

#### CFD Research Group Guide Series

#### Running the Palabos Lattice Boltzmann CFD Package on Windows Guide

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Rev. 3



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This guide contains information on how to set up and run the Palabos lattice Boltzmann CFD software package on Windows.

 First, download the Palabos files by going to <u>https://gitlab.com/unigespc/palabos</u> and downloading a .zip file as shown below (it should download as palabos-master):

| UniGeSPC > p                    | palabos   |   |  |  |  |  |  |  |
|---------------------------------|---|---|--|--|--|--|--|--|
| P palabos  Project ID: 14692818 |   |   |  |  |  |  |  |  |
| - <b> 334</b> Com               | imits 🖇 9 Branches 🛷 4 Tags 🛛 🗔 1,022.1 MB Project Storage 💿 3 Releases |   |  |  |  |  |  |  |
| The Palabo                      | is library source code  |   |  |  |  |  |  |  |
| pipeline p                      | assed License AGPL v3 VTweet a chat 12 online discourse 3.9k users      |   |  |  |  |  |  |  |
| Me<br>Or                        | erge branch '108-add-missing-directory-to-the-ci' into 'master' 🐽       |   |  |  |  |  |  |  |
| master                          | v palabos   | Find file   |  |  |  |  |  |  |
| READM                           | IE 핵 GNU AGPLv3 CHANGELOG B CONTRIBUTING B CI/CD configure              | Download source code       zip     tar.gz       tar.bz2     tar |  |  |  |  |  |  |
| Name                            | Last commit   | Last update   |  |  |  |  |  |  |

- 2. Unzip the folder to a destination of your choice
- Go to <a href="https://azureforeducation.microsoft.com/devtools">https://azureforeducation.microsoft.com/devtools</a> and sign in with your student ID and password
- Click on "Software" on the left hand side and search for "Visual Studio Enterprise 2019". It might already be visible. Select it and then select "Download" in blue on the bottom right of the screen:



| Home > Education   | oftware 🖈 …   |                             |                        | Software ×  |
|--------------------|---|-----------------------------|------------------------|---|
|                    | « Search  | Product category : All      | Operating System : All |   |
| Overview           |   | Product language : English, | Multilanguage          |   |
| Learning resources |   |                             |                        | Visual Studio Enterprise 2019                               |
| 💼 Roles            | 80 Items  |                             |                        | high productivity and seamless coordination across teams of |
| 😡 Software         | Name ↑↓   | Product category ↑↓         | Operating System ↑↓    | any size.   |
| 💎 Learning         | SQL Server 2019 Developer                             | Database                    | Windows                | Windows   |
| Templates          | Visual Studio Enterprise 2019                         | Developer Tools             | Windows                | Product language<br>Multilanguage                           |
| Need help?         | Visual Studio Enterprise Edition 2022                 | Developer Tools             | Windows                | System  |
| Support            | Machine Learning Server 9.4.7 for Windows             | AI + Machine Learning       | Windows                | 64 bit  |
|                    | Microsoft R Client 9.4.7                              | Database                    | Windows                | View Key  |
|                    | Agents for Visual Studio 2019 (version 16.0) Test Age | nt Developer Tools          | Windows                | Give feedback<br>한 Help improve this page                   |
|                    | Agents for Visual Studio 2019 (version 16.0) Test Con | troller Developer Tools     | Windows                | X mep improve and page                                      |
|                    | Azure DevOps Server 2020 Update 1.1 - DVD             | Productivity Tools          | Windows                |   |
|                    | Azure DevOps Server 2020 Update 1.1 - Web Installe    | r Productivity Tools        | Windows                |   |
|                    | Azure DevOps Server 2020 Update 1 - DVD               | Productivity Tools          | Windows                |   |
|                    | Azure DevOps Server 2020 Update 1 - Web Installer     | Productivity Tools          | Windows                |   |
|                    | Azure DevOps Server Express 2020 Update 1.2 - DVD     | Productivity Tools          | Windows                |   |
|                    | Azure DevOps Server Express 2020 Update 1.2 - Web     | Inst Productivity Tools     | Windows                |   |
|                    | Azure DevOps Server Express 2022 - Installer          | Productivity Tools          | Windows                |   |
|                    | Azure DevOps Server Express 2022 - Image              | Productivity Tools          | Windows                |   |
|                    | Azure DevOps Server Express 2020 Update 1.1 - DVD     | Productivity Tools          | Windows                |   |
|                    | Azure DevOps Server Express 2020 Update 1.1 - Web     | Inst Productivity Tools     | Windows                |   |
|                    | Azure DevOps Server Express 2020 Update 1 - DVD       | Productivity Tools          | Windows                |   |
|                    | Azure DevOps Server Express 2020 Update 1 - Web I     | nstal Productivity Tools    | Windows                | Develored Cancel  |
|                    |   | The should be Taula         | 14 Generation and      | Caricer   |

