discrete variables. Same applies, if the involved variables are of boolean or integer type.

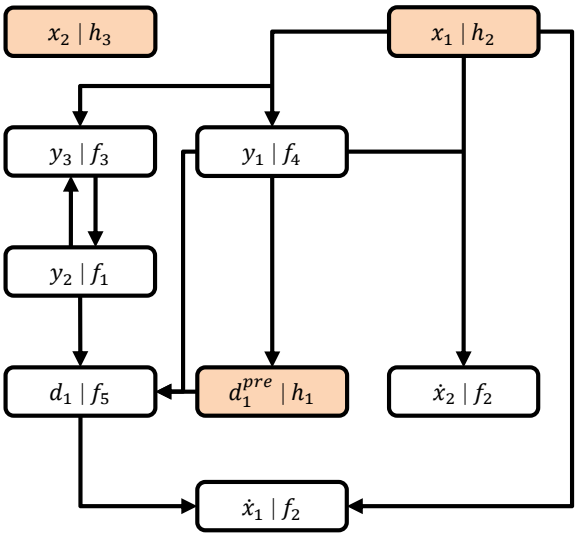

Figure 5.4. Directed graph representation and result of the sorting for the initial system of example model "MathRep".

6. Conclusions and Future Work

This paper describes the principles implemented in the OpenModelica environment, which are utilized to initialize complex hybrid Modelica models. Two major methods, the numeric and symbolic approach, are discussed in detail and advantages and disadvantages have been pointed out.

The numeric approach can deal with over-determined systems and has been successfully applied in [3]. Furthermore, this approach has been extended by the Start Value Homotopy method, which gives the modeler more control on the initialization process.

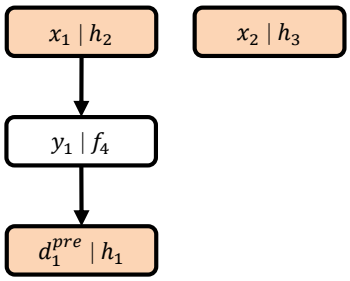

Figure 6.1. Reduced directed graph representation of the initialization problem for the example model "MathRep".

The symbolic approach outperforms the numeric treatment of the initialization problem with respect to performance and solvability in case of large and hybrid systems. With the numeric approach it was so far not possible to initialize the bigger part of model examples in the Modelica Standard Library (MSL). Today, most of MSL examples are initialized efficiently using the symbolic approach.

In case of under-determined initialization problems both approaches introduce additional equations, based on model analysis, in order to generate determined initial systems.

In the future, the two approaches will be more enhanced within the OpenModelica environment. The dependence graph achieved by the symbolic approach can be reduced to represent only the information necessary for determining the initial unknown vector $\underline{\omega}$ (see Figure 6.1 in comparison to Figure 5.4).

Up to now, the Start Value Homotopy method considers all explicitly given start values, which might be not desirable within an object-oriented Modelica drag-and-drop environment. This should be improved by introducing a special Start Value Homotopy annotation keyword. In addition, the Start Value Homotopy feature as well as methods for over-determined systems will be further investigated in order to be integrated into the symbolic approach.

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