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Ultrasound Department

Research topics:

3D/4D Ultrasonography

Description of research topics in the scope of the proposed PhD thesis:

Development of the modern real-time 3D ultrasound image reconstruction methods based on temporal-spatial frequency domain transformation techniques

Ultrasound is an inexpensive and widely used imaging modality for the diagnosis and staging of a number of diseases. In the past two decades rapid advancements in the development of ultrasound imaging techniques have helped to improve diagnosis by providing immediate clinical information. It is its speed, cost-effectiveness, flexibility and noninvasive nature which make the ultrasound imaging more competitive over other imaging modalities. The most recent advances in ultrasound technology now provide 3D imaging capabilities in real-time (4D imaging). Significant development has been the introduction and fast development of portable, hand-held ultrasound systems with advanced computational power. They are becoming more popular among clinicians, especially for point-of-care diagnosis. Hand-carried ultrasound systems are primarily used for imaging internal organs, including heart and peripheral vasculature. However, implementing a high-resolution and high-quality image real-time 3D ultrasound system within the power budget constraints of a hand-held portable device is difficult and extremely complex technologically. Among the unresolved challenges the following can be mentioned: the transmit/receive electronics design which provide high quality of the transmitted and received back-scattered ultrasound signals, 2D array transducers design and manufacturing, connections of 2D arrays comprised of thousands of elements to the transmit and receive electronics, power limitations of the hand-held systems, huge amount of input/output data that must be transferred and processed. No less important are the fast and efficient algorithms for 3D/4D image reconstruction which should be used in the portable hand-held devices. This will be the main topic of the proposed PhD thesis