- 5. This will download a Visual Studio installation file (.exe) to your Downloads folder. Double click the file to start the installation process.
- 6. Make sure that the following is selected and click "Install" in the bottom right corner:

|  |   |   | * & - D   | × |
|--|---|---|---|---|
| Ning-Visual Studio Enterprise 2019—16.11.21<br>Installing—Visual Studio Enterprise 2019—16.11.21<br>Workloads Individual components Language packs In  | nstallation locations   |   |   |   |
| Need help choosing what to install? More info  |   | × | Installation details  |   |
| Web & Cloud (4)  | Azure development   | I | <ul> <li>Desktop development with C++</li> <li>Included</li> <li>C++ core desktop features</li> </ul>   |   |
| Build web applications using ASP.NET Core, ASP.NET,<br>HTML/JavaScript, and Containers including Docker supp   | Azure SDKs, tools, and projects for developing cloud apps<br>and creating resources using NET and NET Framework                               | 1 | <ul> <li>Optional</li> <li>MSVC v142 - VS 2019 C++ x64/x86 build t</li> <li>Windows 10 SDK (10.0.1904.0)</li> <li>Just-Ion-Time debugger</li> <li>Gui amelia tactor</li> </ul>                              |   |
| Python development<br>Editing, debugging, interactive development and source<br>control for Python.  | Nodejs development<br>Build scalable network applications using Nodejs, an<br>asynchronaus event-driven JavaScript runtime.                   |   | <ul> <li>C++ prolining looss</li> <li>C++ CMake tools for Windows</li> <li>C++ ATL for latest v142 build tools (x86 8</li> <li>Test Adapter for Boost.Test</li> <li>Test Adapter for Google Test</li> </ul> |   |
| Desktop & Mobile (5)   |   |   | ✓ Live Share ✓ IntelliCode  |   |
| INET desktop development     Build WPF, Windows Forms, and console applications     using CF, Visual Basic, and FP with .NET and .NET Frame  | Desktop development with C++<br>Build modern C++ apps for Windows using tools of your<br>choice, including MSVC, Clang, CMake, or MSBuild.    |   |   |   |
|  |   |   | C++ Modules for v142 build tools (x64/x8  |   |
| Location<br>CAProgram Files (x86)/Microsoft Visual Studio\2019)Enterprise Change<br>By continuing you agree to the license for the Visual Studio edition you selected. We<br>This software is licensed separately, as set out in the <u>3rd Party Notices</u> or in its accorr | e also offer the ability to download other software with Visual Studio.<br>mpanying license. By continuing, you also agree to those licenses. |   | Total space required 847 GB   |   |
|  |   |   |   |   |

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7. The installation should continue as shown below:

| Visual Studio Installer  | * & - D ×   |
|--|---|
| Installed Available  |   |
| Visual Studio Enterprise 2019 Pause Downloading and verifying: 279 MB of 2.14 GB (111 MB/sec) 12% Installing: package 38 of 429 4% Microsoft ServiceHub Node | Developer News<br>What's new in Visual Studio productivity<br>We often hear feedback from users like you that r<br>Tursday, December 6, 2022<br>Get your developer news<br>Staying up to date with relevant news about your<br>Monday, December 5, 2022<br>Building a new JawScript liniting experience in<br>Varial Studio |
|  | Available today in the 17.4 public release, Visual S.,<br>Thursday, December 1, 2022<br>View more Microsoft developer news  |
|  | Need help? Check out the <u>Microsoft Developer</u><br>Community or reach us via <u>Visual Studio</u><br><u>Support</u><br>Installer version 2.11.69.53063  |

8. Skip creating a Visual Studio account (unless desired), make sure to select "Visual C++" under "Development Settings" and click "Start Visual Studio":

| Visual Stud           | io                      |
|-----------------------|-------------------------|
|                       |                         |
| Start with a famili   | ar environment          |
| Development Settings: | sual C++                |
| Choose your cold      | or theme                |
| Blue                  | O Blue (Extra Contrast) |
| 🔀 Visual Studio       | 📢 Visual Studio         |
|                       |                         |
|                       |                         |
| O Dark                | ⊖ Light                 |
| Visual Studio         | Visual Studio           |
|                       |                         |
|                       |                         |
|                       |                         |

9. Click "Open a local folder" and select the downloaded "palabos-master" folder:



Open a local folder Treate a new project Choose a project template with co to get started

Open a project or solution

You can pin anything that you open frequently so that it's always at the top of the list.

