Reducing data acquisition effort by hierarchical system modelling

The design structure matrix (DSM) is a powerful tool for system analysis and modelling. It has been successfully applied in process management, product design and many other areas. The methodologies based on DSMs have led to more extensive matrix models such as the domain mapping matrix (DMM) and the multiple-domain matrix (MDM). Methods based on matrices depend on high-quality system models. Data acquisition is crucial for the quality of the results of a later analysis. There are different approaches for data acquisition e.g. based on interviews, on workshops or existing system models such as bills of materials or computer aided design models. Interviews and workshops are rather time consuming. Biedermann et al. (2009) proposed a system of metrics to support workshops by highlighting the consequences of a decision during data acquisition. However, this method requires a pre-filling of a DSM and does not reduce the effort but focuses discussions. In this paper a possibility to reduce the data acquisition effort is presented. It uses several levels of hierarchical system models. Starting at an abstract level the network is then mapped to a more detailed level using matrix multiplications. Moreover, a case study modelling an assembly cell
consisting of 103 components is presented. Thereby, it is shown that the proposed method can reduce the data acquisition effort by up to 65%. Finally, possible reasons for the acceleration are given and an outlook to future research is displayed.

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