Free/Libre and Open Source Software (**FLOSS**) Resources for Online Courses*

Kannan M. Moudgalya

PI, FOSSEE and Spoken Tutorial Projects
IIT Bombay

6 August 2020

The FOSSEE project at IIT Bombay has been promoting Free/Libre and Open Source Software (**FLOSS**) in a big way for a decade. It has created excellent free resources by contributions from students and faculty across India, and curated by the FOSSEE Team and other experts.

FLOSS resources made available by FOSSEE will be very useful to colleges that plan to conduct online teaching in the next semester (Autumn 2020). Because of license issues, FLOSS is the only option for many institutions - this is the only product accessible to students from their homes. As a matter of fact, IIT Bombay is likely to use FLOSS in a big way during the next semester. Even if proprietary software is available, accessing the license keys through a VPN Server may create a lot of practical problems. Unauthorised use of commercial software is illegal and will bring a bad name to all.

In this report, we point out some of the useful FLOSS and content available to everyone free of cost. We point out how to use them and how to get help, in case you plan to use some of them. We also invite everyone to join hands with FOSSEE and further improve the usability of FLOSS for the good of the Society.

1 Software and Hardware Promoted by FOSSEE

FOSSEE promotes the following software and hardware.

Scilab	General computation
Python	General computation
OpenFOAM	Computational Fluid Dynamics
DWSIM	Chemical process simulation
OpenModelica	General purpose modelling / Power system simulation / Chemical process simulation
R	Statistics
(FOSSEE created) eSim	Electronic circuit design
(FOSSEE created) Osdag	Steel structure design
Linux	Operating system
Hardware	Arduino, OpenPLC (FOSSEE created)
Art and graphics	GIMP, Inkscape, Scribus, Synfig, Blender 3D

---

*A soft copy of latest version of this report is available at https://fossee.in/teaching-support

2 Commercial and Open Source Equivalence

The software that FOSSEE promotes and the proprietary equivalent are displayed below:

$$
\begin{aligned}
\text{Matlab} &\rightarrow \text{Scilab} \\
\text{Simulink} &\rightarrow \text{Xcos} \\
\text{Fluent} &\rightarrow \text{OpenFOAM} \\
\text{SPSS} &\rightarrow \text{R} \\
\text{ORCAD, PSpice} &\rightarrow \text{eSim} \\
\left.\begin{array}{r} AspenPlus \\ CHEMCAD \\ Simsci\ PRO/II \end{array}\right\} &\rightarrow \text{DWSIM, OpenModelica} \\
\text{CYME, ERACS, PSSE, ETAP} &\rightarrow \text{OpenModelica and OpenIPSL} \\
\text{Adobe Photoshop} &\rightarrow \text{GIMP} \\
\text{Coreldraw, Adobe Illustrator} &\rightarrow \text{Inkscape} \\
\text{Pagemaker, QuarkXPress, Adobe Indesign} &\rightarrow \text{Scribus} \\
\text{Maya, 3D Max} &\rightarrow \text{Blender 3D} \\
\text{Adobe flash} &\rightarrow \text{Synfig Studio} \\
\text{Windows} &\rightarrow \text{Linux}
\end{aligned}
$$

3 Select Important Activities of FOSSEE

FOSSEE promotes the following activities, among various other things:

Textbook Companion: Provide code for a solved example of a standard textbook. Scilab textbook companion has Scilab code, etc.

Lab Migration: Migrate the lab to the indicated open source software. Some examples are migration to Scilab, OpenFOAM, and R.

Case Studies/Circuits/Flowsheets: Solving a relatively larger problem using the software.

Cloud Solutions: Making available some of the tools through Cloud.

Workshops and Conferences: FOSSEE has been conducting workshops and conferences on the FLOSS systems it promotes.

These are explained below.

4 Textbook Companion

Scilab	Code to 75,000 solved examples of 625 textbooks are available here: https://scilab.in/Completed_Books
Python	Code to 50,000 solved examples of 500 textbooks are available here: https://tbc-python.fossee.in/browse-books/
R	Code to 3,000 solved examples of 32 textbooks are available here: https://r.fossee.in/textbook-companion/completed-books
OpenModelica	Code to 5,000 solved examples of 60 textbooks are available here: https://om.fossee.in/textbook-companion/completed-books

