Implementation of Software for Digital Holography in Software CUDA

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Abstract: This article examines the development of software for digital holography CUDA environment optimized by the criterion of the execution time.

Key words: digital holographic interferometry, GPGPU, CUDA, algorithm parallelization of digital holographic interferometry, digital conversion Fresnel suppression of DC component, removing speckle noise.

REFERENCES

[1] http://supercomputingblog.com/cuda/cuda-tutorial-3-thread-communication/
[2] https://msdn.microsoft.com/en-us/magazine/cc337887.aspx
[3] Разработка системы неразрушающего контроля на основе методов цифровой голографической интерферометрии
[4] http://docs.nvidia.com/cuda/cuda-c-programming-guide/
[5] https://developer.nvidia.com/cuFFT
[6] http://stackoverflow.com/questions/3606636/cuda-model-what-is-warp-size
[7] http://stackoverflow.com/questions/16986770/cuda-cores-vs-thread-count
[8] http://stackoverflow.com/questions/10934240/blocks-threads-warpsize
[9] http://cuda-programming.blogspot.ru/2013/01/what-is-constant-memory-in-cuda.html
[10] http://developer.download.nvidia.com/compute/cuda/CUDA_Occupancy_calculator.xls
[11] Рефакторинг. Улучшение существующего кода
[12] Optimizing software in C++ An optimization guide for Windows, Linux and Mac platforms http://www.agner.org/optimize/optimizing_cpp.pdf
[13] http://web.archive.org/web/20080729033434/http://www.abarnett.demon.co.uk/tutorial.html
[14] https://www.sharcnet.ca/help/index.php/CUDA_tips_and_tricks
[15] http://stackoverflow.com/questions/16119923/using-constants-with-cuda
[16] Kreis, T. Suppression of the dc term in digital holography [Text] / T. Kreis, W. Juptner // Optical Engineering. – 1997. – Vol. 36. – P. 2357-2360.
[17] Madrigal R., Acebal P. , Blaya S., Carretero L, Fimia A., Serrano F. GPU-based calculations in digital holography // Holography: Advances and Modern Trends III. – 2013. - Vol. 8776.
[18] S. Lee, H. C. Wey, D. K. Nam and D. S. Park. GPU implementation of wave field translation method for fast hologram generation // Optics and Photonics for Information Processing VIII. – 2014. - Vol. 9216.
[19] Koki Murano1, Tomoyoshi Shimobaba1,, Atsushi Sugiyama1, Naoki Takada1, Takashi Kakue1, Minoru Oikawa1, Tomoyoshi Ito. Fast computation of computer-generated hologram using Xeon Phi coprocessor // Computer Physics Communications. – 2014.
[20] N. Múnera Ortiz, C. A. Trujillo and J. García-Sucerquia. Digital holographic interferometry accelerated with GPU: application in mechanical micro-deformation measurement operating at video rate // 8th Iberoamerican Optics Meeting and 11th Latin American Meeting on Optics, Lasers, and Applications. – 2013. - Vol. 8785
[21] Yasuyuki Ichihashi, Ryutaro Oi, Takanori Senoh, Hisayuki Sasaki, KokiWakunami, and Kenji Yamamoto. A real-time 3D system using electronic holography // SPIE. – 2014.
[22] Mert Dogar, Hazar A. Ilhan, and Meric Ozcan. Real-time reconstruction of digital holograms with GPU // Practical Holography XXVII. – 2013. - Vol. 8644
[23] Koki Muranoa, Tomoyoshi Shimobabaa, Atsushi Sugiyamaa, Naoki Takadab, Takashi Kakuea, Minoru Oikawaa, Tomoyoshi Itoa. Fast computation of computer-generated hologram using Xeon Phi coprocessor // Preprint submitted to Computer Physics Communications. – 2013.
[24] R.V. Uskov. O nekotoryh osobennostjah primenenija tehnologii CUDA dlja modelirovanija perenosa izluchenija // Vestnik MGTU im. N.Je. Baumana. Ser. “Estestvennye nauki”. 2011. № 3
[25] Guzhov V.I. Ispol'zovanie golograficheskoj i spekl-interferometrii pri kontrole promyshlennyh izdelij// Pjataja mezhdunarodnaja nauchno-tehnicheskaja konferencija "Opticheskie metody issledovanija potokov". - Moskva: MJeI.- 1999.- C.107-108.
[26] Cifrovaja golograficheskaja sistema real'nogo vremeni. / Guzhov V.I., Il'inyh S.P., Hajdukov D.S., Kabak E.S. // Sbornik nauchnyh trudov Novosibirskogo gosudarstvennogo tehnicheskogo universiteta, Novosibirsk , – 2014.-№4(78) – S. 97 – 112.
[27] Algoritm rasshifrovki interferencionnyh kartin so sluchajnym fazovym sdvigom. / Guzhov V.I., Il'inyh S.P., Hajdukov D.S. // Sbornik nauchnyh trudov Novosibirskogo gosudarstvennogo tehnicheskogo universiteta, Novosibirsk , – 2014.-№4(78) – S. 79 – 96.

[28] Guzhov V.I., Pod#jakov A.E., Solodkin Ju.N., Shtejngol'c Z.I. Vosstanovlenie fazy volnovogo fronta na osnove odnomernogo preobrazovanija Fur'e// Avtometrija.- 1992.- №6.- C.21-24.

[29] Cifrovaja golograficheskaja interferometrija real'nogo vremeni dlja jeksperimental'nogo issledovanija naprjazhenno-deformirovannogo sosotojanija dinamicheskih ob#ektov. / Guzhov V.I., Il'inyh S.P., Kuznecov R.A., Kabak E.S. // Omskij nauchnyj vestnik, Omsk , – 2015.-№1(137) – S. 158 – 162.
[30] http://fap.sbras.ru/node/4141.

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