Digital Processing Systems: Choosing a Processor/Platform

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Abstract – Applications of Digital Signal Processors are vast. However, there are only seven different types of processor in the market that make up 1000's of different processors that one has to choose from for a specific application. Choosing the right processor has always been a difficult choice since many factors have to be considered and recently economic and political rivalry has made this choice even more complicated as users need to secure the supply of processors and/or to avoid compromising security as has been the case recently with Huawei and UK-based computer chip designer ARM Holdings. The processor market is very large, for instance the gaming industry alone is worth over $100bn and in August-September 2020, ARM was estimated to be around $40bn.

When developing a radio telecommunications system, whether for research or industry, choosing the correct processor(s)/platform(s) and the development (including tools for debugging) are crucial to efficiently utilising the limited manpower of engineers, reducing time-to-market/time-to-publication and cost.

In this talk, a review of the state-of-the art processors in each category will be presented. The processors could be categorised into Microcontroller (μC), Real-Time Unit (RTU), Central Processing Unit (CPU), Graphics Processing Unit (GPU), Digital Signal Processor (DSP), Field-Programmable Gate Array (FPGA) and Application-Specific Integrated Circuit (ASIC). Each of these has their own benefits and drawbacks, and in this keynote, we will also be examining the relative merits of each and how it applies to radio data processing systems and show that in many applications a combination of processors may be required.

Curriculum Vitae

Naim Dahnoun is a Senior Fellow of the Higher Education Academy and Programme Director of the Computer Science and Electronic Programme at the School of Computer Science, Electrical and Electronic Engineering, and Engineering Maths. Naim received a Ph.D. degree in biomedical engineering from the University of Leicester, U.K., in 1990, where he designed and produced the first Portable Bidirectional Doppler device for ambulatory monitoring of blood flow while doing his research at Leicester Royal Infirmary. Following this, he joined the University of Bristol, U.K. in 1994. His main research interests include real-time digital signal processing applied to biomedical engineering, video surveillance, automotive, and photonics. In 2003, in recognition of the important role played by universities in educating engineers in new technologies such as real-time DSP, Texas Instruments (NYSE:TXN) presented the first Texas Instruments DSP Educator Award to Dr Dahnoun for his outstanding contributions to furthering education in DSP technology. In 2018, he obtained the Students' Award for Outstanding Teaching (Engineering) at the University of Bristol. Dr Dahnoun also released a new book in 2018 on Multicore DSP.

Scott Tancock is a PhD student in the Department of Electrical and Electronic Engineering at the University of Bristol. He received a 1st-class masters in Computer Science and Electronics from the University of Bristol in 2016. His PhD topic is high-resolution Time-to-Digital Converters (TDCs) on FPGAs. His research interests also include embedded systems, microcontrollers, VLSI, DSP, image processing and computer vision.