The Operating Environment and Software Installation of MatDEM

1) Software Configuration (details in the MatDEM help.xlsx)

Operating system: Because MatDEM is programmed in MATLAB language, MatDEM can run on Windows, Linux, UNIX or Macintosh operating systems. Currently, most MatDEM users use Windows OS; therefore, the Windows version of MatDEM is compiled and maintained. The Linux version of MatDEM is released every year.

MatDEM Runtime: MatDEM is based on object-oriented programming ideas, programmed in MATLAB language, and packaged as a standalone executable file (MatDEM.exe). Therefore, there is no need to install the MATLAB completely. Users only need to install the free MATLAB Runtime (similar to the Java Runtime Environment).

|  |  |  |
| --- | --- | --- |
| Version | Required Runtime | Supported GPU |
| MatDEM 1.32 | R2017a (9.2) | Telsa K series |
| MatDEM 1.42 and further versions | R2019a (9.6) | Telsa P and V series, 1080, 2080 etc. |
| MatDEM 2.66 and further versions | R2021a (9.10) | Telsa A series, 3080 etc. |

Users can visit the official website of MathWorks and then download and install the MATLAB Runtime.

<https://ww2.mathworks.cn/products/compiler/matlab-runtime.html>

GPU driver: GPU servers purchased from professional manufacturers usually have the CUDA runtime installed. If users' personal laptop or desktop computer prompts that the GPU cannot be recognized or used, they need to update the latest driver or consult the manufacturer on the NVIDIA website.

<https://www.nvidia.cn/Download/index.aspx?lang=en>

2) Hardware Configuration

MatDEM supports CPU and GPU computing and can switch between CPU and GPU calculation at any time while the program is running. When the number of elements is greater than 5000, the computation speed of GPU usually begins to exceed that of CPU. As the number of elements increases, the speed of CPU does not change substantially, while the speed of GPU increases almost linearly. Therefore, the greater the number of elements, the more obvious the computation speed advantage of GPU. When the number of elements reaches 1 million, the maximum computation speed of Tesla P100 can reach 70 times that of a single core CPU.

The recommended hardware configuration of MatDEM is as follows.

GPU: GPU computing requires an NVIDIA discrete graphics card (containing CUDA core). A common laptop can also run a GPU computing, but its efficiency is only approximately 5 times better than that of a CPU. A well-equipped desktop computer with a discrete graphics card can improve efficiency by ten or twenty times. However, if efficiency needs to be improved by dozens of times, a Tesla GPU will be needed. This is a type of a professional computing card produced by NVIDIA, such as Tesla P100 or Tesla V100; Tesla V100 currently has the highest performance. A graphics card with 1 GB of memory can support the calculation of approximately 100,000 3-dimensional elements. Thus, as the Tesla P100 has a graphics card with 16 GB of memory, it can handles up to approximately 1.5 million elements. GPU computing cards constitute most of the cost of GPU workstations and servers.

CPU: GPU computing is controlled by a CPU; therefore, CPUs with greater dominant frequency are required. One GPU usually needs two CPU cores; thus, the requirement for the number of CPUs is not critical. For example, a two-way CPU Xeon E5-2637v4 has a relatively better cost performance. CPUs with greater dominant frequency and more cores therefore have better computing performance.

Graphics card: The three-dimensional display of simulation results of MatDEM relies on graphics cards. Therefore, if the user wishes to display hundreds of thousands of three-dimensional elements, a better professional graphics card is needed. In terms of servers, a professional graphics card is required.

Memory and hard disk: The system memory capacity should ideally be at least twice the GPU memory capacity. If there is only one GPU, the system memory capacity should be 3-4 times greater. For large-scale computing, a SSD of 1 TB or more capacity is recommended, accompanied by an HHD of 8 TB or more capacity.

If an ordinary desktop computer is used, purchasing a game graphics card with a greater memory capacity is recommended. Generally, the configuration of a high-performance game computer is usually sufficient.

<http://matdem.com>