

Short Course – May 11 and 12, 2016 @ INDIANA UNIVERSITY, in Bloomington, Indiana, USA

DataFlow SuperComputing

This course presents the DataFlow SuperComputing paradigm, defines its advantages and sheds light on the related programming model with hands-on coding experience. DataFlow computers, compared to ControlFlow computers, offer speedups of 20 to 200 (even 2000 for some applications), and power and size reductions of up to 1/20. However, the programming paradigm is different, and has to be mastered. The course will explain the paradigm of programming in space, using Maxeler (a provider of dataflow computing platforms) as an example, and will give an overview of ongoing research in the field. Examples include DataEngineering, DataMining, FinancialAnalytics, etc.

Registration & Information: Contact sabry@indiana.edu

Location & Schedule: TBA

May 11 2pm-3pm: Introduction to DataFlow Computing

3pm-4pm: Concepts of DataFlow Computing

4pm-5pm: Applications of DataFlow Computing

5pm-6pm: Details of Programming in Space with Hands-on Activities

6pm-7pm: Selected Examples and Class Projects with Hands-on Activities

7pm-8pm: Open Research Problems

May 12 10:00am: Homework discussion and oral exam

May 18 (Skype) Office Hours for those who decide to do hw: An application for appgallery.maxeler.com

May 19 (Skype) Office Hours for those who decide to do hw: An application for appgallery.maxeler.com

June 30 (eMail) Homework delivery (the date could be adjusted after the course is delivered) and grade assignment

Interesting Facts and Useful Links:

□□ A recent study from Tsinghua University in China reveals that, for Shallow Water WeatherForecast, which is a BigData problem, on the 1U level, the Maxeler DataFlow machine is 14 times faster than the Tianhe machine. Tianhe is rated #1 on the Top 500 list of the fastest computers in the World (based on Linpack, which is a smalldata benchmark).

□□ Maxeler resources <https://appgallery.maxeler.com> and <https://webide.maxeler.com>

References:

□□ **Article:** Trifunovic, N., Milutinovic, V., et al, "An AppGallery for DataFlow Computing," Springer Journal of Big Data, Feb 2016.

□□ **Article:** Trifunovic, N., Milutinovic, V., et al, "Paradigm Shift in BigData SuperComputing," Springer Journal of Big Data, May 2015.

□□ **Book:** Milutinovic, V., Salom, J., Trifunovic, N., Giorgi, R., *Guide to DataFlow Supercomputing*, Springer, 2015.

□□ **Article:** Jovanovic, Z., Milutinovic, V., "FPGA Accelerators for Floating-Point Matrix Multiplication," *The IET Computing and Digital Techniques*, Vol 6., Issue 4, 2012. (The IET 2014 Premium Award for Computing and Digital Techniques).

□□ **Article:** Flynn, M., Mencer, O., Milutinovic, V., et al, "Moving from PetaFlops to PetaData," *Communications of the ACM*, May 2013.

□□ **Book:** *MultiScale DataFlow Programming*, Maxeler Technologies, 2012.

About the Instructor:

Prof. Veljko Milutinovic received his PhD from the University of Belgrade, spent about a decade on various faculty positions in the USA (mostly at Purdue University), and was a codesigner of the DARPA's first GaAs RISC microprocessor. Now he teaches and conducts research at the University of Belgrade, in EE and MATH (Belgrade is math-rated #87 worldwide at the U.S. News Report 2015). His research is mostly in datamining and dataflow computing, with stress on algorithms and mappings of algorithms onto architectures. His co-authored paper on matrix multiplication for dataflow received "The IET Premium Award for 2014" (meaning the single best paper in IET Computing for 2012 and 2013). His paper on the research methodology was published in an ASCE journal and received a special recognition. He published over 20 books with the leading publishers in the USA (for 7 of them, forewords were written by 7 different Nobel Laureates). He has over 60 IEEE or ACM journal papers, and about 4000 Google Scholar citations (including those related to misspellings of his name). He is a Fellow of the IEEE and a Member of Academia Europaea.

Note:

This course is a 3-credit course for those who take a 60-hour homework, a 2-credit course for a 40-hour homework, and a 1-credit course for a 20-hour homework. Those who like to attend without doing a homework are welcome, but will not earn any credit against graduation.