektrituuliku vundamendi arvutamine 30 meetri sügavuses meres“ eest. Töö juhendaja lektor Johannes Pello.

3. veebruar 2015