SEMERNAR- ALL WELCOME
Monday 2nd March 2015, 1pm
College of Engineering – Room 204

Title: Heterogeneous Volume Modelling and Applications

Speaker: Prof Alexander Pasko (Bournemouth University, UK; Uformia AS, Norway & Visiting Professor UCD)

Speaker's biography

Alexander Pasko is a professor at The National Centre for Computer Animation, Bournemouth University in the UK and the board chairman of the Uformia AS company in Norway. He received his PhD from Moscow Engineering Physics Institute (MEPhI) in Russia in 1988, where he was a senior scientist until 1992. He was an assistant professor at the department of computer software, University of Aizu, Japan (from 1993 to 2000); associate and full professor at the Faculty of Computer and Information Sciences of the Hosei University in Tokyo, Japan (2000-2007).

Alexander Pasko’s areas of interest are geometric and volume modelling, computer-aided design and 3D printing, computer animation and computer art. His main research interest is development of a high-level universal model for spatio-temporal objects and phenomena with their internal properties. The model called the Function Representation (FRep) is based on the most universal mathematical language of real functions of point coordinates in geometric spaces. To support the mathematical concepts of this model, Alexander and his colleagues introduced and develop the special-purpose modelling language called HyperFun (from Hyperdimensional Functions), which has extensive applications in education, computer animation, biology, digital fabrication, and other areas. The international R&D Digital Materialization Group led by Alexander has published more than 130 papers in academic journals and conferences, and distributes its software under a special open source license.

Alexander was a co-founder of the Shape Modeling International conference series and he serves on its steering committee. He is on the editorial board of the Computer-Aided Design journal, an Associate Editor of the International Journal of Computer Games technology and an editorial board member of several other international journals. He chaired and co-chaired multiple international conferences and gave a number of invited tutorials and talks worldwide.

He is an Adjunct Visiting Professor with SMARTlab in the College of Engineering and Architecture at UCD.
Heterogeneous volume modelling is a new and quickly developing research area, which deals with many different aspects of a volumetric object, such as its outer shape, its general functionality, its internal structure, an ability to move and to interact with its environment. Man-made objects are often nearly uniform in their internal structure; for example, mechanical parts are typically made of a single type of metal. In contrast, natural objects are rarely homogeneous, having a complicated internal distribution of various materials and microstructures. The next generation of mathematical models and supporting software systems should provide means for modelling artifacts that may be heterogeneous in material, dimension, and other geometrical or physical properties.

This talk presents an approach to heterogeneous volume modelling based on real vector functions of spatial coordinates representing both object geometry and its internal volumetric properties such as multiple material distributions, multi-scale microstructures and other pointwise properties. The approach is illustrated with applications in Computer-Aided Design, additive manufacturing/3D printing, mass customization, artistic design and other areas.

Additional information

Research directions with references
- multi-material heterogeneous volume modelling
  [PASS95, PASS01, PAC08, VPV09, FSP15, SFA*15]
- microstructures, lattices, scaffolds [PFV*11, FVP13]
- direct 3D printing [PVV*06, VMLP08]

Application areas with references:
- multi-material design and additive manufacturing [VMLP08, FVP13, FSP15]
- mass customization [VFSP08], Uformit (uformit.com)
- cultural heritage preservation [VVP*11, PPV*11]
- artistic design [ACP03, SFVP13], Chairgenics project (http://uformia.com/uformia-showcase/jan-habraken)
- creativity for disabled, SHIVA project (http://www.appliedshapes.com/)

Current technology transfer partners:
- Uformia (uformia.com)
- Uformit (uformit.com)
- Applied Shapes (appliedshapes.com)
Related publications (most recent first)


