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SARUS: A Synthetic Aperture Real-Time Ultrasound System

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Total number of authors:
13

Published in:
I E E E Transactions on Ultrasonics, Ferroelectrics and Frequency Control

Link to article, DOI:
10.1109/TUFFC.2013.2770

Publication date:
2013

Document Version
Publisher's PDF, also known as Version of record

Link back to DTU Orbit

Citation (APA):
Jensen, J. A., Holten-Lund, H., Nilsson, R. T., Hansen, M., Larsen, U. D., Domsten, R. P., Tomov, B. G., Stuart, M. B., Nikolov, S. I., Pihl, M. J., Du, Y., Rasmussen, J., & Rasmussen, M. F. (2013). SARUS: A Synthetic Aperture Real-Time Ultrasound System. *I E E E Transactions on Ultrasonics, Ferroelectrics and Frequency Control*, *60*(9), 1838-1852. https://doi.org/10.1109/TUFFC.2013.2770

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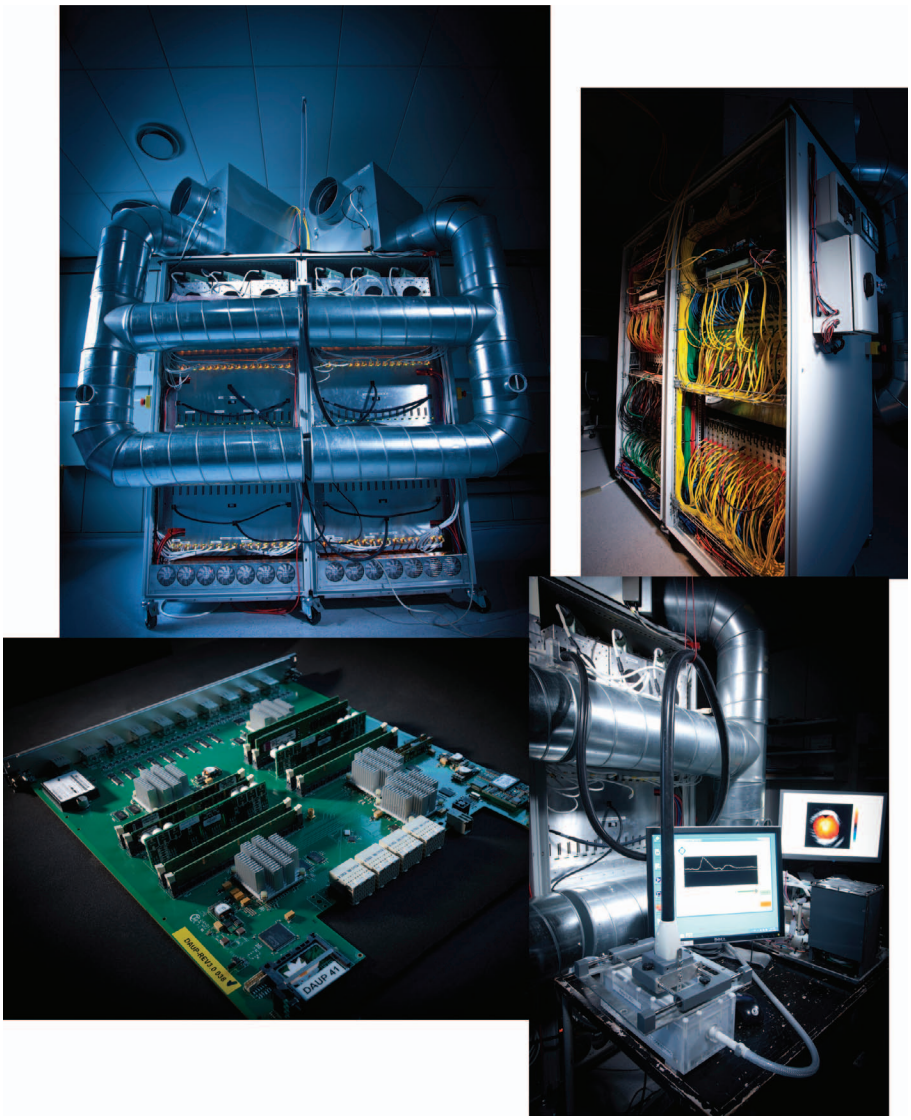
IEEE TRANSACTIONS ON

ULTRASONICS, FERROELECTRICS, AND FREQUENCY CONTROL

A PUBLICATION OF THE IEEE ULTRASONICS, FERROELECTRICS, AND FREQUENCY CONTROL SOCIETY

SEPTEMBER 2013 VOLUME 60 NUMBER 9 ITUCER (ISSN 0885-3010)



Access the journal with its multimedia contents online at: http://www.ieee-uffc.org/tr/

DOI http://dx.doi.org/10.1109/TUFFC.2013.2760

The SARUS (Synthetic Aperture Real-Time Ultrasound System) Research Scanner

The SARUS research scanner is capable of transmitting and receiving ultrasound signals for 1024 independent transducer elements simultaneously. It can transmit an arbitrary signal on each element, and the signal can change from emission to emission. The RF signal can be received on 1024 elements in parallel at a 70 MHz sampling frequency with a precision of 12 bits. The signals can be stored in real time for several seconds. SARUS can also implement real-time synthetic aperture processing using the 320 FPGAs housed in the system. It is connected through sixty-four 1-Gbit/s links and four 10-Gbit/s links to a Linux computer cluster for fast data storage and off-line processing.

(Top left) The front side of the system, showing the 6 standard transducer connectors at the top of the system and the cooling pipe system. (Top right) The 512 interconnect cables, each with 4 channel connections, between the analog and digital sides of the system. (Bottom left) One of the 64 digital boards in the system. Each board houses 16 transmit and 16 receive channels. Below the 5 heat sinks are the 5 field-programmable gate arrays (FPGAs) that are used for transmission, reception, focusing, summing, and control of the system. (Bottom right) A 2-D 32×32 channel matrix probe fully connected to the system and used for 3-D vector velocity estimation.

Images were taken by Jens Rosenfeldt and Morten Fischer Rasmussen and provided courtesy of Jørgen Arendt Jensen, the Center for Fast Ultrasound Imaging, Department of Electrical Engineering, Technical University of Denmark, Lyngby, Denmark. For further reading, see the accompanying article on page 1838 of this issue.