



PIETOOLS_2020a: Troubleshooting

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PIETOOLS 2020a is the first release of MATLAB toolbox used for manipulation of Partial Integral (PI) operators and solving optimization problems involving PI operators, referred to as Linear PI Inequality problems (LPIs).

1 Installing PIETOOLS 2020a

In this section, we discuss about installation and setting up of PIETOOLS 2020a. Additionally, we also discuss some common issues users may run into while installing. Currently, the toolbox is compatible with Windows, Mac or Linux systems and has been verified to work with MATLAB version 2014 or higher, however, we suggest to use the latest version of MATLAB. PIETOOLS 2020a can be installed in two ways.

1. **Using install script:** The script installs the following files — `tbxmanager` (skipped if already installed), `SeDuMi 1.3` (skipped if already installed), `Modified SOSTOOLS 3.03` (always installed), `PIETOOLS 2020a` (always installed). Adds all the files to MATLAB path.
 - Go to the website control.asu.edu/pietools/.
 - Download the file `pietools_install.m` and run it in MATLAB.
 - **Run the script from the folder it is downloaded in to avoid path issues.**
2. **Setting up PIETOOLS 2020a manually:**
 - Download and install C/C++ compiler for the OS.
 - Download `SeDuMi` and run `install_sedumi.m` file.
 - Alternatively, install `MOSEK` and add to MATLAB path.
 - Download the zip file `PIETOOLS_2020a.zip`.
 - Extract the zip file and add it to MATLAB path.

1.1 Troubleshooting: Installation

If PIETOOLS toolbox is installed using the install script, the user may run into one of following errors in rare circumstances. In case of an error, a message is displayed explaining the issue which can be one of the following.

1. *An error appeared when trying to create the folder ...*
Check if the folder already has a folder named **PIETOOLS_2020a**. If that does not resolve the issue try running MATLAB from an administrator account which has the authority to create or modify folders. As a last resort, try installing in a different folder. If that does not fix this, contact us.
2. *The installation directory " " already exists...*
Obvious error. However, if there is no folder with the name PIETOOLS_2020a, check hidden folder.
3. *An error appeared when trying to create the folder...* See the steps to first error.
4. 'tbxmanager' or 'SeDuMi' were not downloaded or installed.
Check your internet connection. Verify that MATLAB is allowed to download files using the internet connection. Check if the websites for tbxmanager and SeDuMi are operational.
5. 'PIETOOLS' was not downloaded or installed.
Check the suggestions for previous question. If that does not fix the issue, contact us.
6. *Could not modify the initialization file "startup.m",...* Try running MATLAB from an administrator account which has the authority to create or modify folders. If that does not fix the issue, manually add SeDuMi or the relevant SDP solver (like MOSEK, sdpt3, sdpnal) to MATLAB path and extract the files in **PIETOOLS_2020a.zip**. Add the PIETOOLS to MATLAB path.
7. *Could not save the path to a default location...* Try running MATLAB from an administrator account which has the authority to create or modify folders. If that does not fix it, just add PIETOOLS, SeDuMi to MATLAB path and skip this step.

1.2 Troubleshooting: Solving LPIs

PIETOOLS can be used for solving LPI optimization problems and users may run into errors often while setting up and solving them. For any errors in setting up an LPI, refer to the function and script headers to ensure that input-output formats are correct. Ensure that PI objects, defined in the LPI problem, are well-defined and valid PI operators. You can use 'isvalid' function to check if a PI operator is well defined. If that does not fix the problem, contact us.

1. How to interpret results of solved optimization problem?

A general rule of thumb is to look at: pinf, dinf, feasratio and Residual norm. pinf and dinf should be 0, while feasratio is in between -1 and 1 (preferably closer to 1).

Lower the residual norm the better. Refer to SeDuMi manual to interpret other output parameters and more details.

2. **pinf is 1**

Verify if the LPI constraints are infact feasible. Verify if the sign-definiteness of the PI operator is on a compact interval (use psatz term if local sign-definite is needed) or entire real line. Use 'getdeg' function to check if your LPI constraint has high degree polynomials. If yes, make sure that all opvar variables used in lpi_eq fucntion have high enough degrees to match it. If this does not resolve the issue contact us and attach the files that you are trying to run along with snapshot of the error/output.

3. **dinf is 1 and feastratio is -1**

Check if the objective function is bounded below. This typically happens when objective function is unbounded below and becomes $-\infty$. If this does not resolve the issue contact us by email and attach the files that you are trying to run along with snapshot of the error/output.

2 Contact Details

To resolve issues, report bugs or to collaborate on any development work regarding PIETOOLS, please contact through email and we will get back to you as quickly as possible. In case of issues with installation, solving problems or bugs identified, please include the script file that causes that generates the error along with images of the error generated in MATLAB. Email address: sshivak8@asu.edu, am.das@tue.nl and mpeet@asu.edu