VHM simulation with Cpp-runtime in OpenModelica

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1 Introduciton

Franke *et al.* [1] investigated the exploitation of Cpp (C++) for Modelica code optimization. They claim that "a publically available application example demonstrates the achievements. CPU times obtained with the OpenModelica [2] C++ runtime are significantly faster than CPU times obtained with the C runtime or with Dymola."

We therefore decided to investigate this claim by focusing on the VHM. The first steps involve building OpenModelica with the `CppRuntime` flag enabled.

2 Results

Some preliminary numerical tests were performed with the following parameters:

- stopTime = 100
- tolerance = 1e-6
- numberOfIntervals = 500

We investigated the DASSL solver with the C runtime. For the C++ runtime, we investigated the following solvers:

- DASSL
- CVode
- IDA

An Intel(R) Core(TM) i7-4710MQ CPU @ 2.50GHz computer containing 8 processors and 16GB RAM, using operating system Linux Ubuntu 14.04 was used for the tests.

Graphical results are shown in Figure 2.1 and Figure 2.2.

A breakdown of the execution times are provided in Table 2.1. Notice that the compilation times are larger for the C++ runs as opposed to the C run, but the simulation times are shorter for the C++

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runs. The DASSL and CVode solvers seem to provide the quickest execution times for the VHM in C++ runtime.

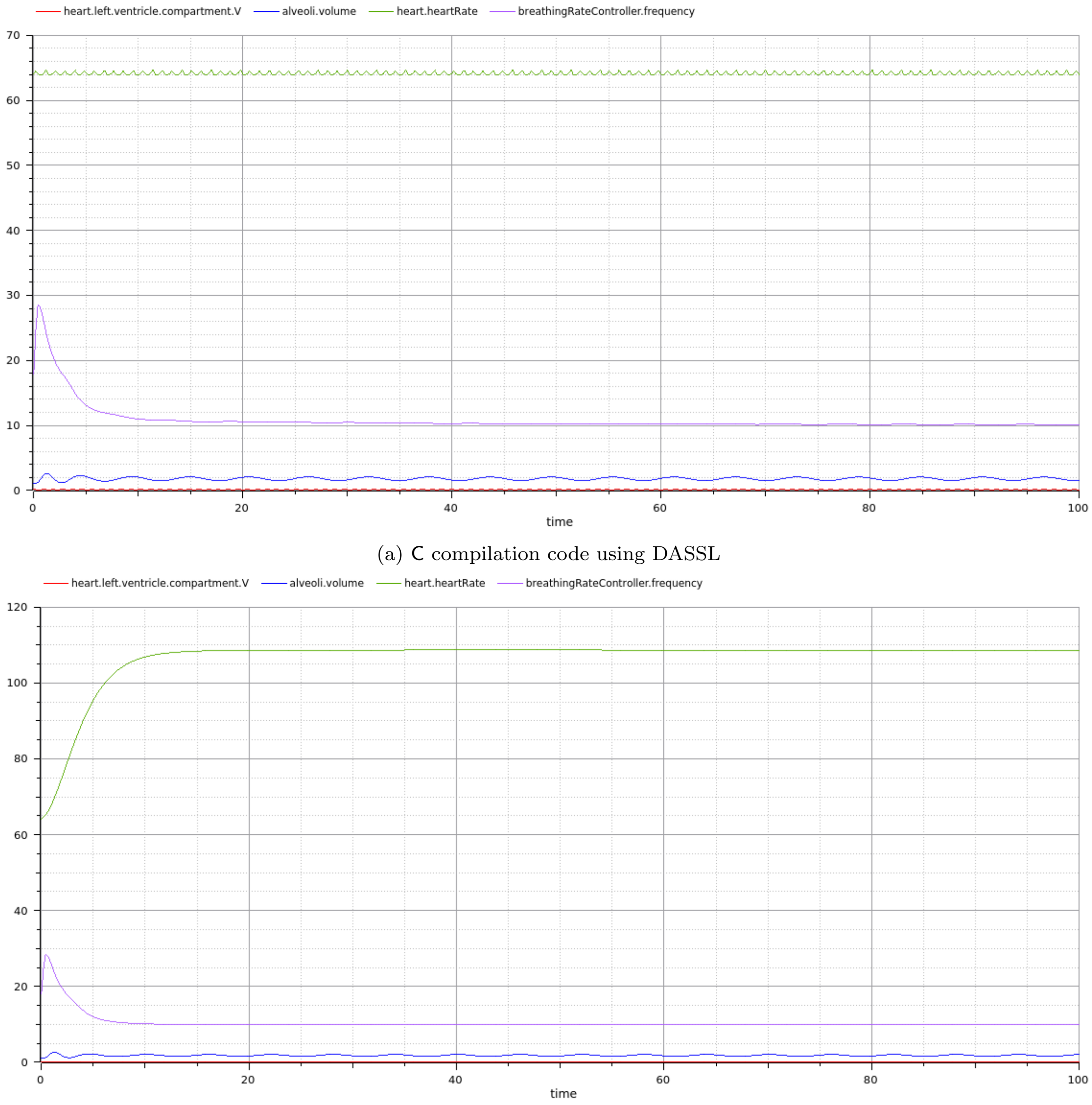
Runtime	Solver	Times	
C	DASSL	timeFrontend	1.605435356
		timeBackend	2.04504742
		timeSimCode	0.328685344
		timeTemplates	0.799143101
		timeCompile	5.007660417
		timeSimulation	31.422863225
		timeTotal	41.208929966
C++	DASSL	timeFrontend	1.505189705
		timeBackend	1.982867962
		timeSimCode	0.3326616499
		timeTemplates	2.469315036
		timeCompile	21.191103299
		timeSimulation	4.864816006
		timeTotal	32.346041009
C++	CVode	timeFrontend	1.521981099
		timeBackend	1.997048266
		timeSimCode	0.320210118
		timeTemplates	2.463317947
		timeCompile	21.14042106
		timeSimulation	4.865331074
		timeTotal	32.308397227
C++	IDA	timeFrontend	1.513984494
		timeBackend	1.993646609
		timeSimCode	0.33445055699
		timeTemplates	2.501393176
		timeCompile	21.10962507
		timeSimulation	13.587780533
		timeTotal	41.040962892