10. There will likely be error messages which is mentioned on the Palabos Gitlab website (https://gitlab.com/unigespc/palabos):

"You may get error messages in the "Output messages" window if MPI and/or HDF5 are not installed on your system. In these cases, deactivate MPI and/or HDF5 by selecting "Manage Configurations" in the "Configuration" button in the toolbar. In the section "CMake variables and cache", you should be able to un-click ENABLE MPI and/or BUILD HDF5 (you may need to wait a bit for these to appear). After this, click "Save and generate CMake cache to load variables" and proceed as indicated above."

| 🕅 File Edit View Git Project Build Debug Tent Analyze Tools Extensions Window Help   | Search (Ctrl+Q) P palabos-manter   | Sign in A – O   | ×                       |
|--|--|---|-------------------------|
| O + O   巻 + 🖕 🔐 🥐 - ヴ +   💦 🛛 🛛 sól-Debug -  | Select Startup Item *  | 년 Live Share  | R                       |
| Image: Solution of the solut | Depart           Secure departs           Demandprisme           Demandpre | Constant<br>Construction<br>(Construction)<br>(Construction)<br>(Construction)<br>(Construction)<br>(Construction)<br>(Construction)<br>(Construction)<br>(Construction)<br>(Construction)<br>(Construction)<br>(Construction)<br>(Construction)<br>(Construction)<br>(Construction)<br>(Construction)<br>(Construction)<br>(Construction)<br>(Construction)<br>(Construction)<br>(Construction)<br>(Construction)<br>(Construction)<br>(Construction)<br>(Construction)<br>(Construction)<br>(Construction)<br>(Construction)<br>(Construction)<br>(Construction)<br>(Construction)<br>(Construction)<br>(Construction)<br>(Construction)<br>(Construction)<br>(Construction)<br>(Construction)<br>(Construction)<br>(Construction)<br>(Construction)<br>(Construction)<br>(Construction)<br>(Construction)<br>(Construction)<br>(Construction)<br>(Construction)<br>(Construction)<br>(Construction)<br>(Construction)<br>(Construction)<br>(Construction)<br>(Construction)<br>(Construction)<br>(Construction)<br>(Construction)<br>(Construction)<br>(Construction)<br>(Construction)<br>(Construction)<br>(Construction)<br>(Construction)<br>(Construction)<br>(Construction)<br>(Construction)<br>(Construction)<br>(Construction)<br>(Construction)<br>(Construction)<br>(Construction)<br>(Construction)<br>(Construction)<br>(Construction)<br>(Construction)<br>(Construction)<br>(Construction)<br>(Construction)<br>(Construction)<br>(Construction)<br>(Construction)<br>(Construction)<br>(Construction)<br>(Construction)<br>(Construction)<br>(Construction)<br>(Construction)<br>(Construction)<br>(Construction)<br>(Construction)<br>(Construction)<br>(Construction)<br>(Construction)<br>(Construction)<br>(Construction)<br>(Construction)<br>(Construction)<br>(Construction)<br>(Construction)<br>(Construction)<br>(Construction)<br>(Construction)<br>(Construction)<br>(Construction)<br>(Construction)<br>(Construction)<br>(Construction)<br>(Construction)<br>(Construction)<br>(Construction)<br>(Construction)<br>(Construction)<br>(Construction)<br>(Construction)<br>(Construction)<br>(Construction)<br>(Construction)<br>(Construction)<br>(Construction)<br>(Construction)<br>(Construction)<br>(Construction)<br>(Construction)<br>(Construction)<br>(Construction)<br>(Construction)<br>(Construction)<br>(Construction)<br>(Construction)<br>(Construction)<br>(Construction)<br>(Construction)<br>(Construction)<br>(Construction)<br>(Construction)<br>(Construction)<br>(Construction)<br>(Constructi | Re Server Lybor Toolson |
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11. To remedy this, go to "Project" --> "CMake Cache (x64-Debug Only) --> "View CMakeCache.txt":

| 🔀 File Edit View Git  | Project   | Build                   | Debug             | Test      | Analyze | Tools   | Extensions      | Window  | Help |
|---|-----------|-------------------------|-------------------|-----------|---------|---------|-----------------|---------|------|
| 0 • 0   🏠 • 🖕 💾 🗳   | Re<br>Dis | scan Solut<br>play Brow | ion<br>sing Datab | oase Erro | ] x6    | 4-Debug |                 | •       |      |
| Solution Explorer - Folder View   | Cl        | ar Browsi               | ng Databas        | se Errors | ;       |         |                 |         |      |
| 00 🔂 🐙 🖉 🖒 🕫 🕼  | ) Ex      | oort Temp               | late              |           |         |         |                 |         |      |
| Search Solution Explorer - Folder   | Ge        | nerate Ca               | the               |           |         |         |                 |         | ٩    |
| <ul> <li>palabos-master (D:\Drop</li> </ul>   | E CN      | lake Cach               | e (x64-Deb        | oug Only  | /) •    | ( C     | elete Cache     |         |      |
| Duild Dui | 🔑 CN      | lake Settir             | ngs               |           |         | 0       | Open in Explore | er      |      |
| Þ 📄 dco   |           |                         |                   |           |         | V       | iew CMakeCa     | che.txt |      |