5 Lab Migration

Scilab	100 labs migrated to Scilab are here: https://scilab.in/lab_migration/completed_labs
R	5 labs migrated to R are here: https://r.fossee.in/lab-migration/completed-labs
OpenFOAM	4 labs migrated to OpenFOAM are here: https://cfd.fossee.in/lab-migration/completed-labs
eSim	6 labs migrated to eSim are here: https://esim.fossee.in/lab_migration/completed_labs
DWSIM	2 labs migrated to DWSIM are here: https://dwsim.fossee.in/lab-migration/completed-labs

6 Case study/Circuits/Flowsheets

Circuit simulation	135 electronic circuits solved through eSim are available here: https://esim.fossee.in/circuit-simulation-project/completed-circuit-simulations - another 350 circuits are expected to be added soon
Flowsheets	175 chemical engineering flowsheets solved through DWSIM are available here: https://dwsim.fossee.in/flowsheeting-project/completed-flowsheet. 50 chemical engineering flowsheets solved using OpenModelica are available here: https://om.fossee.in/chemical/flowsheeting-project/completed-flowsheet
CFD	75 CFD simulations solved through OpenFOAM are available here: https://cfd.fossee.in/case-study-project/completed-case-studies
Power system simulation	35 power system simulations solved using OpenIPSL and OpenModelica are available here: https://om.fossee.in/powersystems/pssp/completed-pssp

7 Cloud Solutions

Scilab	We have made Scilab accessible on the cloud, and have also made available all the 75,000 examples from the Scilab Textbook Companion. You may access this amazing resource here: https://cloud.scilab.in/
Xcos	We have ported Xcos on to the cloud. You can move your code from Desktop to the Cloud and vice versa. Xcos on the Cloud is available here: https://xcos.fossee.in/. About 150 solved examples are available here: https://xcos.fossee.in/example
R	We have made R accessible on the cloud, and have also made available all the 3,000 examples from the R Textbook Companion. You may access this amazing resource here: http://rcloud.fossee.in/
eSim	We are working to make eSim and Arduino simulator available on the Cloud

8 Workshops and Conferences

- Python is already established and is increasing in popularity and important for everyone given how all modern data analysis and AI libraries offer a Python interface. One may learn Python from the perspective of an engineering or science student from a complete and free online course offered by FOSSEE here: https://python.fossee.in/self_learningcourse/. The FOSSEE Team has also been conducting SciPy for a decade, see https://scipy.in.
- To access the proceedings of a National Conference on Process Simulation, please visit https://fossee.in/nccps-2018
- Please frequently visit https://www.it.iitb.ac.in/nmeict/announcements.html to know about the upcoming workshops. This page is updated when new workshops are announced.

9   Additional Learning Resources

FOSSEE   has created the following additional learning resources:

- Free and Open Source Creative Art Library, with useful material on GIMP, Inkscape, Scribus, Synfig and Blender 3D, is available here: https://focal.fossee.in/.

- Yaksh, available at https://github.com/FOSSEE/online_test, is an open source project which allows teachers to host courses that involve programming exercises and quizzes in addition to multiple choice questions. One can host a course with videos and lecture material along with such exams.

Spoken Tutorial   team has created excellent resources to learn the content developed here. Some examples are given here:

- Spoken Tutorials are available on all the topics mentioned here, namely, Scilab, Xcos, Python, DWSIM, OpenModelica, eSim, R, GIMP, Inkscape, Synfig, Blender, etc. One can find them here: https://spoken-tutorial.org, and also through SWAYAM, available here: https://swayam.gov.in/

- This 20 minute recording of my lecture explains how to use the 75,000 example code of Scilab Textbook Companion for (a) finding information on commands (b) doing what if studies (c) executing on the cloud and (d) setting problems/assignment/quiz. One can extend the same approach to all the other software listed in this report.

- If anyone needs any help with any of these, and especially to adopt them into a course, the FOSSEE and Spoken Tutorial teams will be glad to help.

10   Summary of Available FLOSS Resources

We summarise the FLOSS resources created by FOSSEE and Spoken Tutorial projects here:

No.	Software	Textbook Companion	Lab Migration	Case Study	Spoken Tutorials	Workshops
1	Scilab	✓	✓		✓	✓
2	Python	✓	✓		✓	✓
3	eSim		✓	✓	✓	✓
4	DWSIM		✓	✓	✓	✓
5	OpenFOAM		✓	✓	✓	✓
6	OM chemical process flowsheet		✓	✓	✓	✓
7	OM power system simulation		✓	✓	✓	✓
8	OM	✓			✓	✓
9	R	✓	✓	✓	✓	✓
10	Arduino		✓	✓	✓	✓