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SUMMARY

„Selection of controller parameters of power electronics devices in the power system based on the identification, model order reduction and Neimark's D-decomposition"

Power electronics devices included in the subsystems play and will continue to play an increasingly important role in the proper functioning of the entire power system. Power electronic devices, as solutions based on semiconductors, are inherently non-linear. Additionally, their parameters vary over temperature and time. Individual objects, as well as their combination into groups of objects, are a challenge in the field of control. The mathematical models are the basis of the solution.

There is a requirement for a new approach in this area. The solution to the problem at the level of devices and systems is to use the D-decomposition technique in combination with a mathematical model identification and reduction.

As part of the doctoral dissertation, an advanced mathematical method based on the theory of the D-decomposition technique in combination with frequency- and time-domain constraints were presented. This was used during determining the areas of permissible controller parameters in conjunction with the model identification methods and its order reduction technique. They were selected basing on review of scientific literature. Analysis of the influence of changes in the parameters of transfer function models on the area of permissible controller gains with use of the D-decomposition technique was performed. The analyses has been done at the individual- and system-level.

The results obtained at the level of individual objects were verified on the experimental setup including (i) boost converter and (ii) dual active bridge.

The results at the system level based on a mathematical model, verified in an advanced simulation model, were collected too. These models take into account parasitic elements of components, control delays and real characteristics of transistors. The system was considered as a cascade connection of two subsystems. Each subsystem consisted of a passive filter and a boost converter. Then analyses were conducted for two of such systems connected in serial to form another system.

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PhD student signature