- 12. The file will open. First modify Line 202 as shown (ON to OFF) and save:
  - 201 //Enable MPI 202 ENABLE\_MPI:BOOL=ON

- 201 //Enable MPI 202 ENABLE MPI:BOOL=OFF
- 13. Click "Generate Cache" as shown:



- 14. Modify Line 18 as shown (ON to OFF), save and click "Generate Cache" once more:
  - 17 //compile with hdf5
    18 BUILD HDF5:BOOL=ON

17 //compile with hdf5
18 BUILD\_HDF5:BOOL=OFF

Note that from now on "Generate Cache" in the menu will be replaced with "Configure palabos"

15. Find a test case in the tree like shown and double click on the .cpp file (cavity.cpp chosen here):







16. Click on "Current Document (cavity2d.cpp)" underneath the search box.

| 🕅 File Edit View Git Project Build Debug Test Analyze Tools Extensions Wi | indow Help Search (Ctrl+Q)             |
|---|--|
| 🐰 🗢 🔹 🗎 🎽 🦉 🦻 - 🕫 -   💦 -   🐂   📓   x64-Debug                             | Current Document (cavity2d.cpp)        |
| Solution Explorer - Folder View   |  |
| G O 🏠 🚚 🛃 🕹 🗇 🕼 💻   | 💁 cavity2d.exe (D:\Dropbox\downloads_V |
| Search Solution Explorer - Folder View (Ctrl+;)                           | 1 ⊟/* This file is part<br>2           |

17. A build process will begin and the simulation will run:



18. Any output files can be found in the "tmp" folder in the tree on the left:







**<u>Note</u>**: If the output files are not generated this way, double click the up-to-date .exe file in the cavity2d folder in Windows Explorer outside of Visual Studio to generate the files.

- 19. To create a new simulation, the easiest thing to do is to copy an existing simulation folder (cavity2d chosen in this case) and rename as desired.
- 20. Rename the .cpp file to be the same as the folder name e.g. mylbsimulation.cpp
- 21. Following that, open CMakelists.txt in the "palabos-master" main folder and add your simulation name as shown (example used is mylbsimulation on Line 204), then save:







22. CMake should automatically refresh. Following that, modify set(EXECUTABLE\_NAME "...") in the CMakeLists.txt file within the simulation folder to include the correct name

(mylbsimulation used as an example again):



23. Open your new .cpp file, and click "Build" --> "Build Current Document":

| 🕅 File Edit View Git Project                              | Bu | ld Debug                 | Test    | Analyze    | Tools     | Extensions | Window            | Help | Search (Ctrl+Q) ${\cal P}$ palabos-master   |
|---|----|--------------------------|---------|------------|-----------|------------|-------------------|------|---|
| 0 - 0   20 - 0  |    | Build All<br>Rebuild All |         |            |           |            | F7<br>Ctrl+Alt+F7 | •    | 🕨 Current Document (mylbsimulation.cpp) 👻 📲 🎁 📋 🕲                                   |
| Solution Explorer - Folder View                           |    | Clean All                |         |            |           |            |                   | Ψ×   | mylbsimulation.cpp 😐 🗙  |
| o o 🎧 🗐 😂 🖒 🕫 🕒 🗕   | *  | Build Curren             | nt Docu | ment (mylb | simulatio | on.cpp)    | Ctrl+B            |      | 💁 mylbsimulation.exe (D:\Dropbox\downloads_WL\palabos-maste                         |
| Search Solution Explorer - Folder View (Ctrl+             |    | Install palab            | os      |            |           |            |                   | P    | 1 ⊡/* This file is part of the Palabos lib<br>2                                     |
| <ul> <li>dsl3d</li> <li>externalFlowAroundObst</li> </ul> | P  | Compile                  |         |            |           |            |                   | ^    | 3 * The Palabos softare is developed sin<br>4 * (Switzerland) and the University of |
| generalExternalFlow                                       | _  |                          |         |            |           |            |                   |      | 5 * own the IP rights for most of the co  |

24. After that, you can run the simulation as done previously (click "Current Document (mylbsimulation.cpp) underneath the search box)