Combining CFL-like conditions and multirate DAE framework for applications in system simulation software

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Vehicle propulsion simulation packages such as AVL CRUISE^{TM}M[†] provide concepts for automatic generation and stable simulation of multi-physical system models. Performance in particular with respect to real time applications as well as accuracy and stability of results have to be ensured. In the developed co-simulation multirate framework each physical subsystem as well as the overall system can be solved e.g. by implicit or explicit Runge-Kutta methods. Besides error based adaptive solvers and fixed step solvers, there is also the possibility of a component based step size control using physical based CFL (Courant-Friedrichs-Lewy)-like conditions. In addition to existing criteria for electric and gas networks, a CFL-like condition for fluid circuits is extending the multirate solver framework. Step sizes derived from such conditions allow large steps while guaranteeing stability of the results. In combination with the multirate approach, a stable high performance and real-time capable system simulation is ensured.

[†]https://www.avl.com/cruise-m