KTH SOLID MECHANICS SEMINAR; Wednesday, January 31th, 10.15; KTH Solid Mechanics Seminar room

Janis Sliseris
"Multi-scale modeling of fiber reinforced materials"

Janis Sliseris has obtained his Dr. degree in 2013 from Riga Technical University, Faculty of Civil Engineering. His thesis contributed to the research of numerical modeling and topology optimization of plywood composite plates. After doctoral studies he was postdoc in Fraunhofer Institute of Industrial Mathematics where the research was related to numerical modeling of strength and stiffness of medium density wood fiberboards (MDF) on micro and macro scales. Current research is related to meso scale and structural scale modeling of fiber reinforced concrete and geopolymer with the aim to create an efficient numerical method for prediction of building's safety against the progressive failure that can be caused by explosion or impact loads.

The ever-increasing demand of fibre-reinforced composites in various engineering applications calls for accurate predictions of their mechanical behaviors. A numerical method for the prediction of tensile and bending stiffness and strength of medium density fiberboards (MDF), flax fiber composite, fiber reinforced concrete will be discussed. The fiber geometry, orientation and other factors will be analyzed with the aim to find their influence on material effective properties. First, the virtual microstructure is generated by random fiber generator or simulations of a fiber lay-down and a subsequent compression to obtain the necessary density. The fiber orientation can be estimated from CT images and image analysis tools or in case of self-compaction concrete by using computation fluid dynamics and particle tracking methods. On the micro-scale, periodic representative volume elements can be formulated as a Lippmann–Schwinger type equation in elasticity and solved by using Fast Fourier Transformation (FFT) or solved by finite elements where fibers are embedded in matrix. On the structural scale, there will be discussed a problems related to simulation of multi-story building's progressive failure and shown an innovative way to couple structural scale simulation with material scale.