Table 2.1: Simulation times in seconds.

References

[1] Franke R, Walther M, Worschech N, Braum W & Bachmann B, 2015, *Model-based control with FMI and a C++ runtime for Modelica*, Proceedings of the 11th International Modelica Conference, Versailles, France, pp. 339–347.

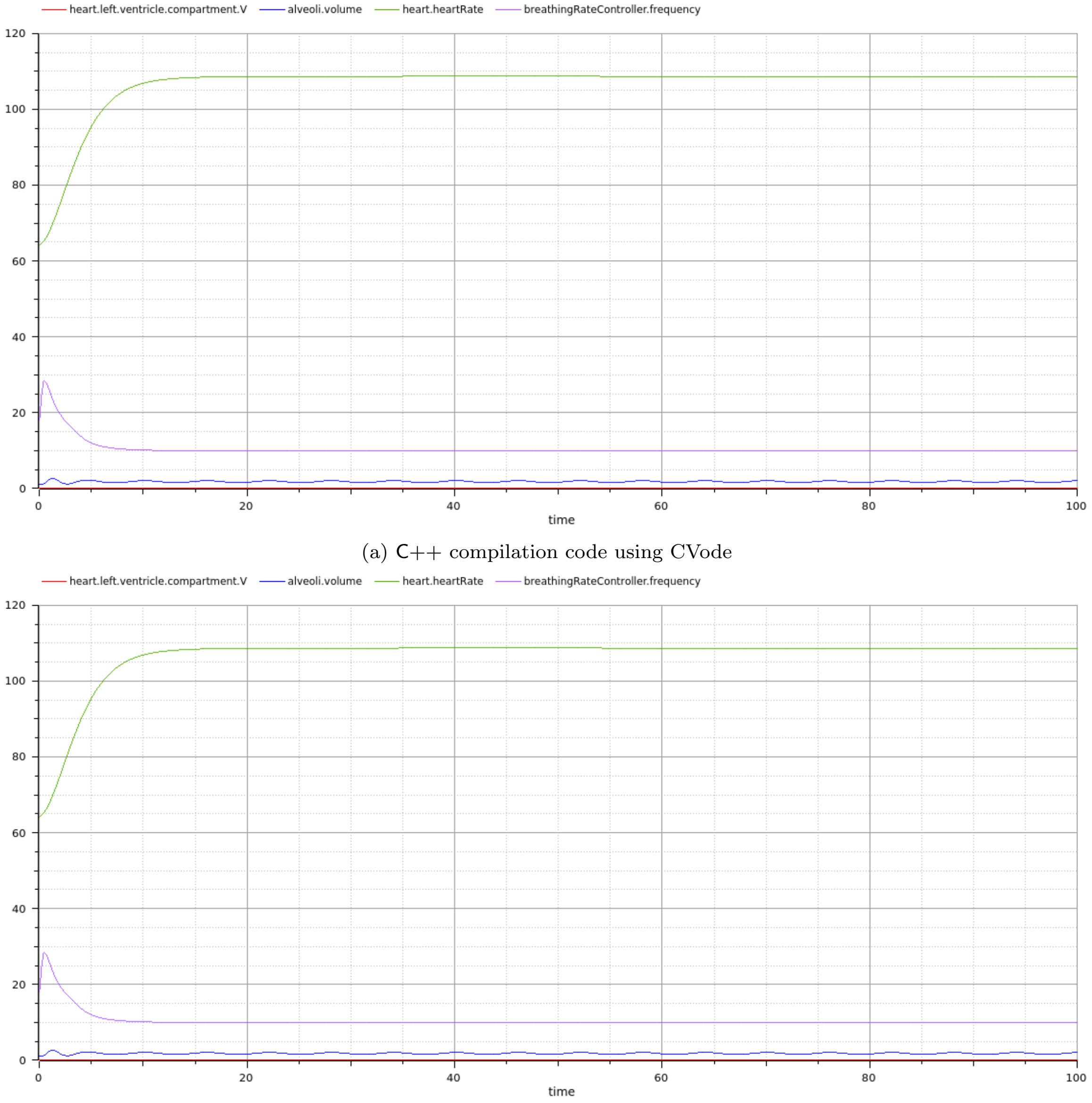
[2] OpenModelica, 2016, *Open Source Modelica Consortium*, [Online], Cited 15th March 2016, Available from `https://openmodelica.org/`



(a) C compilation code using DASSL

(b) C++ compilation code using DASSL

Figure 2.1: Numerical results of the DASSL solvers in (a) C and (b) C++ for the VHM.



(a) C++ compilation code using CVode

(b) C++ compilation code using IDA

Figure 2.2: Numerical results of the (a) CVode and (b) IDA solvers in C++ for the VHM.