VRIJE UNIVERSITEIT BRUSSEL

The faculty of Engineering of the Vrije Universiteit Brussel invites you to attend the public defense leading to the degree of

DOCTOR OF ENGINEERING SCIENCES

of **Volodymyr Seliuchenko**

The public defense will take place on **Tuesday, 2nd February 2021 at 3pm.**

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Meeting ID: 885 4342 4766
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ACTIVE PIXELS FOR HIGH DYNAMIC RANGE AND 3D IMAGING APPLICATIONS

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Abstract of the PhD research

Our world is being reshaped by machines which are getting closer to humans in perceptive and cognitive abilities enabling previously unimaginable applications. Autonomous cars, mobile home assistant robots, drone delivery networks are just a few examples of the emerging disrupting technologies of this brave new world. Accelerating trends in computational power availability fuel the evolution of artificial intelligence systems which become capable of digesting more and more information that, for systems interacting with the real world, must come from sensors. These emerging mobile robotics applications rely heavily on the image and distance sensors to create awareness about their environment - the quality of the sensory data, in most cases, determines the key performance parameters and system safety. Real applications are often posing the sensory system challenging conditions pushing the sensor specifications to the limits and often calling for novel sensing and signal processing approaches.

In this work, 2D and 3D image sensor systems, the key sensor components of mobile robotics, are discussed. Firstly, quantum efficiency improvement methods and a method for dynamic range extension of 4T image pixels that preserves 4T pixel dark noise performance are proposed. These quantum efficiency improvement methods and the dynamic range extension method can be applied to both 2D and 3D imaging. Further, indirect Time-of-Flight 3D image sensors are analyzed, and improved 3D image sensors based on Current Assisted Photonic Demodulators are proposed. Finally, a hybrid Time-of-Flight method that produces a time domain echo signal using photonic demodulator sensor is proposed and compared to direct Time-of-Flight methods..